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The Application of the Decomposition Method in Predicting the Sale of Building Materials on CV. Laris Baja

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Abstract

CV. Laris Baja is a retail store that sells various construction needs and home supplies such as iron, boards, paint, pipes, and cement. The stock recording process is still done manually, which often leads to inaccuracies in inventory control, resulting in overstock or out-of-stock situations. These conditions can cause significant financial losses if not addressed promptly. This study aims to implement the decomposition method to predict the sales of building materials and to design a web-based sales prediction system to support decision-making at CV. Laris Baja. The research applies the decomposition method, with data collected through observation, interviews, and literature studies. The results show that the decomposition method is effective in identifying sales patterns by combining seasonal and trend components to produce reliable sales estimates. The developed prediction system helps the company optimize inventory management, reduce the risk of overstocking or stockouts, and improve operational efficiency. This study emphasizes the importance of systematically utilizing historical data to support data-driven decision-making, while also considering unpredictable external factors. Overall, the study provides a significant contribution to business planning in the building materials industry and can serve as a reference for future research in different scales and contexts.

Keywords: *Sales Prediction, Decomposition, Historical Data, Inventory Management, Web-Based System.*

1. Introduction

Technology is a useful tool to help individuals in completing work, especially information technology which is one of the means to improve company and business performance[1].The presence of computers as a form of information technology advancement in providing a positive role to an organization or company. In connection with the rapid development of information technology, it currently has a very important role for every company in the presentation and processing of data. Information technology is a set of computers consisting of hardware and software to process data that can provide the necessary information and will increase the effectiveness, productivity, and efficiency of a company[2].

CV. Laris Baja is one of the places to sell construction needs and home equipment such as iron, boards, paint, pipes, and cement[3]. Buying and selling transactions at CV. Lasis Baja is carried out directly in the store, where customers select the goods they need, then make payments to the cashier. After the transaction is completed, the stock recording of goods is done manually using books by store staff. However, this manual method is often inaccurate, so it is not able to provide optimal inventory control. As a result, there is often a state of overstock (excess inventory) and outstock (lack of inventory). Overstock can incur high storage costs and hurt the company, while outstock can lead to lost sales opportunities[4]. If this condition is left for a long time, the potential for large losses and even bankruptcy can occur. Therefore, a system that is able to predict the sale of building tools more accurately is needed. One solution that can be applied is the decomposition method, a data mining technique that utilizes historical data patterns to support more informed decision-making[5].

Previous research was conducted by Ahmad Raihan with the title "Comparison of *Fuzzy Time Series* Method and Decomposition Method in Predicting the Number of Visitors to the Malikussaleh University Library". The results showed that *the Fuzzy Time Series* method produced more accurate predictions compared to the Decomposition method. This can be seen from the smaller *Mean Absolute Percentage Error* (MAPE) value for *the Fuzzy Time Series method* [6]. The difference between the research that the researcher raised and the previous research is that the previous research focused on comparing prediction methods for the number of library visitors, and found that *the Fuzzy Time Series was* more accurate while the research that the researcher raised focused on the application of the decomposition method to predict the sales of building tools in CV. Selling Steel.

Based on the explanation above, to overcome stock management problems and improve operational efficiency, a building equipment sales prediction system was designed at CV. Selling Steel by applying the decomposition method. This system aims to improve the accuracy of sales predictions, so that it can help companies optimize stock management and prevent overstock and outstock[7]. In addition, this system

is also expected to support more effective marketing strategy planning. With this system, it is hoped that the resulting solutions will not only be relevant for CVs. Best-selling Steel, but can also be adapted for a variety of other business needs[8].

2. Method

In carrying out this research, the author uses the Research and Development (R&D) method to obtain data that suits the needs of the author. In this study, the author collected data by observation, interviews, samples and literature studies[9]. According to Saputra, the steps in the Research and Development method can be described as follows [10]:

1. Potential and Problem, namely the identification of the main problems faced by the CV. Steel's sales are related to the predicted sales of building materials. For example, difficulty in accurately predicting demand, significant sales fluctuations, or inaccuracies in stock planning.
2. Data collection, i.e. collecting data on the sales of building materials in recent years, including the type of building materials, quantities sold, selling prices, and external factors that may affect sales (e.g., economic conditions, large construction projects.
3. Product Design, which is choosing the most appropriate decomposition method for building material sales data. Some commonly used methods are additive and multiplicative methods.
4. Design Validation, which is to ensure to the research place and supervisors whether the methods and systems to be built are in accordance with the purpose of the research
5. Design Revision, which evaluates the accuracy of the decomposition model by comparing the prediction results with actual data using evaluation metrics such as *Mean Absolute Error* (MAE), *Mean Squared Error* (MSE), or *Root Mean Squared Error* (RMSE).
6. Product Trial, which is the process of implementing a validated decomposition model into the CV information system. Selling Low. The finished system will later be tested using *blackbox testing*.
7. Product Revision, which is a repair process based on the results of previous tests. If the previous test did not find any problems or suggestions for improvement, it can pass this stage.
8. Trial Use, which is the application of a system that has been made to the place of the research object. This requires checking at all times to see if the system is running properly or not.

2.1. System Development Methods

The system development method that will be used in this project is Rapid Application Development (RAD). RAD is a software development approach that focuses on developing prototypes that can be developed quickly and tailored to the needs of users[11]. In the context of this research, the use of the RAD method can help accelerate the development of the system while still ensuring that quality and user needs are met. With a focus on rapid, iterative development, and active stakeholder engagement, the RAD method can be an effective approach to achieving the goals of this research[12].

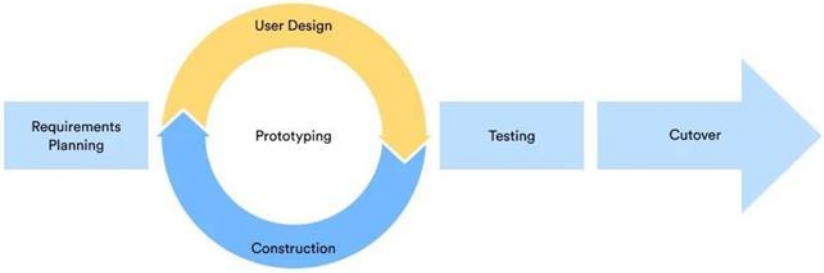

Fig. 1: RAD Sitsem Development Method

There are some key steps in the RAD application development model[13]:

1. *Requirements Planning* , which is the initial stage in the development of a system, which focuses on collecting and analyzing user needs. At this stage, the researcher discusses with the user to understand the needs of the system, the scope of the project, and the end goal to be achieved.
2. *User Design* , at this stage the user is actively involved in the system interface design process. This stage emphasizes collaboration and direct feedback from users. Through an iterative approach, developers design and validate system designs according to the needs that have been collected.
3. *Prototyping* , the initial prototype of a system developed as a form of visualization or functional model of the system to be built. Prototypes allow users to evaluate system features and provide feedback for improvements.
4. *Construction* , which is the stage where the researcher completes *coding*, system integration, and creation of complete functionality based on a refined prototype.
5. *Testing* , which is a stage that focuses on testing the system to ensure that the system is free of errors (bugs) and runs according to the needs of the user.
6. *Cutover* (Implementation), which is the final stage where the completed system is implemented or moved to the actual operational environment.

3. Results and Discussion

The analysis of system needs in this study is what includes the need to build a system in a research. The analysis of system needs needed in this study is observation data, application of decomposition formulas and system design and system implementation.

3.1. Observation Data

The data in this study was obtained through observation, interviews and literature studies. Observations are made directly on CV. Laris Baja was sold by the researcher himself, while the interview was conducted with Mr. Tono as the owner of the CV itself. In the table below is the data on the purchase of building materials at CV.Laris Baja per month. Here, the researcher took purchase data for 12 consecutive months. For example, the researcher took sales data for January.

Table 1 : Sales Data of CV Goods Selling Steel in January 2024

No.	Product Type	Initial Stock	Sales Amount	Final Stock
1	Semen Dynamix 20kg	100	10	90
2	Semen Tiga Roda 40kg	100	15	85
3	Besi 6x12 SNI	50	12	38
4	Besi 8x10 KS	50	10	40
5	Pipa PVC Rucika 1/2 inci	200	20	180
6	Pipa PVC Wavin 3/4 inci	150	18	132
7	Triplek Serba Guna 2mm	100	12	88
8	Triplek Anti-Air 4mm	80	8	72
9	Cat Dulux Weathershield 5kg	60	10	50
10	Cat Avian Paint Oil 1kg	80	15	65
11	Semen SCG Portland 20kg	120	25	95
12	Besi Beton Polos 6x10	80	10	70
13	Pipa Galvanis Medium 1 inci	100	12	88
14	Triplek Anti-Lembab 3mm	50	10	40
15	Cat Nippon Paint Vinilex 5kg	100	15	85
16	Cat Avian Super Gloss 2kg	120	20	100
17	Semen Padang 20kg	200	18	182
18	Besi Baja Ringan 4x4	60	10	50
19	Pipa PVC Rucika 1/4 inci	150	15	135
20	Triplek Ekonomis 2mm	100	8	92
21	Cat Avitex Interior 5kg	120	12	108
22	Semen Gresik Portland 50kg	100	10	90
23	Besi Ulir Full SNI 10mm	50	8	42
24	Pipa PVC Standard 2 inci	80	10	70
25	Triplek Meranti Multiplex 4mm	60	7	53

3.2. Application of Decomposition

In this study, the application of the decomposition formula was carried out for the calculation of sales predictions for January 2025 based on sales data from October to December 2024. Researchers will calculate T (Trend), S (Seasonal), and E (Residual) for each product and then make predictions for January. Here are the calculation steps.

a. Calculating the Moving Average (T)
For January 2025, we will use a 3-month moving average. For example, the researcher will take a product from the Iron 6x12 SNI first transaction data every month.

Table 2 : Calculating the Moving Average Iron 6x12 SNI

Month	Sales (Y)	Tren (T)
Januari	12	= 2×T_Feb − T_Mar (there isn't any yet)
Februari	10	(12 + 10 + 8) / 3 = **10.00**
Maret	8	(10 + 8 + 8) / 3 = **8.67**
April	8	(8 + 8 + 6) / 3 = **7.33**
Mei	6	(8 + 6 + 5) / 3 = **6.33**
Juni	5	(6 + 5 + 4) / 3 = **5.00**
Juli	4	(5 + 4 + 3) / 3 = **4.00**
Agustus	3	(4 + 3 + 3) / 3 = **3.33**
September	3	(3 + 3 + 2) / 3 = **2.67**
Oktober	2	(3 + 2 + 3) / 3 = **2.67**
November	3	(2 + 3 + 2) / 3 = **2.33**
Desember	2	= 2×T_Nov − T_Okt = 2×2.33 − 2.67 = **2.00**

b. Counting the Season(S)
To calculate the seasonal component (S), the researcher used the formula:

$$S_t = \frac{Y_t}{T_t} \mid S = \frac{Penjualan\ Aktual}{Tren}$$

Table 3 : Counting the Season(S) Iron 6x12 SNI

Months	Y (Actual)	T (Tren)	S = Y / T
Februari	10	10.00	1.00
Maret	8	8.67	0.92
April	8	7.33	1.09
Mei	6	6.33	0.95
Juni	5	5.00	1.00
Juli	4	4.00	1.00
Agustus	3	3.33	0.90

September	3	2.67	1.12
Oktober	2	2.67	0.75
November	3	2.33	1.29

Seasonal average:

$$S_{Besi\ 6x12\ SNI} = \frac{1.00+0.92+1.09+0.95+1.00+1.00+0.90+1.12+0.75+1.29}{10} = 1.00$$

c. Calculating Residual (E)

The residual component (E) is calculated by the formula:

$$Et = \frac{Yt}{(Tt \times St)}$$

Table 4 : Calculating Residual (E) Iron 6x12 SNI

Month	Y	T	S	E = Y / (T × S)
Februari	10	10.00	1.00	1.00
Maret	8	8.67	1.00	0.92
April	8	7.33	1.00	1.09
Mei	6	6.33	1.00	0.95
Juni	5	5.00	1.00	1.00
Juli	4	4.00	1.00	1.00
Agustus	3	3.33	1.00	0.90
September	3	2.67	1.00	1.12
Oktober	2	2.67	1.00	0.75
November	3	2.33	1.00	1.29
Bulan	**Y**	**T**	**S**	**E = Y / (T × S)**
Februari	10	10.00	1.00	1.00
Maret	8	8.67	1.00	0.92
April	8	7.33	1.00	1.09
Mei	6	6.33	1.00	0.95
Juni	5	5.00	1.00	1.00
Juli	4	4.00	1.00	1.00
Agustus	3	3.33	1.00	0.90
September	3	2.67	1.00	1.12
Oktober	2	2.67	1.00	0.75
November	3	2.33	1.00	1.29

$$E_{Besi6x12SNI} = \frac{1.00+0.92+1.09+0.95+1.00+1.00+0.90+1.12+0.75+1.29}{10} = 1.00$$

d. Predictions for January 2025

By using the prediction formula:

$$Y_{prediksi} = T_{prediksi} \times S_i x E$$

Since T, S, and E for January can be estimated from the calculated averages, then:

Table 5 : Predictions for January 2025 Iron 6x12 SNI

No	Product	T (Jan)	S	E	Prediction
1	Besi 6x12 SNI	12.00	0.998	1.00	11.98
2	Besi 8x10 KS	8.33	0.999	1.00	8.33
3	Besi Baja Ringan 4x4	10.00	0.982	1.00	9.82
4	Besi Beton Polos 6x10	10.33	1.017	1.00	10.51
5	Besi Ulir Full SNI 10mm	7.67	0.984	1.00	7.54
6	Cat Avian Paint Oil 1kg	14.33	1.002	1.00	14.36
7	Cat Avian Super Gloss 2kg	19.00	1.002	1.00	19.03
8	Cat Avitex Interior 5kg	13.33	0.999	1.00	13.33
9	Cat Dulux Weathershield 5kg	9.33	1.013	1.00	9.45
10	Cat Nippon Paint Vinilex 5kg	13.67	1.001	1.00	13.69
11	Keramik Roman 40x40	18.00	1.004	1.00	18.07
12	Keramik Milan 30x30	19.00	0.999	1.00	18.98
13	Keramik Mulia 25x25	12.33	0.999	1.00	12.32
14	Lem Fox 500gr	8.00	1.001	1.00	8.01
15	Lem Rajawali 250gr	6.00	0.999	1.00	5.99
16	Paku Beton 5cm	6.00	0.998	1.00	5.99
17	Paku Beton 7cm	7.33	0.998	1.00	7.31
18	Paku Payung Seng	9.00	1.000	1.00	9.00
19	Paku Seng 1.5 inch	8.00	1.001	1.00	8.01
20	Paku Seng 2 inch	9.00	1.000	1.00	9.00
21	Pipa PVC Rucika 1/2 inci	17.33	1.001	1.00	17.35
22	Pipa PVC Rucika 3/4 inci	14.00	0.998	1.00	13.97
23	Semen Dynamix 20kg	11.33	1.002	1.00	11.36
24	Semen Gresik 40kg	13.67	0.997	1.00	13.63
25	Semen Tiga Roda 40kg	14.33	1.003	1.00	14.38

e. Accuracy and Error Level Testing
Accuracy and error testing of each product quantity prediction using APE (*Absolute Percentage Error*) with the formula :

$$APE = \left|\frac{Y_{Aktual} - Y_{prediksi}}{Y_{Aktual}}\right| x100\%$$

Table 6 : Accuracy and Error Level Testing

No	Producr	T (Jan)	S	E	Prediction	Actual (Jan)	APE (%)
1	Besi 6x12 SNI	10.67	1.00	1.00	10.67	10	6.70
2	Besi 8x10 KS	8.33	0.99	0.99	8.17	8	2.12
3	Besi 10x12 KS	6.67	0.997	0.99	6.58	7	6.00
4	Besi 8x12 KS	6.00	0.98	1.00	5.88	6	2.00
5	Besi 10x10 KS	5.33	0.99	1.00	5.28	5	5.60
6	Besi Beton 8mm	14.33	0.99	1.00	14.22	14	1.57
7	Besi Beton 10mm	12.22	0.99	1.00	12.12	12	1.00
8	Besi Beton 12mm	10.33	0.99	1.00	10.22	10	2.20
9	Besi Beton 16mm	8.33	0.99	1.00	8.27	8	3.37
10	Cat Tembok Dulux 5kg	10.56	0.99	1.00	10.43	10	4.30
11	Cat Tembok Avitex 5kg	9.33	0.99	1.00	9.24	9	2.67
12	Cat Tembok Mowilex 5kg	8.39	0.99	1.00	8.29	8	3.62
13	Cat Kayu Mowilex 1kg	7.25	0.99	1.00	7.18	7	2.57
14	Cat Kayu Dulux 1kg	6.25	0.99	1.00	6.18	6	3.00
15	Semen Dynamix 20kg	11.00	1.00	1.00	11.00	11	0.00
16	Semen Tiga Roda 40kg	14.33	1.00	1.00	14.00	14	0.00
17	Semen Gresik 50kg	13.00	1.00	1.00	12.97	13	0.23
18	Semen Holcim 40kg	12.00	1.00	1.00	11.96	12	0.33
19	Pipa PVC Rucika 1/2 inci	19.00	1.00	1.00	19.00	19	0.00
20	Pipa PVC Rucika 1 inci	17.33	0.99	1.00	17.11	17	0.65
21	Pipa PVC Rucika 2 inci	15.11	0.99	1.00	14.91	15	0.60
22	Triplek 3mm	8.11	0.99	1.00	8.04	8	0.50
23	Triplek 6mm	7.00	1.00	1.00	7.00	7	0.00
24	Triplek 9mm	6.11	0.99	1.00	6.08	6	1.33
25	Triplek 12mm	5.00	1.00	1.00	5.01	5	0.20

With a total of 25 products, then add up all APEs and then divide by 25. It is known that the total APE of 25 products is 48.35%. The calculation of MAPE is as follows:

$$MAPE = \frac{48.35\%}{25} = 1.93\%$$

Based on the MAPE results obtained, the average prediction error is 1.93%. This means that the prediction is quite accurate, since MAPE below 10% is generally considered very good, between 10-20% is still quite good, so these results show that our short decomposition model is quite accurate.

3.3. System Design

Unified Modeling Language (UML) is used in model design. Use cases, activity charts, and class charts are some of the charts used in UML design.

a. Use Case Diagram

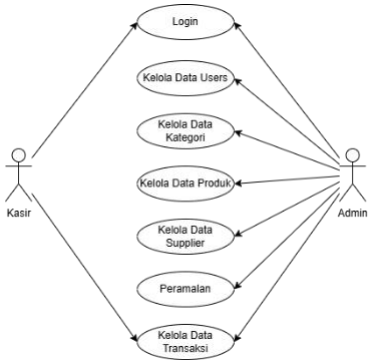

Fig. 2: Use Case Diagram

Use cases illustrate the relationship between actors and activities in the system[14]. The actors who play a role in the use case diagram in this study are store owners, treasurers and warehouse heads. Each actor carries out his duties according to his or her access rights.

b. Activity Diagram

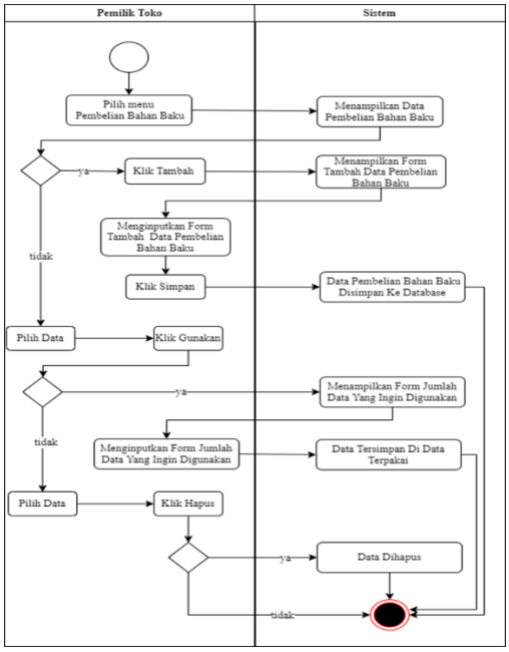

Fig. 3 : Activity Diagram Managing The Raw Material Data Menu

The image above shows the process of managing the raw material data menu, where the system will display the data after the business owner chooses the raw material option. To add data, the store owner can click on the "add" button, fill out the form provided, and then press "save". If you want to edit the data, the store owner can simply click the "edit" button on the action, make changes to the form that appears, and then save it again so that the data is updated automatically. Meanwhile, to delete data, the store owner can press the "delete" button, and the data will be instantly deleted from the system and database.

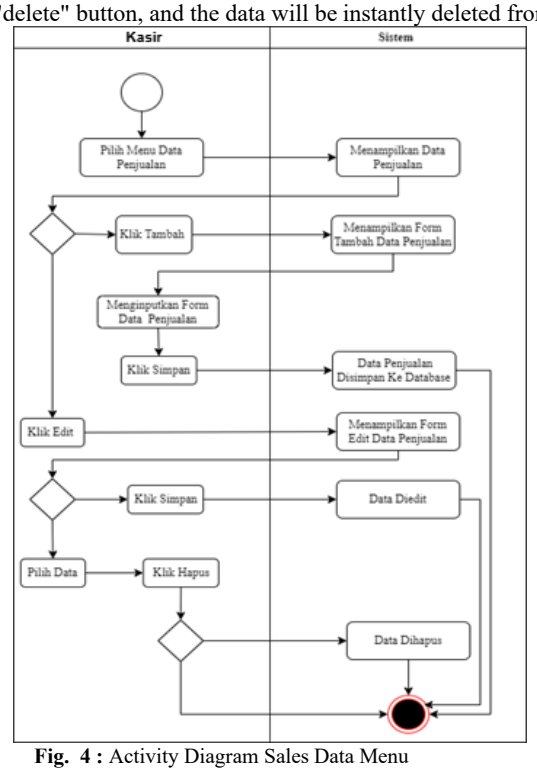

Fig. 4 : Activity Diagram Sales Data Menu

The image above shows the process on the sales data menu, where the store owner first selects the menu to display sales data. To add data, store owners can click on the "add" button, fill out the form displayed, and then press "save". If you want to change the data, the store owner simply clicks the "edit" button, makes changes to the form, and then saves it for the data to be updated automatically. As for deleting data, the store owner can click the "delete" button, and the system will instantly delete the data from the database.

c. Class Diagram

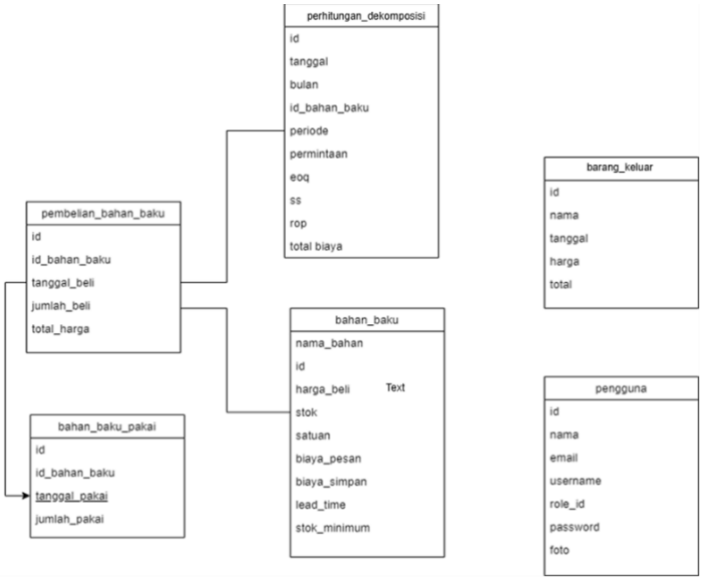

Fig. 5 : Class Diagram

A class diagram is a diagram that describes the object structure of a system[15]. It displays a class of objects consisting of diagrams as well as the relationships between them, which are described in the image above.

3.4. System Implementation

At the implementation stage of the web-based building tool sales prediction system at CV. Laris Baja, the application of program code is carried out to realize the main features that have been designed. This implementation aims to overcome the problems of stock management, recording purchase and sales transactions, and demand prediction based on the decomposition method so that inventory is more optimal. The system coding uses the Laravel framework as the backend, MySQL for data management, and Bootstrap as a responsive, easy-to-use interface. The main features implemented include user authentication, access management, building materials management, prediction calculation, recording of incoming and outgoing goods, and presentation of reports in the form of interactive tables and graphs to support decision-making.

a. Initial Views

This view is the first view when visiting the system. This view contains information about CVs. Selling Steel.

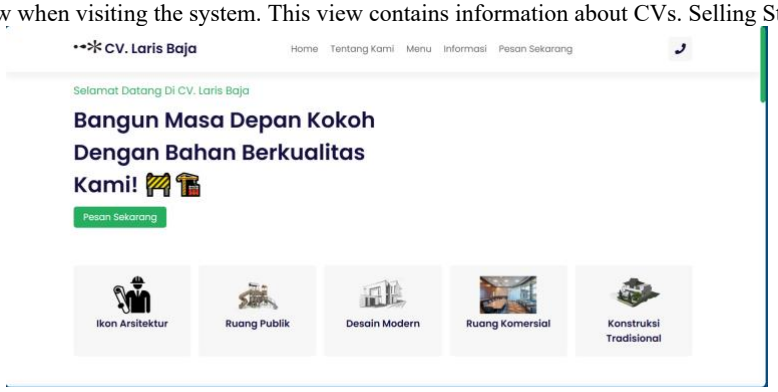

Fig. 6 : Initial Views

b. Login Page

The display in the image below is a login page that directs users to the dashboard page which is the main page of the application.

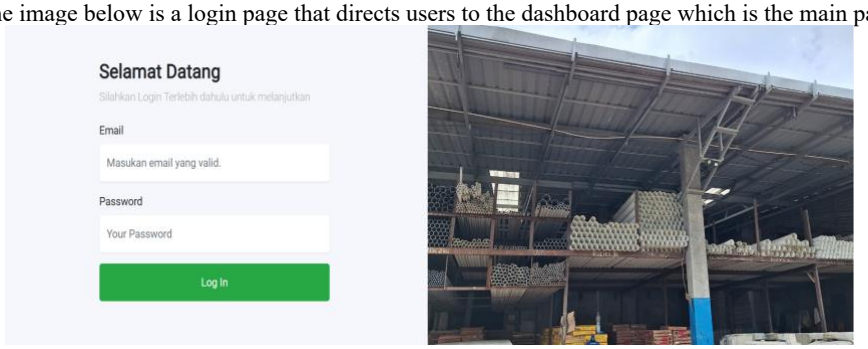

Fig. 7 : Login Page

c. Dashboard Page

If the user has successfully entered the login and password correctly, the dashboard page will be displayed as shown in the image below. The current raw material stock graph is shown on this page.

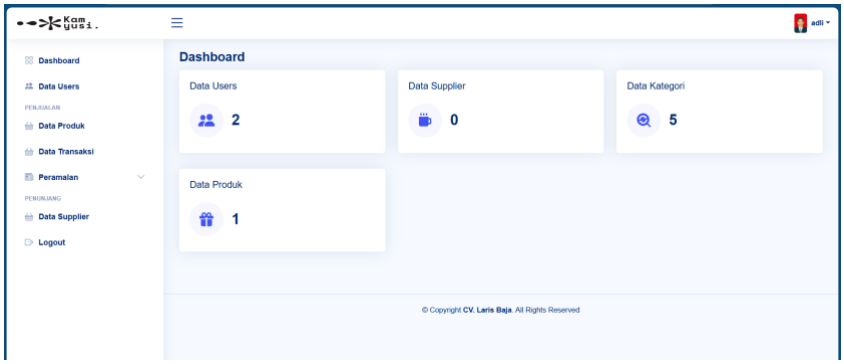

Fig. 8 : Dashboard Page

d. Product Data Page

The raw material page displaying the entire raw material input data is shown in the figure below. It has features like add, edit, and remove. In this view, there is also a filter feature, where *users* can see raw material data in previous months. On this display there is a notification feature, where raw material stocks that have reached ROP and SS will display a notification.

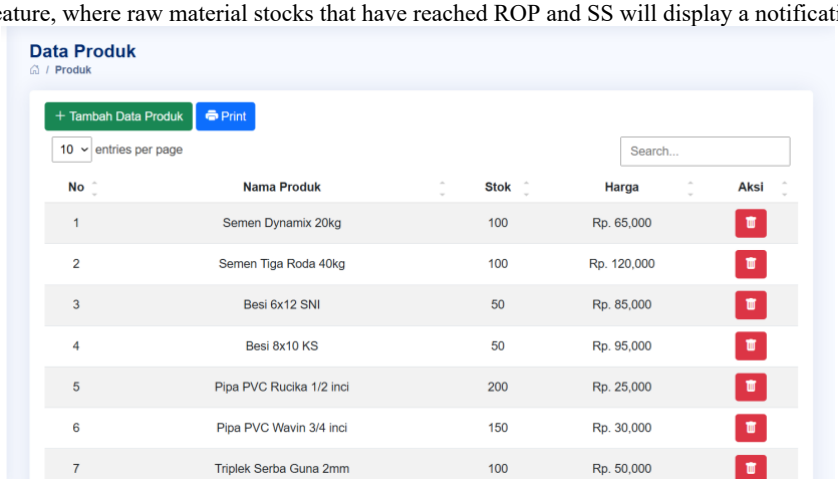

Fig. 9 : Product Data Page

e. Product List Add Form Page

The display in the image below is a display of *the raw material add form* page containing the name, purchase price, storage cost, order cost, *lead time*, minimum stock, and units.

Fig. 10 : Product List Add Form Page

f. Product Purchase Page

The raw material purchase page that displays all raw material purchase input data can be seen in the image below. It has features like add, use, and remove. In this view, there is also a filter feature, where *users* can see raw material purchase data in the previous months.

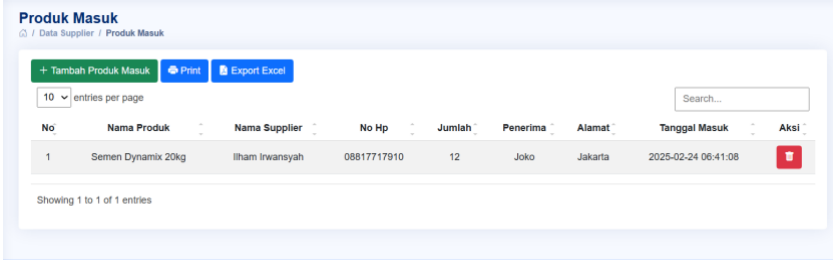

Fig. 11 : Product Purchase Page

g. Forecasting Data Page

The image below shows the Decomposition forecasting page view which includes all the calculated monthly sales recap data. It has features like add, edit, and remove. In this view, there is also a filter feature, where *admins* can see calculation data in the previous months.

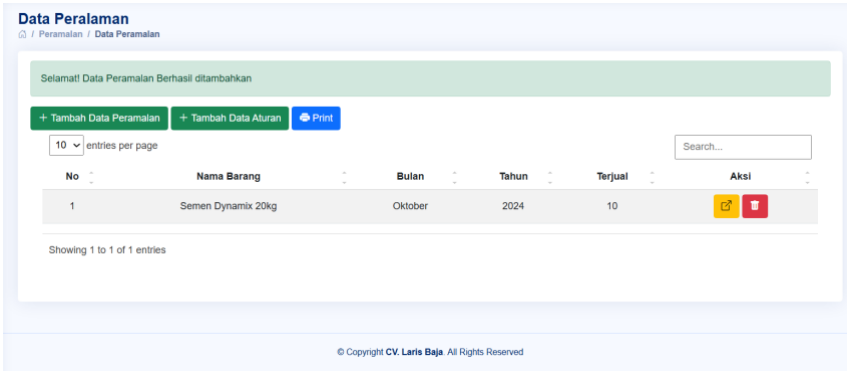

Fig. 12 : Forecasting Data Page

h. Decomposition Calculation

On this page, the admin can do a decomposition calculation to predict sales in the next month. This page includes a recap of sales from the previous 7 months.

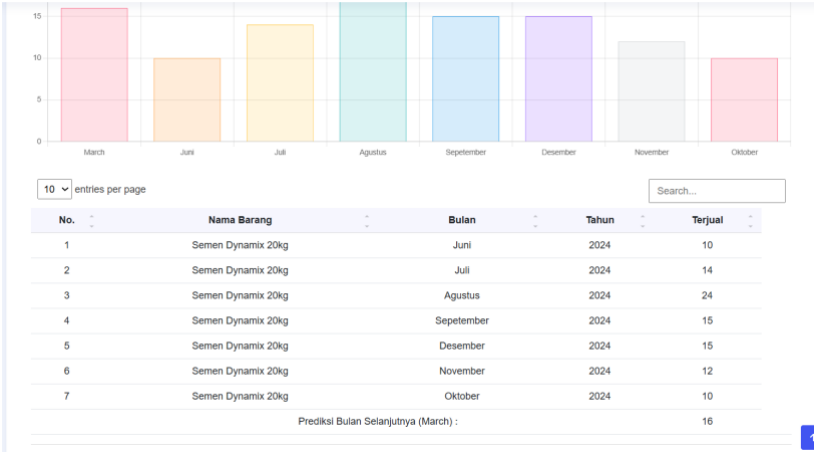

Fig. 13 : Decomposition Calculation

i. Sales Data Page

All the entered sales data is displayed on the sales data page as seen in the image below. On this page, transactions can be made.

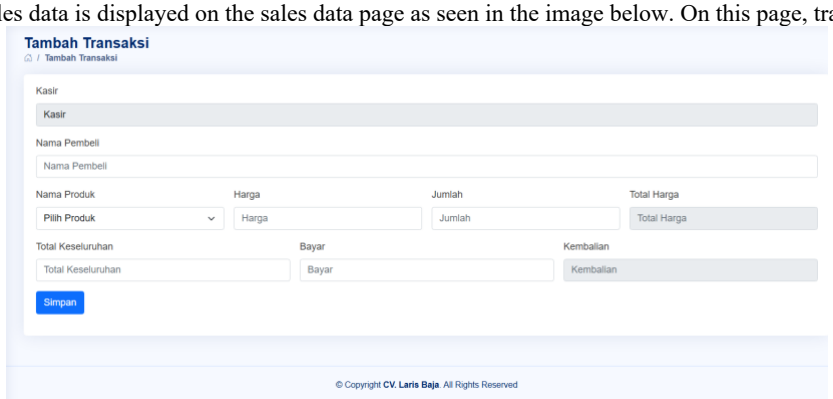

Fig. 14 : Sales Data Page

j. User Page

The user list page view is shown in the image below. Where user information is displayed based on their role.

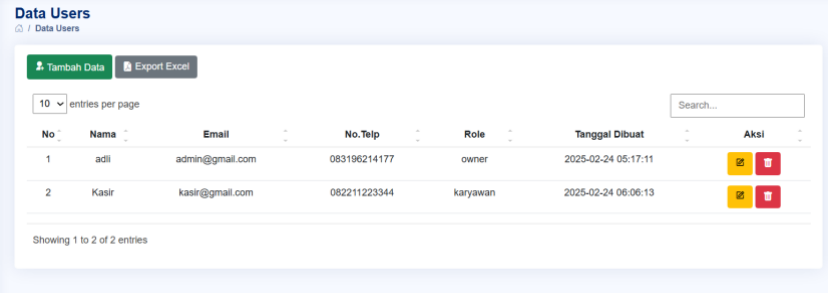

Fig. 15 : User Page

4. Conclusion

This study successfully applied the decomposition method to predict the sale of building materials on cv. Selling well, with results that can be used as a strategic reference in stock planning and inventory management. Through the analysis of sales data from October to December 2024, trend, seasonal, and residual components were successfully identified and used to predict sales in January 2025. The predicted results show that the decomposition method is effective in identifying sales patterns, accurately combining seasonal and trend components to produce reliable estimates. With structured sales predictions, cv. Steel sales can optimize inventory management, reduce the risk of overstock or understock, and improve operational efficiency. In addition, this study also shows the importance of using historical data systematically to support data-driven decision-making. However, several factors such as market dynamics, changes in the price of building materials, and unpredictable external conditions still need to be considered in the implementation of these predicted results. Overall, this research makes a significant contribution to the utilization of decomposition methods for business planning, particularly in the building materials industry, and can serve as a reference for further research on different scales and contexts.

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References

[1] A. B. Nasution, "Implementasi Pengamanan Data Dengan Menggunakan Algoritma Caesar Cipher Dan Transposisi Cipher," *J. Teknol. Inf.*, vol. 3, no. 1, pp. 1–6, 2019.

[2] D. A. Kristiyanti and Y. Sumarno, "Penerapan Metode Multiplicative Decomposition (Seasonal) Untuk Peramalan Persediaan Barang Pada PT. Agrinusa Jaya Santosa," *J. Sist. Komput. dan Kecerdasan Buatan*, vol. III, no. 2, pp. 45–51, 2020.

[3] L. Farosanti, "Analisa Peramalan Penjualan Alat Kesehatan dan Laboratorium di PT. Tristania Global Indonesia Menggunakan Metode ARIMA," *JIMP-Jurnal Inform. Merdeka Pasuruan*, 2022, [Online]. Available: http://ejurnal.unmerpas.ac.id/index.php/informatika/article/view/428

[4] M. Ena, "Penerapan Metode Single Exponential Smoothing Dalam Memprediksi Jumlah Penerimaan Mahasiswa Baru," *J. Lebesgue J. Ilm. Pendidik. ...*, 2023, [Online]. Available: https://lebesgue.lppmbinabangsa.id/index.php/home/article/view/357

[5] R. R. Mathindas, S. R. Sentinuwo, and ..., "Implementasi Fitur Prediksi Harga dengan menggunakan Metode Single Exponential Smoothing pada Aplikasi Katalog Penjualan Berbasis Android," *J. Tek. ...*, 2021, [Online]. Available: https://ejournal.unsrat.ac.id/index.php/informatika/article/view/33972

[6] R. W. AHMAD, "Perbandingan Metode Fuzzy Time Series Dan Metode Dekomposisi Dalam Memprediksi Jumlah Pengunjung Perpustakaan Universitas Malikussaleh," 2022, *Universitas Malikussaleh*.

[7] D. R. H. Roosaputri and C. Dewi, "Perbandingan Algoritma ARIMA, Prophet, dan LSTM dalam Prediksi Penjualan Tiket Wisata Taman Hiburan (Studi Kasus: Saloka Theme Park)," *Kesatria J. Penerapan Sist. ...*, 2023, [Online]. Available: http://tunasbangsa.ac.id/pkm/index.php/kesatria/article/view/199

[8] C. C. Kurniawan, S. Rostianingsih, and L. W. Santoso, "Penerapan Metode KNN-Regresi dan Multiplicative Decomposition untuk Prediksi Data Penjualan pada Supermarket X," *J. Infra*, 2022, [Online]. Available: https://publication.petra.ac.id/index.php/teknik-informatika/article/view/12801

[9] F. Rihal, N. Pratiwi, J. Statistika, I. Sains, & Teknologi, and A. Yogyakarta, "Perbandingan Metode Double Exponential Smoothing Dan Metode Dekomposisi Untuk Peramalan Jumlah Tamu Domestik Hotel Berbintang Di Provinsi Nusa Tenggara Timur," *J. Stat. Ind. dan Komputasi*, vol. 07, no. 2, pp. 1–11, 2022.

[10] S. Samsudin, M. D. Irawan, and A. H. Harahap, "Mobile app education gangguan pencernaan manusia berbasis multimedia menggunakan Adobe Animate CC," *J. Teknol. Inf.*, vol. 3, no. 2, pp. 141–148, 2019.

[11] S. Samsudin, I. Zufria, and T. Triase, "Augmented Reality Jejak Rasulullah SAW Dalam Menerima Wahyu Al-Qur'an," 2019.

[12] H. Viranty, "Sistem Peramalan Jumlah Kemunculan Titik Api Kabupaten Bengkalis Provinsi Riau Menggunakan Metode Dekomposisi," p. 11, 2021, [Online]. Available: http://repository.uin-suska.ac.id/42551/%0Ahttp://repository.uin-suska.ac.id/42551/1/File Lengkap Sampai Lampiran Kecuali Hasil Penelitian.pdf

[13] S. Kemala, M. Fakhriza, and A. B. Nasution, "E-HEALTH INDEKS TUBUH KUCING PERSIA MENGGUNAKAN FUZZY Silvia Kemala , 2 M . Fakhriza , 3 Adnan Buyung Nasution Sistem Informasi , Fakultas Sains dan Teknologi , Universitas Islam Negeri Sumatera," vol. 8, no. 2, pp. 263–273, 2024.

[14] Z. Arif, N. A. S. Adhi, and A. Muttaqin, "Penerapan Jaringan Syaraf Tiruan dan Certainty Factor untuk Peramalan Penjualan Sepeda Motor," *REMIK Ris. dan E-Jurnal Manaj. ...*, 2023, [Online]. Available: https://polgan.ac.id/jurnal/index.php/remik/article/view/12768

[15] D. Novanda and R. Hidayati, "Prediction of The Number of Pulmonary Tuberculosis Disease Using The Moving Average Forecasting Method And Time Series Decomposition," *Antivirus J. Ilm. Tek. ...*, 2024, [Online]. Available: https://ejournal.unisbablitar.ac.id/index.php/antivirus/article/view/3468