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Inventory Management with Forecasting Method: Single Moving Average and Trend Projection

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Abstract

Inventory management using forecasting methods aims to improve effectiveness and efficiency that facilitate trading businesses in the process of business transactions, improve delivery of information quickly, accurately, and transaction data properly and minimize errors. The system running in the system of selling goods is still manual, that is, it is not well computerized. The method used is forecasting which helps determine the estimated future stock of goods. Single Moving Average and Trend Projection. It can be concluded that the results of implementing this new system can assist trading businesses in recording transactions in the system. We can predict the current flow of goods which has been calculated based on 2 modules that have a connection with the system.

I. INTRODUCTION

The development of technology and information is growing rapidly nowadays, starting from the aspects of human life all using technology, and it has become a necessity that cannot be separated from the lifestyle, even humans are increasingly dependent on technology which results in business people having to use computers as a medium to carry out their business activities for store data due to the ability of computers to store and process information quickly, accurately and efficiently. Many companies no longer do their business processes manually, namely using computers. A computer is a machine that can process digital data by following a series of commands or programs [1]. Computers are electronic devices that receive data input, process data, and provide information by using a program stored in computer memory and storing programs and processing results that work automatically [2].

One of the roles in the development of technology and information is helping a company predict sales of goods in order to optimize sales of a company. Companies need sales forecasting to help companies determine future sales so that the company has optimal performance, and avoids excessive costs so that the costs incurred for sales are not large.

Inventory control is the efforts made by a company including decisions taken so that the need for materials for the production process can be optimally fulfilled with the least possible risk. Inventory that is over stock is a waste because it causes too high costs for storage and maintenance during storage in the warehouse. Besides that, too large an inventory means too large a capital goods that is idle and not rotating. Likewise, on the other hand, out of stock can interfere with the smooth running of the production process so that the on time delivery as set by the existing customer is not fulfilled so that the customer runs to another company.

Sales recording is still manual, namely, recording through a defacta book. For this reason, it is necessary to create a system that can assist trading businesses in recording sales and can predict future sales using a sales forecasting method, so that the trading business can control the sales of future goods.

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II. Related Works/Literature Review (Optional)

Inventory Management

Inventory is one of the most important company assets because it has a direct effect on the company's ability to obtain opinions [3]. Therefore, inventory must be managed and recorded properly so that the company can sell its products and earn revenue so that the company's goals are achieved. Inventories are materials or goods that are stored and will be used to fulfill certain purposes, for example for use in the production process or for spare parts of equipment or machines. Inventories can be in the form of raw materials, auxiliary materials, goods in process, finished goods, or spare parts. It can be said that there is no company that operates without inventory even though in fact the inventory is only a source of funds related to it that cannot be used for other purposes. So important is this inventory that accountants include it on the balance sheet as a current asset account.

Inventory management itself has a function, namely the inventory function in meeting company needs, namely [4]:

1. Eliminates the risk of delays in delivery of raw materials or goods needed by the company.
2. Eliminates the risk if the material ordered is not good so it must be returned.
3. Eliminates the risk of rising prices or inflation.
4. To store raw materials that are produced seasonally so that the company will have no trouble if the material is not available in the market.
5. Benefit from purchases based on quantity discounts.
6. Providing services to customers with the availability of the necessary items.

Inventory management has an approach model consisting of Economic Order Quantity (EOQ), Periodic Review, Material Reference Planning (MRP) which explains the following:

1. Economic Order Quantity (EOQ)
   Economic Order Quantity that is, the most economical number of orders, namely, the number of purchases of goods that can minimize the total cost of maintaining goods in the warehouse and ordering costs each year.
2. Periodic Review
   In this approach, orders are made at the same time interval. This means that ordering goods has been scheduled regularly so that the costs prepared can be estimated.
3. Material Reference Planning (MRP)
   In MRP, the purchase of goods required planning to make a product that consists of several components, known as the assembling system. The goal is to keep inventory levels to a minimum, as well as to plan shipping activities, scheduling, and material purchases.

Forecasting

Forecasting is the "art and science of predicting future events" [5] [6] [7].
Forecasting itself has types, namely, forecasting can be divided into several types [8]. Judging from future operational planning, forecasting is divided into 3 types, namely:

1. An economic forecast describes the business cycle by predicting the rate of inflation, the availability of money, the funds needed to build housing and other planning indicators.
2. Technological forecasting takes into account the level of technological advancement that can launch attractive new products, which require new factories and equipment.
3. Demand forecast is a prediction of the demand projection for a company's production or services.

The methods used are:

Single Moving Average

Single Moving Averageis a method of forecasting that is done by taking a group of observed values, looking for the average value as a forecast for the coming period. The Single Moving Average method has special characteristics, namely:

1. To determine the forecast for the future period requires historical data for a certain period of time. For example, with a 3 month moving average, the forecast for the 5th month is only made after the 4th month has finished / ended. If the month moving averages the 7th month can only be created after the 6th month ends.
2. The longer the moving average is, the more noticeable the effect of slippage will be in the forecast or produce a smoother moving average.
   Single moving average mathematical equation s are as follows:

$$Mt = Ft + 1 = \frac{Xt + Xt - 1 + Xt - 2 + \cdots + Xt - n + 1}{n} \ldots\ldots\ldots\ldots\ldots\ldots (2.1)$$

Keterangan:

Mt	:	Moving Average period t
Ft+1	:	Forecast for the period t + 1
Xt	:	The real value of period t
N	:	The number of limits in the moving average

$$Mt = Ft + 1 = (Y1 + Y2 + \ldots + Yn) / n$$

Information:

Ft+1	:	The forecast for the next period
Y	:	Data on the past
N	:	The number of periods moved

Trend Projection

A method used to match trend lines to a past data set, then project the line on the future for medium or long term forecasting. The trend line in the trend projection method can be expressed by the following equation:

$$\check{y} = a + bX \ldots\ldots$$

Where:

$\check{y}$	:	time series data
a	:	y-axis cross
b	:	the slope of the regression line (rate of change at y for changes occurring at X)
X	:	independent variable

To find the value of b can be found by the following equation:

$$b = \frac{\Sigma xy - n\overline{xy}}{\Sigma x^2 - n\overline{x}^2} \ldots\ldots\ldots\ldots\ldots\ldots$$

Where:

b	:	the slope of the regression line
x	:	the value of the known independent variable
y	:	the known value of the related variable
$\overline{x}$	:	mean of x values
$\overline{y}$	:	average y-values
n	:	the amount of data or observations to find the value of a can be found with the following equation:

$$a = \overline{y} - b\overline{x} \ldots\ldots\ldots\ldots$$

Where:

a	:	axes cross
b	:	the slope of the regression line
$\overline{x}$	:	mean of x values
$\overline{y}$	:	average y

III. METHODS

Single Moving Average

Single Moving Average is a method of forecasting that is carried out by taking a group of observed values, looking for the average value as a prediction for the coming period.

$$\mathrm{M}t = Ft + 1 \ = (Y1 + Y2 + \ \ \ldots + Yn) \ / \ n$$

Example: Hansaplast sales data found at Pharmacies in January-June 2019

January	:	20
February	:	25
March	:	16
April	:	20
May	:	25
June	:	?

Calculations using the Single Moving Average method found in Pharmacies for January-June 2019:

April	:	20 + 25 + 16 / 3 = 20.3
May	:	16 + 23 + 25 / 3 = 21.3

So the number of Hansaplast that must be purchased by Pharmacies for June 2019 is **21.3**

Trend Projection

A method used to match trend lines to a past data set, then project the line on the future for medium or long term forecasting. The trend line in the trend projection method can be expressed by the following equation:

$$\check{y} = a + bX \ldots \ldots$$

September	:	20
Oktober	:	44
November	:	50
Desember	:	70
Januari	:	

Penjualan Apotik pada bulan September 2019 sampai Desember 2019

Month (x)	**Sales (y)**	**x²**	**Xy**
September	20	1	20
October	44	4	88
November	50	9	150
December	70	16	280
Σx = 10	Σy = 184	Σ x² = 30	ΣXy = 538

$$x = \frac{\sum x}{n} = \frac{10}{4} = 2.5$$

$$y = \frac{\sum y}{n} = \frac{184}{4} = 46$$

$$b = \frac{\sum xy - nxy}{\sum x^2 - nx^2} = \frac{538 - (4)(2.5)(46)}{30 - (4 * 2.5^2)} = \frac{78}{5} = 15.6$$

$$a = \overline{y} - b\overline{x} = 46 - (15.6)(2.5) = 7$$

So, where x is the next month then $y = a - bx = 7 + 15.6\ x,$

$$y = a - bx = 7 + 15.6\ (5) = \mathbf{85}$$

Requirement Elicitation

In designing an application, a list of the needs of the application user is needed so that the application that will be created will be in accordance with the user's wishes. Therefore Requirement Elicitation is needed, which is distributed to people who will use this drug control application in order to make the application in accordance with the user's wishes.
This stage describes the requirements in the program for the Pharmacy. The list of requirements is:

Elicitation Phase I

Phase I elicitation is prepared based on the needs of the Pharmacy. The following is a table of the results of phase I elicitation, in the form of data that has been obtained from the collection process in the form of interviews and filling forms:

Table 1. Requirement Elicitation Phase I

No.	User Want System Can
1	Displays the login page
2	Display easy to understand
3	Can edit, delete, save
4	Has a single moving average forecasting calculation method
5	Has a Trend Projection forecasting calculation method
6	Have a sales transaction report
7	Can print sales transaction reports
8	Has a Single Moving Average forecasting report
9	Has a Trend Projection forecasting report
10	Can print Single Moving Average forecasting report
11	Can print Trend Projection forecasting reports
12	Can change password
13	Can view product data
14	Can log out

Elicitation Phase II

Elicitation Phase II is formed based on stage I elicitation and then classified to be processed again. The classification process uses the MDI method. This MDI method aims to separate important system designs, along with a full explanation:

a. M in MDI is Mandator, meaning that this need must exist and should not be eliminated at the time of system creation.
b. D on MDI is Desirable, meaning that this need is not too important and can be eliminated. But if these requirements can be implemented it will make the system more perfect.
c. I in MDI is Inessential, meaning that these requirements are not part of the system being discussed and are outside the system.

The following is the table of results from the phase II requirement elicitation, option (I) in the table will be eliminated:

Table 2. *Requirement Elicitation Phase II*

Functional				
No.	User Want System Can	M	D	I
1	Displays the login page	*		
2	Display easy to understand		*	
3	Can edit, delete, save	*		
4	Has a single moving average forecasting calculation method	*		
5	Has a Trend Projection forecasting calculation method	*		
6	Have a sales transaction report	*		
7	Can print sales transaction reports	*		
8	Has a Single Moving Average forecasting report	*		
9	Has a Trend Projection forecasting report	*		
10	Can print Single Moving Average forecasting report	*		

11	Can print Trend Projection forecasting reports	*		
12	Can change password	*		
13	Can view product data	*		
14	Can log out	*		

Elicitation Phase III

After the Phase II Elicitation has been completed, then the next step is to reclassify using the TOE method. The explanation of the TOE method is as follows:

a. T in TOE is Technical, meaning how are the procedures / techniques for making these requirements in the proposed system?
b. O in TOE is Operational, meaning how will the procedures for using these needs in the system be developed?
c. E in TOE is Economy, meaning how much it costs to build these needs in the system?

The TOE method is subdivided into several options, namely High, Middle, and Low. The following is a table of classification results in stage III elicitation:

Table 3. Requirement Elicitation Phase III

Feasibility		**T**			**O**			**E**		
Risk		**H**	**M**	**L**	**H**	**M**	**L**	**H**	**M**	**L**
1	Displays the login page			*			*			*
2	Display easy to understand		*				*			*
3	Can edit, delete, save		*				*		*	
4	Has a single moving average forecasting calculation method	*				*		*		
5	Has a Trend Projection forecasting calculation method	*				*		*		
6	Have a sales transaction report		*				*		*	
7	Can print sales transaction reports		*				*		*	
8	Has a Single Moving Average forecasting report	*				*		*		
9	Has a Trend Projection forecasting report	*				*		*		
10	Can print Single Moving Average forecasting report		*				*		*	
11	Can print Trend Projection forecasting reports		*				*		*	
12	Can change password		*			*			*	
13	Can view product data		*				*		*	
14	Can log out			*			*			*

Final Elicitation

After the Phase III Elicitation is complete, the final stage is final elicitation, in the form of the final result achieved from the elicitation process which will be used as the basis for making the system in this study. The following table of the final elicitation:

Table 4. Final Elicitation

Functional	
No.	**User Want System Can**
1	Displays the login page
2	Can edit, delete, save
3	Has a single moving average forecasting calculation method
4	Has a Trend Projection forecasting calculation method

5	Have a sales transaction report
6	Can print sales transaction reports
7	Has a Single Moving Average forecasting report
8	Has a Trend Projection forecasting report
9	Can print Single Moving Average forecasting report
10	Can print Trend Projection forecasting reports
11	Can change password
12	Can view product data
13	Can log out
Non Functional	
1	Display easy to understand

IV. RESULTS

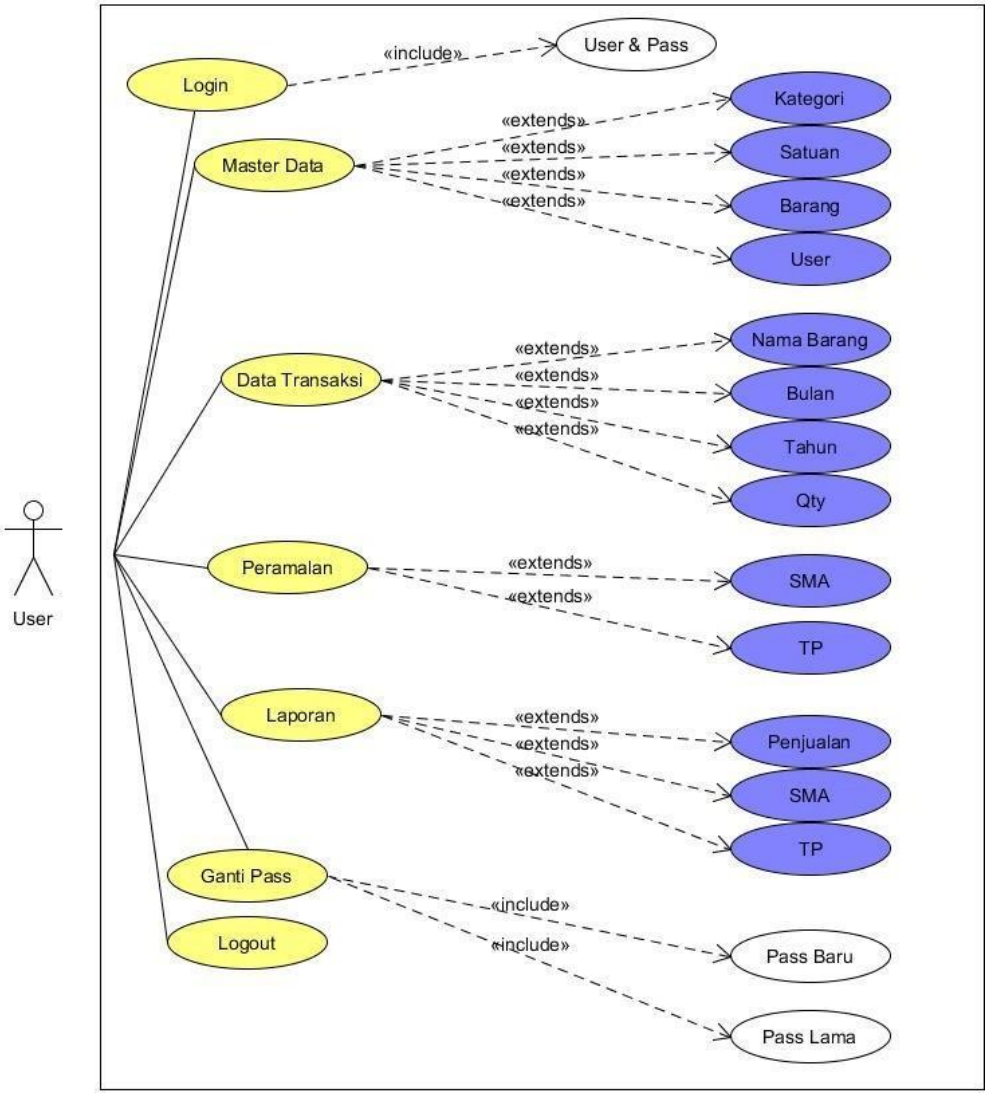

Figure 1. Usecase Forcasting

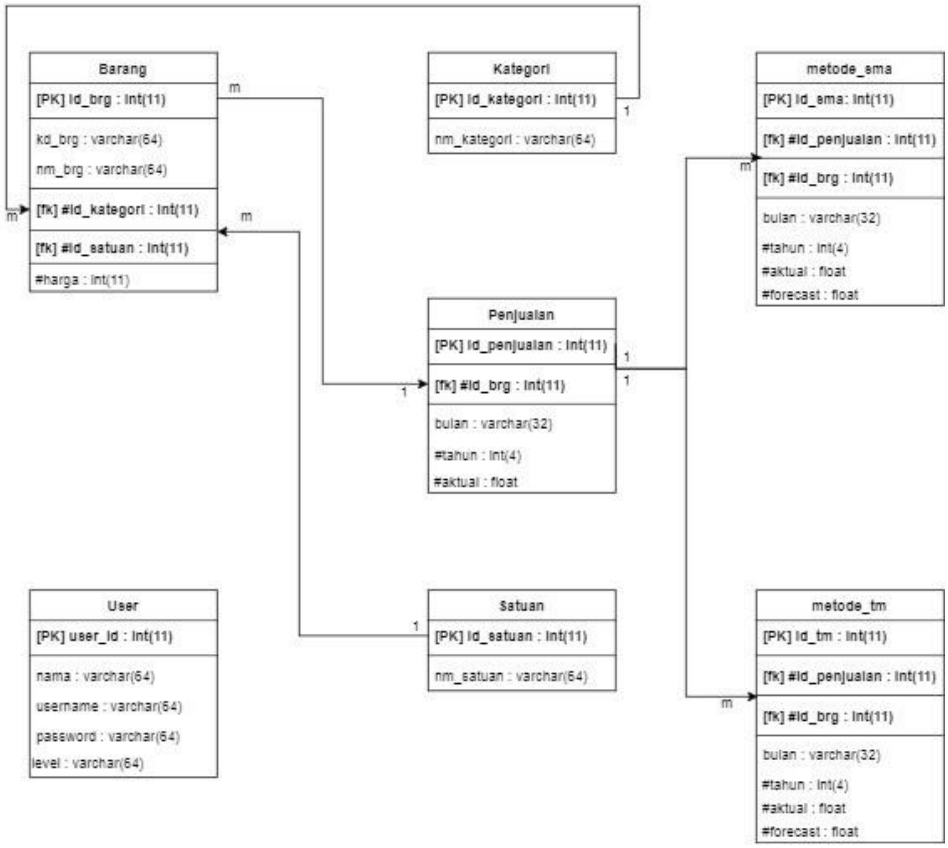

Figure 2. Class Diagram Forcasting

File Structure

File name : barang
File code : barang
Field Key : id_brg

Table 5. Item File Specifications

No.	Field Name	Type	Long	Description
1	id_brg	int	11	Item id
2	kd_brg	varchar	64	item code
3	Nm_brg	varchar	64	Name of goods
4	Id_kategori	int	11	Category id
5	Id_satuan	int	11	Unit id
6	harga	int	11	Price
7	created	datetime	-	Time

File name : user
File code : user
Field Key : user_id

Table 6. User File Specifications

No.	Field Name	Type	Long	Description
1	user_id	int	11	User id
2	nama	varchar	64	Name
3	username	varchar	64	Username
4	password	varchar	64	User password

5	level	varchar	64	Level access

File name : kategori
File code : kategori
Field Key : id_kategori

Table 7. File Category Specifications

No.	Field Name	Type	Long	Description
1	id_kategori	int	11	Category id
2	nm_kategori	varchar	64	Category name

File name : penjualan
File code : penjualan
Field Key : id_penjualan

Table 8. Sales File Specifications

No.	Field Name	Type	Long	Description
1	id_penjualan	Int	11	Sales id
2	id_brg	Int	11	Item id
3	bulan	varchar	32	Month of sale
4	tahun	Int	4	Sales year
5	aktual	Float	-	Quantity

File name : Satuan
File code : Satuan
Field Key : id_satuan

Table 9. Unit File Specifications

No.	Field Name	Type	Long	Description
1	id_satuan	int	11	Unit id
2	nm_satuan	varchar	64	Unit name

File name : metode
File code : metode
Field Key : id_sma

Table 10. SMA Method File Specifications

No.	Field Name	Type	Long	Description
1	id_sma	int	11	Id Single Moving Average
2	id_penjualan	int	11	Sales id
3	id_brg	int	11	Item id
4	bulan	varchar	32	Month of sale
5	tahun	int	4	Sales year
6	aktual	float	-	Quantity
7	forecast	float	-	Forecasting

File name : metode
File code : metode
Field Key : id_tm

Table 11. TM Method File Specifications

No.	Field Name	Type	Long	Description
1	id_tm	int	11	Id Trend Moment
2	id_penjualan	int	11	Sales id
3	id_brg	int	11	Item id
4	bulan	varchar	32	Month of sale
5	tahun	int	4	Sales year
6	aktual	float	-	Quantity
7	forecast	float	-	Forecasting

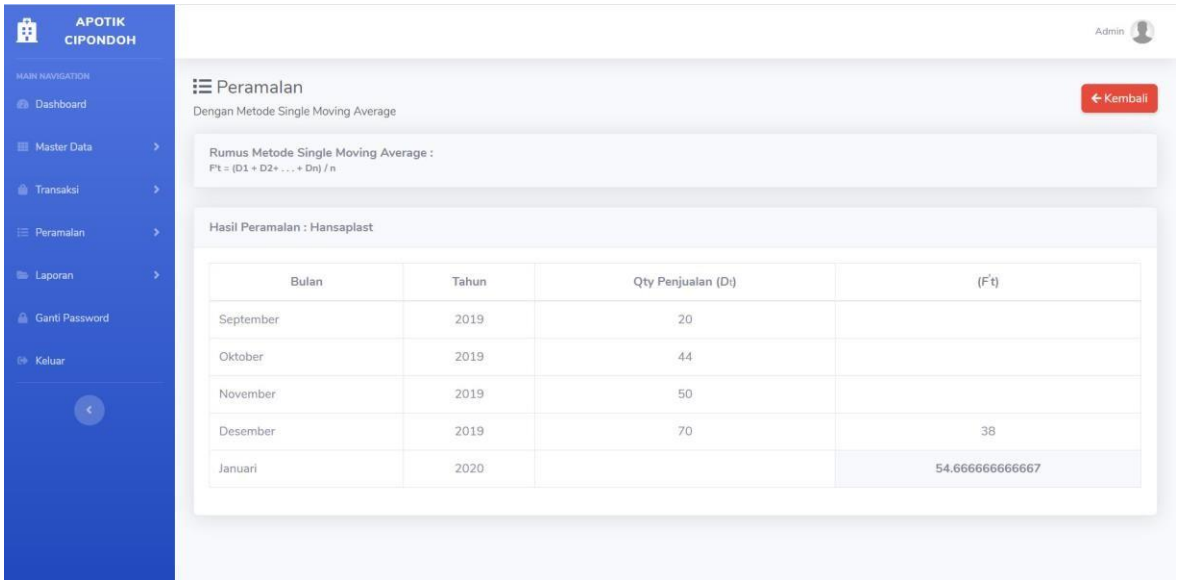

Figure 3. Single Moving Average Result

On this page in accordance with the calculation results of the example in the method described earlier, where in January the forecast result is 54.6

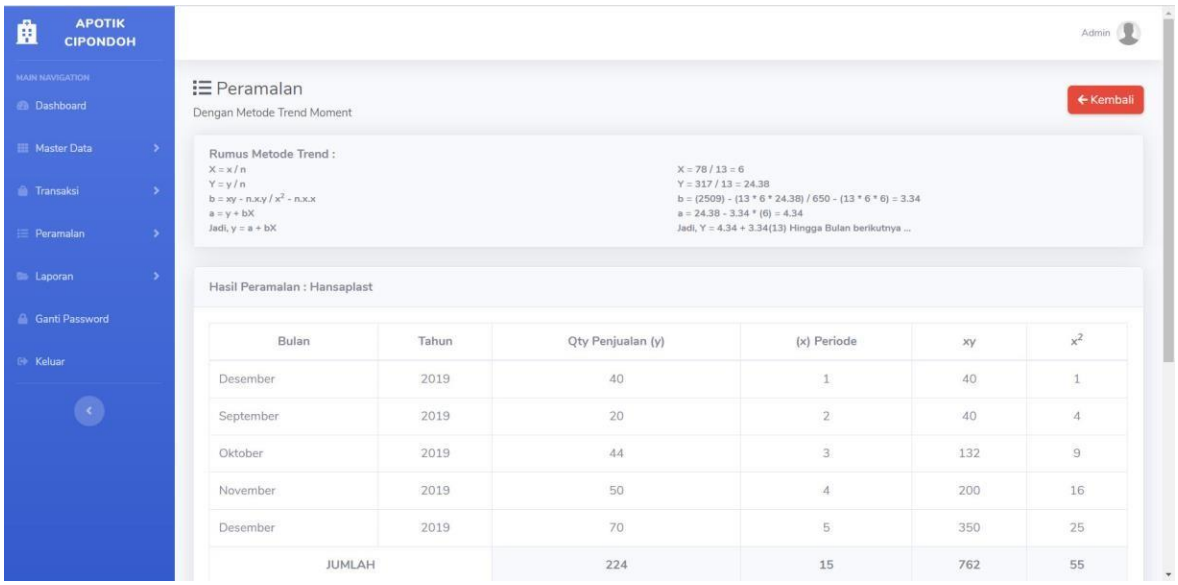

Figure 4. Trend Projection Results

On this page according to the calculation results of the example in the method described earlier, where in December the forecast result is 55

V. CONCLUSIONS

Based on the results of research and observations on trading business, there are several conclusions from the programs that have been made in accordance with the objectives of the research and observations as follows:

1. The use of forecasting methods is successfully applied to trading businesses that can help predict future sales so that trading businesses can control drugs.
2. This system can help trading businesses in improving performance by entering web-based sales data.

VI. REFERENCES

[1] Sujatmiko, "Kamus Teknologi Informasi dan Komunikasi," p. 156, 2012.

[2] Jogiyanto, "Analisis & Desain Sistem Informasi : Pendekatan Terstruktur Teori dan Praktek Aplikasi Bisnis," p. 2, 2006.

[3] Rudianto, "Pengantar Akutansi Konsep dan Tekhnik Penyusunan Laporan Keuangan," p. 222, 2012.

[4] Herjanto, "Manajemen Produksi dan Operasi," p. 238, 2007.

[5] Render dan Heizer, "Operations Management," p. 136, 2005.

[6] Y. Kurnia, I. Yohanes, Y. C. Giap, A. Hermawan and R. Riki, "Study of application of data mining market basket analysis for knowing sales pattern (association of items) at the O! Fish restaurant using apriori algorithm," *Journal of Physics: Conference Series*, vol. 1175, no. 1, 2019.

[7] A. Pataropura, R. Riki and A. Saputra, "Sales Analysis Using the Forecasting Method," *bit-Tech*, vol. 1, no. 3, pp. 146-149, 2019.

[8] Render dan Heizer, "Operations Management," 2004.

[9] a. aku and b. buku, “title is short,” *Journal of Dummy*, vol. 1, no. 1, pp. 1-10, 2017.