Implementation of Triple Exponential Smoothing Method To Predict Palm Oil Production of PT.Lonsum Web-Based

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***Abstract*— This research aims to develop a web-based palm oil (CPO) production forecasting system by applying the Triple Exponential Smoothing (TES) method to the production data of PT Lonsum Turangi. The data used includes 60 monthly data from 2020 to 2024. The first 36 data were used for model training, while the remaining 24 data were used for validation. Research instruments included semi-structured interviews and participatory observations to understand the operational patterns and needs of the system in the field. Triple Exponential Smoothing method was chosen for its ability to handle level, trend and seasonal components simultaneously, making it superior to other time series forecasting methods that require large volumes of data. The system was developed using the Rapid Application Development (RAD) method, PHP programming language, and MySQL database. The test results show a good level of prediction accuracy with a Mean Absolute Percentage Error (MAPE) value of 17.34% at an alpha value of 0.1. This system not only improves prediction accuracy, but also provides practical benefits in production planning, meeting market demand, and reducing potential losses due to production imbalances. The novelty of this research lies in the integration of the TES method into a web-based decision support system specific to the CPO industry.**

Keywords*— *Crude Palm Oill (CPO), Prediction, Production, Triple Exponential Smoothing, Website

I. INTRODUCTION

Information technology continues to develop rapidly where this is also influenced by the use of various types of technological media, one of which is in the industrial sector[1]. The palm oil industry is one of the sectors that continues to innovate with technology. This industry is one of the economic sectors that plays an important role as a foreign exchange earner as well as a significant provider of employment [2]. The majority of foreign exchange from the palm oil industry is generated by crude palm oil (CPO) and palm kernel oil (PKO). CPO is the oil derived from the flesh of the oil palm fruit while PKO is the oil derived from the seeds of the oil palm fruit [3].

PT. PP London Sumatera Utara Tbk (Lonsum) is a leading agro-industrial company engaged in the management of agricultural commodities, one of which is oil palm. Overall Crude Palm Oil (CPO) production at PT.Lonsum fluctuates from year to year with total production reaching 194 thousand tons in 2024. In the previous year the amount of production had increased even though in 2024 it decreased. The amount decreased by 10% from the previous year. One of PT.Lonsum palm oil mills is located in the village of Turangie, Langkat Regency focusing on the management of Fresh Fruit Bunches (FFB) into palm oil derivative products, especially Crude Palm Oil (CPO). PT.Lonsum palm oil mill faces a problem of inaccurate prediction of the amount of palm oil (CPO) production. PT.Lonsum palm oil mill still predicts the amount of CPO production manually, without utilizing historical data that is systematically integrated. Estimated production results are still measured based on the number of incoming FFB, machine capacity and weather conditions. This has an impact on not fulfilling the demand for CPO, less than optimal factory production and company losses. The gap between market demand and production capacity is increasingly visible due to the inability to utilize historical production data for more accurate forecasting results.

Forecasting is a process carried out to estimate future situations based on historical past data [4]. Forecasting is an effort to determine the quantity of products in the future with certain constraints and conditions [5]. The use of forecasting plays a role in careful planning, determining the resources needed as well as the basis for making the right decisions so that the results needed in the future can meet the target [6]. Forecasting production quantities is one of the crucial aspect of operations and supply chain management. In forecasting production quantities, one of the processes involves estimating the quantity of products that will be produced in the future. This is measured based on historical data, market trends and market demand. Forecasting is widely used in various companies to predict future conditions by testing past conditions [7]. However, previous studies have shown that problems with the accuracy and effectiveness of palm oil production forecasting have serious implications for the gap between demand and production capacity [8].

Triple Exponential Smoothing is one of the improved algorithms from the Single and Double Exponential Smoothing algorithms. This algorithm is an appropriate prediction algorithm by considering level, trend and seasonal factors [9].

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This algorithm is considered very suitable for Crude Palm Oil (CPO) production patterns which are also influenced by seasonal factors. Unlike other forecasting algorithms such as ARIMA that require stationary data or machine learning models that require large amounts of data [10], Triple Exponential Smoothing can work effectively even with more limited stationary data. It is also able to capture regularly recurring seasonal patterns. Forecasting algorithms that are applied to an integrated website can make their effectiveness and efficiency better. A website-based prediction system can also make it easier for companies to predict future production results.

In research conducted by Nelfi Yolanda [11] using the Triple Exponential Smoothing method to predict the amount of pineapple production in Riau in the first quarter to the third quarter of 2025 resulted in a value of MAPE = 3.7% MAD = 1.93% MSD = 7.05% which can be categorized as accurate and very good. This is characterized by previous data and forecast data that has been made. Prediction calculations in this study were made using Minitab software but were not developed in the form of a website. The next research by Dewi et al., [12] Using the Triple Exponential Smoothing Method to predict motor vehicle tax revenue in North Sumatra. The results showed the smallest error value with a MAPE value below 10% which proves the prediction accuracy is very good.

Research by Sandika et al., [13] combine Triple Exponential Smoothing and Double Moving Average method to predict palm kernel production. This study produces an optimum alpha value with the MAPE level of the Triple Exponential Smoothing method of 9.48% where this is categorized as very good and the Double Moving Average MAPE value of 11.2% with a good category. The results of the study are expected to anticipate palm kernel production more optimally. Saputro et al., [14] implemented Triple Exponential Smoothing method for predicting helmet sales with the results of Cargloss helmet sales data obtained resulted in forecasting for 2022. The results of the accuracy calculation with Mean Absolute Percentage Error with Alpha, Beta and Gamma values of 0.3 are 44.4%. Based on the Mean Absolute Percentage Error value, helmet sales forecasting with the Triple Exponential Smoothing method is feasible to use. Research conducted by R.Puspita [15] use Triple Exponential Smoothing method to predict Banten Province's Unemployement rate for the next 7 periods. The resultsd from the forecasting in a value of MAPE = 8.858859% which that shows very accurated prediction.

The new contribution of this research is the integration of Triple Exponential Smoothing method into a web-based decision support system specifically for the palm oil industry. This research will allow the process of forecasting the amount of CPO production to be carried out automatically, real-time, and integrated, improving the accuracy of predictions and the efficiency of operational decision making. With the ability of Triple Exponential Smoothing to handle trends and seasonality simultaneously, this system is very relevant to be applied to volatile production data such as in PT.Lonsum Turangi palm oil mill. This research is a review of several previous studies, namely the use of proven predictions to streamline planning, preparation and optimization of operations for research sites, both in the form of companies and businesses of various levels. This research uses the Triple Exponential Smoothing method and develops it in the form of a website to predict future Crude Palm Oil (CPO) production results so that the resulting production is maximized, market demand can be met and minimize company losses. By implementing the Triple Exponential Smoothing method into an integrated website, this research can be a reference and technology development in the industry, especially the palm oil industry in the future..

II. METHODOLOGY

This research uses quantitative methods where this method emphasizes objective measurement, measurement and generalization of research results. The main purpose of using this method is to produce findings that can later be measured and tested statistically to support or reject the research hypothesis[16]. This research uses several stages in implementing the Triple Exponential Smoothing method into a web-based system. The research stage include observation or problem identification, data collection, system planning and development, algorithm implementation and testing and evaluation. The making of research stages aims to make the research carried out have a clear development structure and can implement the algorithm properly in accordance with the problems and observations that have been made.

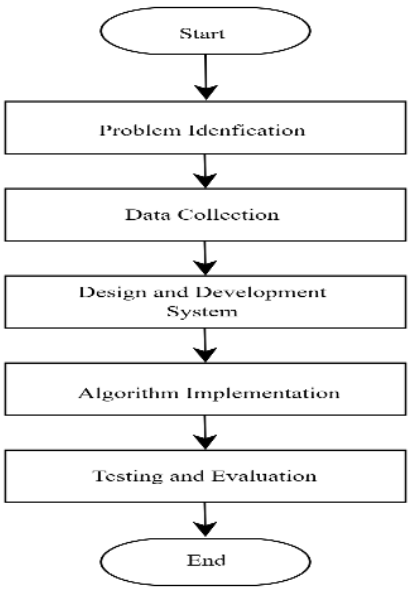

Fig. 1. Research Stage

A. *Research Data and Research Instruments*

This research use Palm Oil (CPO) production data of PT.Lonsum Turangie for the last 5 year period (2020-2024) collected from the production department of PT.Lonsum. The data was collected in kilograms (Kg) per month, with total of 60 data points. Then, the data was divided into two parts: The first 36 data points (2020-2022) were used as training data to build the forecasting model, while the next 24 data points (2023-2024) were used for model validation.

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TABLE I. SAMPLE PRODUCTION DATA

CPO Production Data (Kg)			
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Jan	2921590	2546240	1912060
Feb	2961510	2584770	2309680
Mar	3151180	3816720	3135080
Apr	4030690	3154050	2767410
Mei	2902720	2784580	2476290
June	3586180	3195620	3060090
July	3567940	2972110	2792920
Aug	2925480	2672330	2337800
Sept	2523180	3068400	2545780
Okt	2994030	2260500	2093150
Nov	2202440	2297550	2449280
Des	2638310	2622660	3280290
Total	36405250	33975530	31159830

In this research, the instruments used for data collection were semi-structured interviews and participative observation. Interview were conducted with stakeholders who have a direct role in the production and planning process at PT.Lonsum Turangi palm oil mill. The interview aimed to collect depth information about production patterns, operational challenges and forecasting methods that have been used by the company. Direct observations were also made at PT.Lonsum Turangi palm oil mill to learn about the flow of CPO production process, daily data recording and the interaction between the working unit in making production decisions. The combination of interviews and observations provides a comprehensive overview of the needs of an accurate and real-time forecasting system, and becomes the basis for designing a system that is in accordance with field conditions.

B. System Development Method

This research uses one of the models from the System Development Life Cycle (SLDC), namely the Rapid Application Development (RAD) or Rapid Prototyping development method. RAD is an incremental software development method. The Rapid Application Development (RAD) method emphasizes a short, short and fast software development cycle [17]. Rapid Application Development (RAD) develops systems through a working model that is contributed at the beginning of development. Where this aims to determine the final user needs (requirements). In this system development model, the working model is only used once as an initial design as well as the final system implementation. The Rapid Application Development (RAD) method is also a linear sequential development method that emphasizes a short development cycle [18].

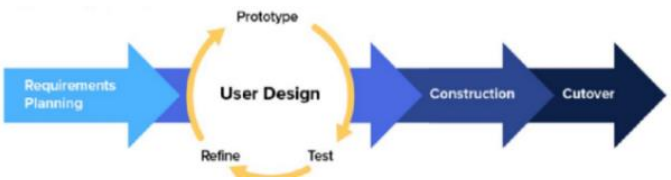

Fig. 2. Rapid Application Development (RAD) Stage Method

The stages of development using the Rapid Application Development (RAD) method that the author does:

1) Requirements planning

Requirements planning is based on observations and identification of problems that have been carried out previously. This stage aims to make the system that will be made in accordance with user needs and can be a solution to the problems faced by users [19]. The requirement panning stage is carried out in the following way

- *Observation*

Author makes direct observations at the Palm Oil Mill PT.Lonsum Turangi operational area where production data management is done using Microsoft Excel, however there is no system that can predict the amount of CPO production in the future.

- *Interview*

Author conducted an interview with the Head of Administration in PT Lonsum Palm Oil Mill Turangi operational area regarding the production process, production raw materials, and production data management. The interview process is also dug up information and data information and data available at the PT Lonsum Palm Oil Mill in the Turangi operational area.

- *Literature study*

Author conducts a literature study by studying journals, books and literature related to the research, including forecasting, Exponential smoothing method, Triple exponential smoothing method and website implementation.

2) User design

The user design stage is carried out to design the system process and interface that will be proposed to users [20]. User design design is carried out using UML (Unified Modeling Language) as system modelling. This stage aims to make sure that the design made is in accordance with user needs.

3) System development (construction)

After the design has been made and confirmed according to user needs, the design is developed into the form of a system that has been planned previously [21]. In this research, system development is carried out starting from coding to adjusting the design that has been made into the system using PHP and MySQL as a database.

4) Testing (cutover)

After the development is carried out, the system will be developed. Testing (cutover) After system development is carried out, testing is carried out on the system that has been developed[22]. Testing is carried out on the program module then continued with black-box testing, verification of system features, forecasting accuracy testing and comparison of system forecasting results with the manual forecasting method used in PT Lonsum Turangi palm oil mill.

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C. Triple Exponential Smoothing Method

Triple Exponential Smoothing is one of the forecasting methods developed by Brown. The Triple Exponential Smoothing method performs forecasting with three times smoothing analysis using a predetermined constant value with the aim that the forecasting results obtained are effective and appropriate so that prediction errors can be minimized [23]. This method is used on stationary and non-stationary data that has a regularly recurring seasonal pattern [24].

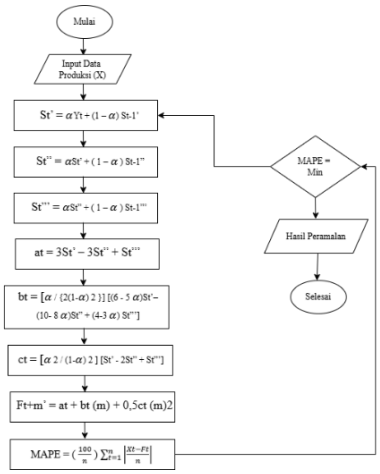

Fig. 3. Triple Exponential Smoothing Algorithm Flowchart

In the Triple Exponential Smoothing method, the first step is to determine the value based on trial and error by finding the value closest to the actual value. This method is applied to CPO production data of PT.Lonsum Turangi palm oil mill with the parameter α = 0.1 which is choosen based on comparative trials. Then the Triple Exponential Smoothing is implemented in the system as follows :

1) Parameter initialization

At this stage, the value of parameter α = 0.1 is determined based on the trial results. Then initialize the first values of S'1, S''1 and S'''1 using the actual data of the first period.

2) Calculating of Smoothing Value

After obtaining the parameter value, three smoothing calculations are carried out including : (1) calculating the Single Exponential Smoothing (S't) value for level data, (2) calculating Double Exponential Smooting (S''t) value for trend data and (3) calculating Triple Exponential Smooting (S'''t) value for seasonal data.

3) Forecasting parameter calculation

After calculating the smoothing value, the next step is calculate the constant (at) as the base of forecasting value, the slope (bt) for the trend component and ct value for seasonal component.

4) Forecasting value calculation

At this stage, the calculation of the forecasting value for the upcoming period is carried out with the following equation:

$$Ft + m = at + bt\,(m) + \tfrac{1}{2}\,ct\,(m^2) \quad (1)$$

5) Accuracy measurement

After obtaining the forecasting value is obtained, the next test is carried out on the forecasting results using the Mean Absolute Percentage Error (MAPE) equation. Mean Absolute Percentage Error (MAPE) is amethod of measuring the absolute error rate in forecasting period by finding the percentage error value of the difference between actual data and forecasting data. The smaller MAPE value, more accurate the forecasting [25]. This following table is the criteria for determining MAPE.

TABLE II. INTERPRETATION OF MAPE VALUE

MAPE	Interpretation
<10%	Highly accurate forecasting
10% -20%	Good forecasting
20% - 50%	Reasonable forecasting
>50%	Innacurate forecasting

To calculate the MAPE value using the following equation:

$$MAPE = \frac{1}{n} \sum^{n} i=0 \mid Ft-yi\ yi \mid n\ i=0 \times 100\% \quad (2)$$

Where :
Ft = forecasting value
yi = actual value
n = data

III. RESULT AND DISCUSSION

A Data Analysis

Based on the sample data, there is a pattern of decreasing CPO production over a 3-year period, with total production decreasing from 36,405,250 kg in 2020 to 31,159,830 kg in 2022 (a decrease of approximately 14.4%). This pattern indicates a downward trend that needs to be considered in the forecasting analysis. In addition, the data shows significant monthly fluctuations, with the highest production pattern generally occurring in March-April and the lowest in November, indicating seasonal factors affecting CPO production.

Some of the factors that can affect this production pattern include:

- *The oil palm harvest cycle which is influenced by the rainy and dry seasons.*
- *Productive age of oil palm plants in PT.Lonsum plantations*
- *Fluctuating weather and climate conditions during the period*
- *Technical factors such as machine capacity and mill operational efficiency*

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B *User Requirement Analysis*

Identification as well as data analysis, then an analysis of user needs for the system is carried out. The analysis process includes information collection, modeling and system development according to user needs [26]. By analyzing user needs, it will be easier for researchers to build a system that can be a solution that is functional as well as intuitive and user-friendly [27]. User needs analysis was carried out on three users, namely the Administrator, Production Manager and Production Supervisor.

TABLE IV. USER REQUIREMENT ANALYSIS

User Requirements for the System			
No	**Actor**	**Feature**	**Description**
1	Administrator	- Login and access - Prediction chart dashboard - User management - Historical data management - Monitoring sistem - Export reports	- Administrator can manage other users account - Upload, Update and export production data
2	Production Manager	- Login - Prediction graphic dashboard - View historical and prediction reports - Export reports	- Production managers can access historical production data and view prediction results
3	Production Supervisor	- Login - View historical data - Perform prediction - View prediction results - Export reports	- Production supervisor can access historical data and prediction data - Using the *Triple Exponential Smoothing* Algorithm

C *Unified Modelling Language (UML)*

As system modeling, researchers use UML (Unified Modeling Language) use case diagrams so that the system workflow can be described properly. The following is a use case diagram used in the palm oil (CPO) production forecasting system at PT.Lonsum with three users. The use case diagram created has been adjusted to the user needs analysis that has done previously.

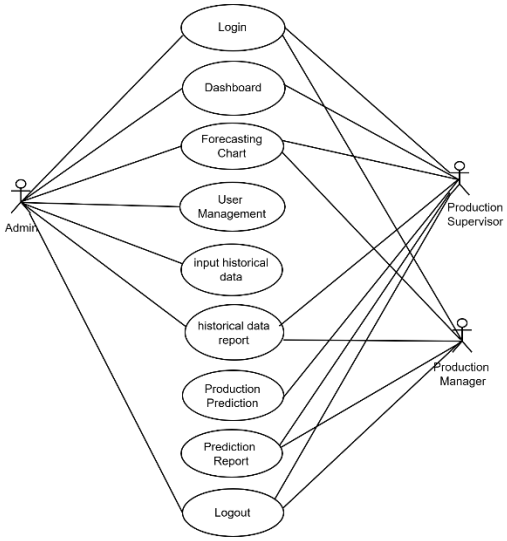

Fig. 4. Unified Modelling Language (UML)

D *Application of the Triple Exponential Smoothing Method*

In applying the triple exponential smoothing method, the first thing to do is to determine the parameter values first trough trial and error. The parameter value used is 0.1. where is the value choosen as a value that is close to the actual value. Next,the 12th period Single Exponential Smoothing (S′t) is performed as follows :

$$S't = a\,Xt + (1 - a)\,S't - 1 \quad (1)$$

$S'1 = 1775040$

$S'2 = (0.1)\ 1959700 + (1 - 0.1)\ 1775040$

$= 1793506.00$

$S'3 = (0.1)2899260 + (1 - 0.1)\ 1793506.00$

$= 1904081.40$…….etc

After the Single Exponential Smooting is done, the second smoothing or Double Exponential Smooting is done as follows:

$$S''t = a\,S't + (1 - a)\,S''t - 1 \quad (2)$$

$S''1 = 1775040$

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S″2 = (0.1) 1793506,00 + (1 – 0.1)1775040
= 1776886.60
S″3 = (0.1) 1904081,40 + (1 – 0.1)1776886.60
= 1789606.60……..etc

Next, the third smoothing or Triple Exponential Smoothing is carried out as follows:

S‴t = a S″t+ (1 − a) S‴t - 1 (3)
S‴1 = 1775040
S‴2 = (0.1) 1775040 + (1 – 0.1) 1776886,60
= 1775224.66
S‴3 = (0.1) 1789606,08 + (1 – 0.1) 1776886,60
= 1778158.55..……..etc

After obtaining the results of the three smoothing, the equation is then used to find the constant value (at) as follows:

at = 3S′t - 3S″t + S‴t (4)
at1 = 3(1775040) - 3(1775040) + 1775040
= 1775040
at2 = 3(1793506,00) - 3(1776886,60) + 1775224,66
= 1825082,86
at3 = 3(1904081,40) - 3(1789606,08) + 1778158,55
= 2121584,51..……etc

After getting the constant value (at) then do the equation to find the slope value (bt) and the ct value as follows:

bt = a / 2(1- a)(6 - 5. a)S' - (10-8. a) S" + (4- 3. a) S‴t (5)
bt1 = (0,1/2) x (1 - 0.1)² x ((6 - (5 x 0,1)) x 1775040 - ((10 – (8 x 0,1)) x 1775040+ ((4 – (3 x 0,1) x 1775040))
= 1775040
bt2 = (0,1/2) x (1 - 0.1)² x ((6 - (5 x 0,1)) x 1793506,00 - ((10 – (8 x 0,1)) x 1776886,60 + ((4 – (3 x 0,1) x 1775224,66))
= -267772.96
bt3 = (0,1/2) x (1 - 0.1)² x ((6 - (5 x 0,1)) x 1904081,40 - ((10 – (8 x 0,1)) x 1789606,08 + ((4 – (3 x 0,1) x 1778158,55)) = -245631.81..……etc

ct = a 2 (1- a) 2 (S′t - 2S″t + S‴t) (6)
ct1 = 0,1² / (1 – 0,1)² x (1775040 – (2 x 775040) + 1775040)
= 0
ct2 = 0,1² / (1 – 0,1)² x (1793506,00 – (2 x 1776886,60) + 1775224,66)
= 184.66
ct3 = 0,1² / (1 – 0,1)² x (1904081,40 – (2 x 1789606,08) + 1778158,55)
= 1271.95..…….etc

The next step is to determine the production forecasting value for the next period followed by determining the MAPE value to determine the accuracy of the prediction results.

Ft + m = at + bt (1) + ½ ct (1) (7)
Ft + m = 2999947.48 + -248536.92 (1) + (1,89 x 3389.71 (1)²)
= 2753105.41

The results of palm oil (CPO) forecasting using the PT.Lonsum Triple Exponential Smoothing method for the January 2025 period produced 2753105 Kg of Crude Palm Oil (CPO) with the MAPE values :

$$MAPE = \frac{1}{n}\sum^{n} i=0 \mid Ft-yi\ yi \mid n\ i=0 \times 100\% \quad (8)$$

MAPE = 17.34 (Good forecasting)

E Analysis of Forecasting Results

The results of forecasting with the Triple Exponential Smoothing (TES) method show a MAPE value of 17.34%, which according to the MAPE interpretation category is included in Good Forecasting category (10%-20%). However, it is necessary to analyze more deeply the factors that affect the level of accuracy

1) Alpha (α) parameter selection analysis

The value of alpha (α) = 0.1 selected through trial and error is a relatively small value, which indicates that the model gives greater weight to historical data compared to recent data. This small alpha value selection is suitable for data that has high random fluctuations, as seen in PT Lonsum's CPO production data which has significant monthly variations. To validate this parameter selection, a comparison was made with several other alpha values

TABLE V. COMPARISON OF OTHER ALPHA VALUES

Alpha	MAPE	Interpretation
0.1	17.34%	Good forecasting
0.2	19.26%	Good forecasting
0.3	21.58%	Reasonable forecasting
0.4	23.75%	Reasonable forecasting

From this comparison, it can be seen that the alpha = 0.1 value does provide the best MAPE results, validates the accuracy of the parameter selection.

2) Model and Data limitation

Although the forecasting results show a good level of accuracy, there are some limitations in the model and data that need to be considered. The model only uses 3 years of data (2020-2022) which may not adequately represent the long-term pattern of CPO production, especially given the consistent downward trend in production over the period.

Triple Exponential Smoothing model does not explicitly take into account external factors such as extreme weather changes, company policy changes, or market conditions that may affect CPO production. Historical data shows a downward trend in production from year to year, which may affect the forecasting results if this trend does not continue in the future. The use of a

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single alpha value (α = 0.1) for all model components (level, trend, and seasonality) may not be optimal, as each component can have different dynamic characteristics.

F System Implementation

System implementation using the Rapid Application Development (RAD) approach, which focuses on accelerating the development process through continuous iterations. The implementation stages include historical data analysis, user requirements analysis and system modelling using UML and application of Triple Exponential Smoothing (TES) method to generate the accurate forecasting results. After carrying out these stages, it is necessary to implementation and testing of the system where this test aims to check that the system running process is in accordance with user needs and to check whether the system running is in accordance with the planning in the research method used.

- *Login View*

Fig. 5. Login view

On this view users must enter their username and password in order to have access to the system. There are 3 users with each username and password that have been registered : Admin, Supervisor and Manager. Users must ensure that the username and password entered are correct. The login page also limits each user to different access rights that have been determined by the system.

- *Dashboard View*

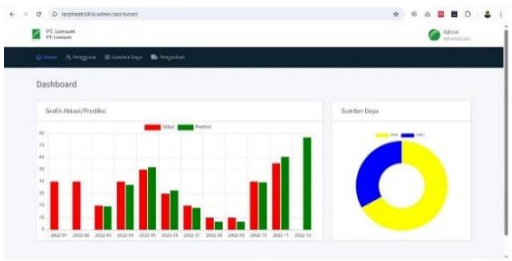

Fig. 6. Dashboard View

On the dashboard view there is a comparison graph of actual data and forecasting results that have been carried out. there is also a resource graph : CPO and FFB. each user can access the dashboard view.

- *Page as Admin*

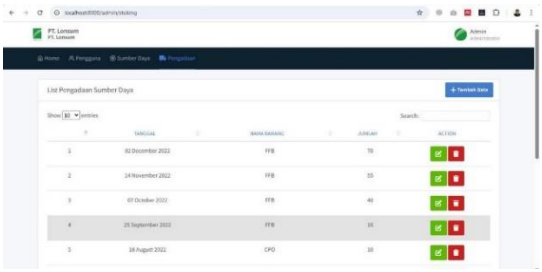

Fig. 7. Resource procurement view

After logging in as Administrator, user is directed to several features : dashboard, user management, resources and resource procurement. User can management system user : edit, update and delete user data that has access to the system. On the resource view and resource procurement view, users can add resources and input historical production data. User can also view historical data report.

- *Page as Supervisor*

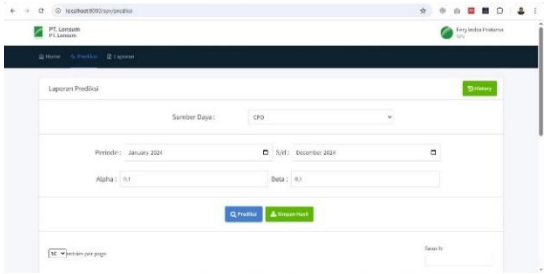

Fig. 8. Forecasting process view

After logging in as a production supervisor, user is directed to the dashboard display in the form of a graph. users can access the forecasting view, historical data report and forecasting data report.

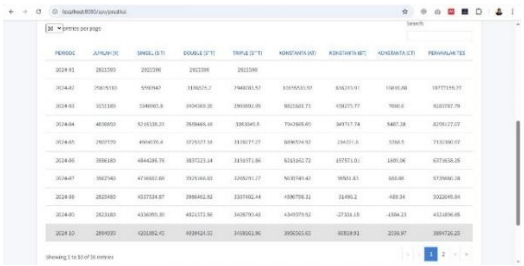

Fig. 9. Forecasting results view

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- *Page as Manager*

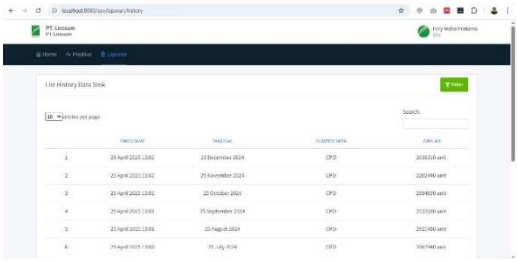

Fig. 10. Historical data report

After logging in as a production manager, user is directed to dashboard display in the form of graph. Users can access Forecasting data report and Historical data report.

IV. CLOSING

The implementation of a production prediction system based on the Triple Exponential Smoothing method has been successfully implemented at PT Lonsum Turangi Palm Oil Mill with good results. By using alpha value = 0.1, the system is able to predict palm oil (CPO) production with a good level of accuracy, as evidenced by the MAPE value of 17.34%. The predicted amount of CPO production for the January 2025 period is 2,753,105 Kg. This research contributes to the integration of the Triple Exponential Smoothing method into a web-based decision support system specifically designed for the palm oil industry. The system enables better data-driven production planning by visualizing historical data and prediction results in an user-friendly interface, which helps management in optimizing mill operations and meeting market demand.

However, this research has several limitations as follows:

1) The prediction is only based on historical production data without considering external variables such as weather conditions, market prices, and other environmental factors that may affect production.
2) The current system only focuses on prediction for one factory location, so it cannot provide a comprehensive picture of the company's overall production.

For future development, some potential areas that can be explored are:

1) Expansion of the prediction system to multi-production sites in one integrated platform.
2) Integration of adaptive smoothing techniques that can automatically adjust parameters based on recent data patterns
3) Integration of external variables such as weather data, soil conditions, and market factors to improve prediction accuracy
4) Development of a "what-if" analysis module to simulate various production scenarios
5) Implementation of machine learning and artificial intelligence to improve the system's predictive capabilities

With this web-based production prediction system, PT. Lonsum and the palm oil industry are expected can be more responsive to market fluctuations, optimize the use of resources, and ultimately improve profitability and operational sustainability.

REFERENCES

[1] M. Y. R. Siahaan and D. Darianto, "Karakteristik Koefisien Serap Suara Material Concrete Foam Dicampur Serat Tandan Kosong Kelapa Sawit (TKKS) dengan Metode Impedance Tube," *J. Mech. Eng. Manuf. Mater. Energy*, vol. 4, no. 1, pp. 85–93, 2020, doi: 10.31289/jmemme.v4i1.3823.

[2] A. E. Batubara, M. F. Yahya, R. Nasyaa, and P. R. Silalahi, "Analisis Ekspor Impor Kelapa Sawit Indonesia Dalam Meningkatkan Pertumbuhan Ekonomi," Jurnal Manajemen, 2023.

[3] E. Lette, M. Zunaidi, and W. R. Maya, "Prediksi Penjualan Crude Palm Oil (CPO) Menggunakan Metode Regresi Linear Berganda," *J. Sist. Inf. Triguna Dharma (JURSI TGD)*, vol. 1, no. 3, p. 128, 2022, doi: 10.53513/jursi.v1i3.5106.

[4] M. I. Wiladibrata, N. Azizah, and K. Rifai, "Smoothing dengan Algoritma Golden Section," pp. 507–511, 2022.

[5] P. A. Qori, D. S. Oktafani, and I. Kharisudin, "Analisis Peramalan dengan Long Short Term Memory pada Data Kasus Covid-19 di Provinsi Jawa Tengah," *Prism. Pros. Semin. Nas. Mat.*, vol. 5, pp. 752–758, 2022, [Online]. Available: https://journal.unnes.ac.id/sju/prisma/article/view/54319

[6] M. A. Siregar and N. B. Puspitasari, "Peramalan Hasil Produksi Minyak Kelapa Sawit PT . Bakrie Pasaman Plantations Dengan Metode Holt-Winter ' S Exponential Smoothing," *Ind. Eng. Online J.*, vol. 12, no. 2, p. 10, 2023.

[7] Anisah Anisah and Hadita Hadita, "Penerapan Metode Forecasting Dalam Menentukan Persediaan Kopi Susu Pada Usaha Mikro Kecil Menengah Dalam Hal Ini Sir Coffeehouse Bekasi," *J. Manag. Creat. Bus.*, vol. 2, no. 1, pp. 97–107, Jan. 2024, doi: 10.30640/jmcbus.v2i1.2070.

[8] M. N. Akhtar, E. Ansari, S. S. N. Alhady, and E. Abu Bakar, "Leveraging on Advanced Remote Sensing- and Artificial Intelligence-Based Technologies to Manage Palm Oil Plantation for Current Global Scenario: A Review," Feb. 01, 2023, *MDPI*. doi: 10.3390/agriculture13020504.

[9] S. Madianto, E. Utami, and A. D. Hartanto, "Algoritma Triple Exponential Smoothing Untuk Prediksi Trend Turis Pariwisata Jatim Park Batu saat Pandemi Covid-19," 2021. [Online]. Available: http://jurnal.polibatam.ac.id/index.php/JAIC

[10] J. Ryan and H. Wijaya, "Implementasi Data Mining untuk Sales Forecasting Berbasis Website dengan Metode ARIMA," *bit-Tech*, vol. 7, no. 1, pp. 19–27, 2024, doi: 10.32877/bt.v7i1.1332.

[11] R. Nelfi Yolanda, D. Rahmi, A. Kurniati, S. Yuniati, J. H. Pendidikan Matematika Fakultas Tarbiyah dan Keguruan Universitas Islam Negeri Sultan Syarif Kasim Riau Jl Soebrantas NoKm, and T. Karya Kec Tampan Riau, "Penerapan Metode Triple Exponential Smoothing dalam Peramalan Produksi Buah Nenas di Provinsi Riau," *J. Teknol. dan Manaj. Ind. Terap. (JTMIT*, vol. 3, no. 1, pp. 1–10, 2024.

[12] R. S. Dewi, I. Jaya, and I. Husein, "Peramalan Penerimaan Pajak Kendaraan Bermotor Menggunakan Metode Triple Exponential Smoothing di Sumatera Utara," *Prox. J. Penelit. Mat. dan Pendidik. Mat.*, vol. 7, no. 2, pp. 572–583, 2024, doi: 10.30605/proximal.v7i2.3724.

[13] R. A. Sandika, S. K. Gusti, L. Handayani, and S. Ramadhani, "Implementasi Triple Exponential Smoothing dan Double Moving Average Untuk Peramalan Produksi Kernel Kelapa Sawit," *J. Inf. Syst.*

p-ISSN 2301-7988, e-ISSN 2581-0588
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Res., vol. 4, no. 3, pp. 883–893, 2023, doi: 10.47065/josh.v4i3.3359.
[14] R. B. Saputro, K. P. Kartika, and W. D. Puspitasari, "Implementation of the Triple Exponential Smoothing Method for Predicting Helmet Sales," *JOINCS (Journal Informatics, Network, Comput. Sci.*, vol. 5, no. 2, pp. 30–34, 2022, doi: 10.21070/joincs.v5i2.1607.
[15] R. N. Puspita, "Peramalan Tingkat Pengangguran Terbuka Provinsi Banten Dengan Metode Triple Exponential Smoothing," *J. Lebesgue J. Ilm. Pendidik. Mat. Mat. dan Stat.*, vol. 3, no. 2, pp. 358–366, 2022, doi: 10.46306/lb.v3i2.138.
[16] F. Wajdi *et al.*, *Metode Penelitian Kuantitatif*, vol. 7, no. 2. 2024.
[17] D. Murdiani and M. Sobirin, "Perbandingan Metodologi Waterfall Dan RAD Dalam Pengembangan Sistem Informasi," *JINTEKS (Jurnal Inform. Teknol. dan Sains)*, vol. 4, no. 4, pp. 302–306, 2022, [Online]. Available: http://www.jurnal.uts.ac.id/index.php/JINTEKS/article/view/2008
[18] Nurman Hidayat and Kusuma Hati, "Penerapan Metode Rapid Application Development (RAD) dalam Rancang Bangun Sistem Informasi Rapor Online (SIRALINE)," *J. Sist. Inf.*, vol. 10, no. 1, pp. 8–17, 2021, doi: 10.51998/jsi.v10i1.352.
[19] A. K. Nalendra, "Rapid Application Development (RAD) model method for creating an agricultural irrigation system based on internet of things," *IOP Conf. Ser. Mater. Sci. Eng.*, vol. 1098, no. 2, p. 022103, 2021, doi: 10.1088/1757-899x/1098/2/022103.
[20] N. Purwati, O. R. Fadhlurrahman, D. Iswahyuni, S. Kiswati, and H. Faqih, "Sistem Informasi Cuti Karyawan Menggunakan Berbasis Web dengan Metode Rapid Application Development (RAD)," *Infomatek*, vol. 25, no. 1, pp. 61–68, 2023, doi: 10.23969/infomatek.v25i1.7822.
[21] S. Suendri, T. Triase, and S. Afzalena, "Implementasi Metode Job Order Costing Pada Sistem Informasi Produksi Berbasis Web," *Js (Jurnal Sekolah)*, vol. 4, no. 2, p. 97, 2021, doi: 10.24114/js.v4i2.17954.
[22] A. Azzahra, W. Ramdhan, and W. M. Kifti, "Single Exponential Smoothing: Metode Peramalan Kebutuhan Vaksin Campak," *Edumatic J. Pendidik. Inform.*, vol. 6, no. 2, pp. 215–223, 2022, doi: 10.29408/edumatic.v6i2.6299.
[23] A. T. Hidayat, D. P. Sari, and P. Andriani, "Forecasting Penjualan Produk Sembako Menggunakan Metode Triple Exponential Smoothing," *RESOLUSI Rekayasa Tek. Inform. dan Inf.* , vol. 4, no. 4, pp. 436–445, 2024, [Online]. Available: https://djournals.com/resolusi
[24] R. F. Putri and E. Ekadiansyah, "Metode Triple Exponential Smoothing Dalam Prediksi Persediaan Bahan Baku Pada PT. Bumi Menara Internusa Berbasis Web," *UNES J. Sci. Res.*, vol. 3, no. 1, pp. 81–87, 2022.
[25] I. Yulian, D. S. Anggraeni, and Q. Aini, "Penerapan Metode Trend Moment Dalam Forecasting Penjualan Produk CV. Rabbani Asyisa," *J. Teknol. dan Sist. Inf.*, vol. 6, no. 2, pp. 193–200, 2020.
[26] L. P. Nugraha, R. S. Sianturi, and L. Fanani, "Perancangan Pengalaman Pengguna Aplikasi Knowledge Management System UMKM menggunakan Metode Human Centered Design (Studi Kasus: UMKM Bogor)," *J. Pengemb. Teknol. Inf. dan Ilmu Komput.*, vol. 6, no. 10, pp. 4829–4838, 2022, [Online]. Available: https://j-ptiik.ub.ac.id/index.php/j-ptiik/article/view/11699
[27] F. Oliyan, R. Heriyanto, Y. Septriani, and K. Tania, "Analisis Kebutuhan Pengguna Untuk Perancangan Aplikasi Database Laporan Keuangan Dengan Menggunakan Microsoft Access untuk UMKM," vol. 3, no. 2, pp. 1–10, 2024.

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