Application of Double Exponential Smoothing Method and Dashboard Visualization to Analyze Sales Transaction Data at PT Natural Nusantara Partnership
(Case Study: Stockis BG.3005 Muara Enim)

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Abstract

This study discusses the application of the BI roadmap method and the double exponential smoothing method. The BI roadmap method is used in building a business intelligence dashboard to evaluate product sales of PT. Natural Nusantara on Stockist BG.3005 Muara Enim and double exponential smoothing are used to forecast sales at Stockist BG.3005 Muara Enim for the next period. The application of the two methods showed that sales in 2020-2021 decreased, the best-selling product categories were cosmetic and body care, household, health, and agrocomplex products, and also got the 5 most interested products, namely Nasa Toothpaste, Moreskin: Clean & Glow Cream, Grece AntiPerspirant, Quwless : Liquid Hygiene For Man and Shanas : Shampoo 3 in 1. Forecasting on the five products for January 2022, namely, Nasa Toothpaste = 33 items, Moreskin : Clean & Glow Cream = 2 item , Grece AntiPerspirant = 3 items, Quwless : Liquid Hygiene For Man = 2 items, and Shanas : Shampoo 3 in 1 = 4 items.

I. Introduction

Information is a need of every human being, every human being needs information in order to increase his knowledge of something. Every activity carried out by humans requires information to achieve the desired goals, including in the business field. Information helps entrepreneurs to make quick and appropriate decisions to develop their business (Steven et al., 2021).

According to Hughes and Kapoor in (Huda et al., 2021) business is an organized individual activity to produce or sell goods and services in order to gain profit in meeting the needs of society. These activities may include the sale of goods or service offerings involving several parties, namely producers, intermediaries, and consumers. Information technology makes business competition more competitive.

Business people make the best use of information technology to support the company's operational activities so that they can excel in the competition and make the business more developed (Nagitec, 2020). In general, the development of a business, especially in the field of selling goods, makes more and more data generated. The data generated in the form of sales data, purchase data, customer data, and product data.

PT Natural Nusantara (NASA) is a company engaged in trading natural products, where this company sells various products including health, cosmetics & body care, household, as well as agro-complexes such as agriculture and animal husbandry. In facilitating the distribution and marketing of products, PT Natural Nusantara formed a partnership called NASA Stockists, one of which is Stockis BG.3005. Marketing is a

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process of planning and execution, starting from the conception stage, pricing, promotion, to the distribution of goods, ideas and services, to make exchanges that satisfy the individual and his institutions (Dianto in Asmuni *et al*, 2020). According to Tjiptono in Marlizar (2020) marketing performance is a function that has the greatest contact with the external environment, even though the company only has limited control over the company's environment. In the world of marketing, consumers are assets that must be maintained and maintained their existence in order to remain consistent with the products we produce (Romdonny and Rosmadi, 2019).

Stockis BG.3005 is one of the partnerships of PT Natural Nusantara which is located in Muara Enim. In its operational activities, this stockist utilizes a desktop-based application called foxpro provided by PT Natural Nusantara. This application is used for data management of goods, sales transactions, and customer data. The sales transaction data is accumulated and is only used as an archive and is not reused. Sales transaction data that is only used as an archive and not analyzed properly causes difficulties for Stockist BG.3005 in stock management and knowing sales trends. Stock of goods that cannot meet demand will disappoint customers. On the other hand, items that are piled up and do not sell well will also cause losses. In fact, if the transaction data is processed and analyzed properly, it can produce information about sales trends and assist in managing inventory more precisely.

Business Intelligence dashboards can speed up the process of analyzing data into information, especially information about the most sold products and products that are less attractive to customers (Achmad and Susilawati, 2020). And) *double exponential smoothing* is very appropriate for use on data that has a trend pattern, so that sales predictions can be generated for the coming period and make it easier to manage stock of goods (Andini and Auristandi, 2016).

Therefore, by utilizing *power BI* sales transaction data in Stockis BG.3005 Muara Enim is processed and visualized in the form of a dashboard in order to provide information on sales trends and apply the *Double Exponential Smoothing* to predict future sales, so that it can help Stockist BG.3005 in managing the stock of goods better.

II. Research Method

2.1 Method BI Roadmap

Business Intelligence is part of a decision-making system that includes methods, tools, and applications to provide interactive access to data. By analyzing historical data and performance, *stakeholders* gain knowledge that can be used to make better and more appropriate decisions (Sharda et al., 2018). In this paper, the method used in designing and building *a business intelligence dashboard* uses a business intelligence roadmap approach (Moss and Atre, 2003). The steps in the *BI Roadmap* are as follows.

a. Justification

The first step that must be done is to make observations on Stockist BG.3005 Muara Enim and identify problems that will be used as research and propose solutions to solve these problems.

In distributing Natural Nusantara products, Stockist BG.3005 Muara Enim had difficulty in seeing the development of the business he was running, due to the unknown sales trend which caused a mismatch between customer demand and the existing stock of goods.

b. Planning

At the planning stage, what is done is to determine the *tools* (*hardware* and *software*) used in the construction of *business intelligence dashboards* and data source analysis. *tools* used in this research include Microsoft *Power BI,* Microsoft Excel, Xampp, and Microsoft Word and the data source is obtained from the Foxpro application which is used in the operational data management of Stockis BG.3005 Muara Enim. The data used is PT Natural Nusantara product sales transaction data for 2020 – 2021 at Stockist BG.3005 Muara Enim in excel format (xlsx).

c. Business Analysis

At this stage, an analysis of the information needs to be displayed in the *BI dashboard* as well as the ETL process for the data needed in the research.

d. Design

At the design stage, the thing to do is to design a *warehouse* to store sales transaction data, systems *import* data to make it easier to save data to *the database,* and design *a business intelligence dashboard*.

1. Design *warehouse* Sales

Designing a data warehouse is the process of selecting a fact table and dimension table on a data. In this case, the fact table is the transaction table which consists of id, item code, customer id, quantity, and price. Meanwhile, the dimension table is the customer table and the product table. The following are details regarding the fact table and dimension table at the *data warehouse* BG.3005 Muara Enim
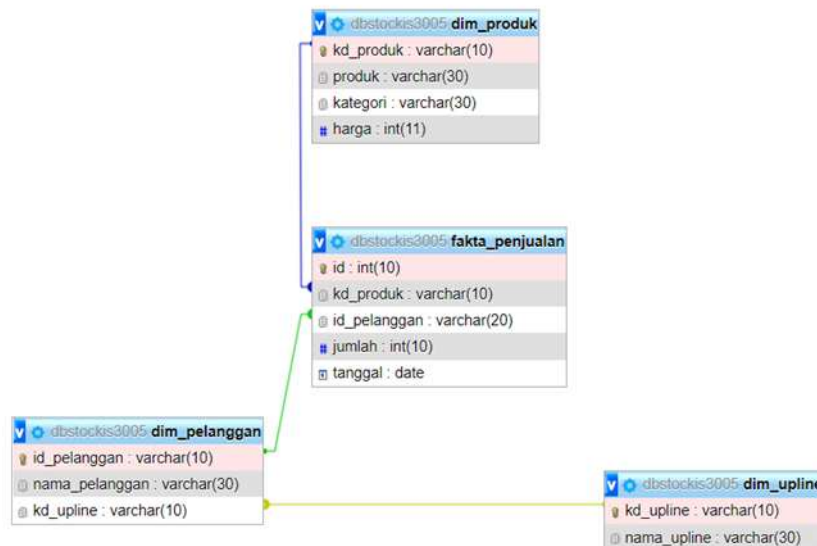

Figure 1. *SEQ * ARABIC 1. Stockist sales datawarehouse scheme BG.3005 Muara Enim*

2. System design

Data import system to facilitate the storage of sales data in excel format into the database. In this system there are 3 menus, namely transactions (viewing transactions and importing data into the database), customers (viewing customer data), and goods (viewing data on goods sold).

Figure 2. *SEQ * ARABIC 2. Data import system menu design*

3. The Business Intelligence Dashboard

BI dashboard consists of 2 pages, namely the business performance dashboard and sales prediction dashboard.
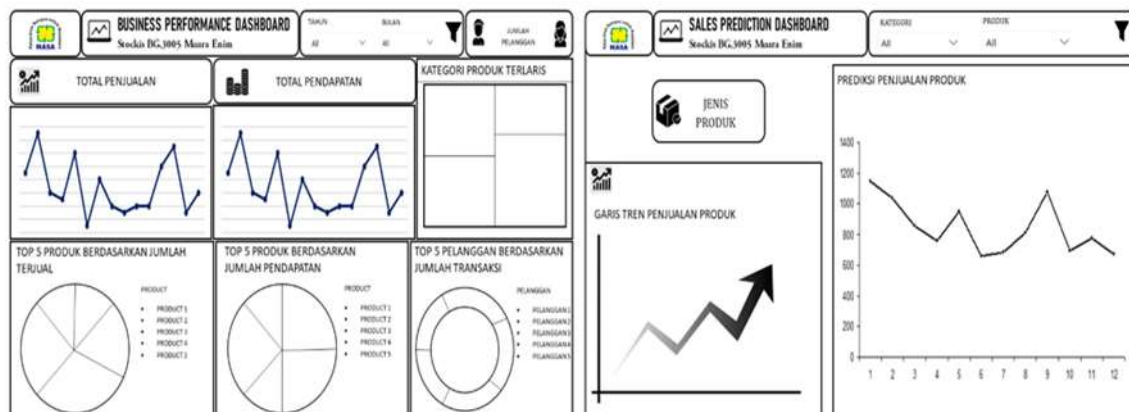

Figure 3. *SEQ * ARABIC 3. Dashboard design*

e. Construction

At this stage, the construction of a data warehouse on database MySQL loading data into the database, and the construction of a business intelligence dashboard.

1. The process of loading data into the database

The following is the process of loading data from an excel file into a database called dbstockis3005 and pulling back the data in the required format.

a) Prepare sales data for 2020 and 2021 which have been cleaned in Microsoft Excel previously.
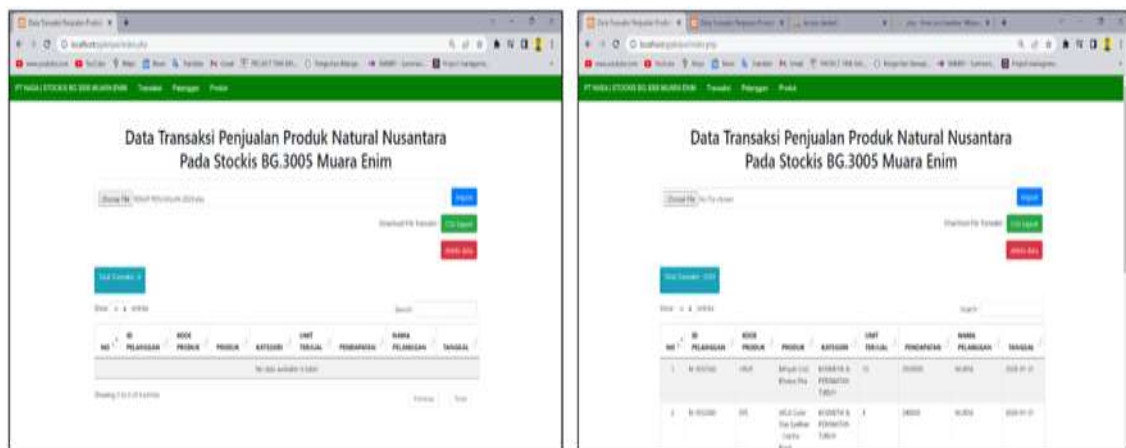
Figure 4. SEQ * ARABIC 4. *The Process of loading exel data into database*

b) Open the import that was created earlier to select the data column to be saved into the database. Click the choose file button and select the sales transaction data to be imported and click import button

2. Development BI dashboard

The application of Microsoft Power BI is used to process sales transaction data in csv format that was obtained in the previous stage. In processing data in the Microsoft Power BI application, there are several steps, namely

Load data into Power BI

At this stage, data is loaded into Microsoft Power BI. The steps are as follows.

a) The first step is to select the Get data menu section home. Then select MySQL database to pull data from the database to power BI. Then the transaction data will be displayed in table format, making sure the data is correct and appropriate. Then click load button to start the data load
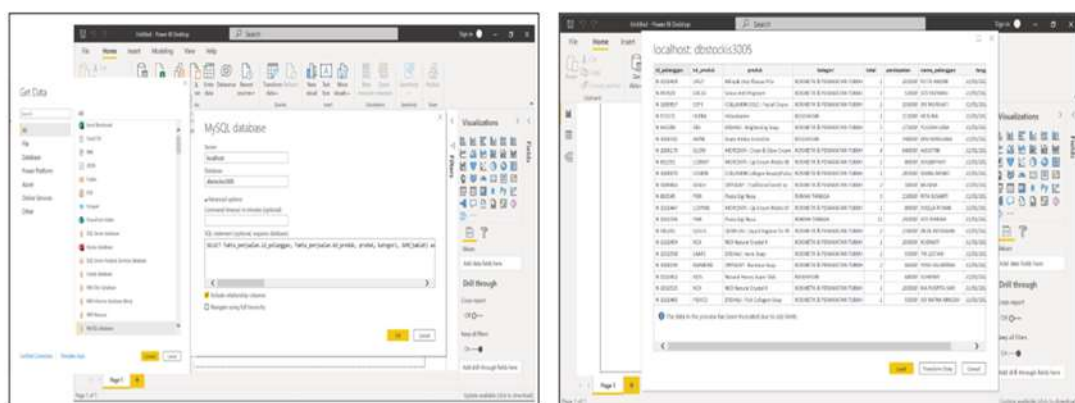

Figure 5. SEQ * ARABIC 5. *Get data from database*

b) Process load in Microsoft Power BI will run and the data has been successfully imported into Microsoft Power BI
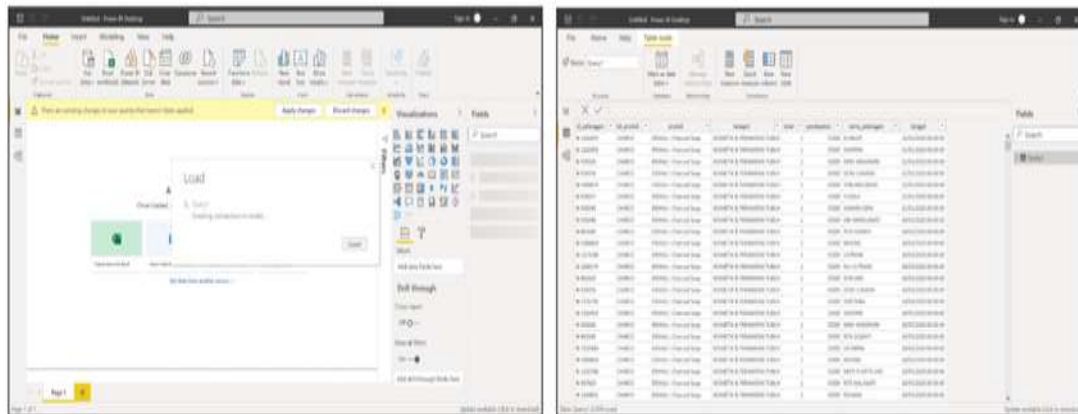
Figure 6. SEQ * ARABIC 6. The process of loading the database into Power BI

2.2 Method Double Exponential Smoothing

Exponential smoothing is a type of moving average forecasting technique that weighs past data in an exponential way so that the most recent data has a greater weight or scale (Utama, 2019). Exponential smoothing is included in the time series model. Time Series Model predicts by using previous data sets to make predictions in the future (Heizer et al., 2017). The method used in this study is the Double exponential smoothing. Double exponential smoothing is the right method for forecasting data that has a trend pattern, either an up or down trend pattern (Marlianah et al., 2019). The following is the formula for the double exponential smoothing method.

$$S't = \alpha Xt + (1 - \alpha)S't{-}1 \tag{1}$$

$$S''t = \alpha S't + (1 - \alpha)S''t{-}1 \tag{2}$$

$$at = 2S't + S''t \tag{3}$$

$$bt = \frac{\alpha}{1-\alpha}(S' - S''t) \tag{4}$$

$$ft{+}m = at + bt\,(m) \tag{5}$$

S' = Single exponential smoothing.
S'' = Double exponential smoothing
at = Constanta.
bt = Trend coefficient.
$ft{+}m$ = Forecast.
$\propto$ = Alpha parameter.
m = Forecasting period.

III. Results and Discussion

Figure 7. ** ARABIC 1. Business Performance Dashboard and Sales Prediction Dashboard*

- **Visualization** *business performance dashboard*

1. Total sales in 2020 – 2021.

The peak of sales during 2020 – 2021 was in January which sold 1231 *items* and the lowest was in September which only sold 91 *items*. So, the products sold in 2020-2021 were 5948 *items*.
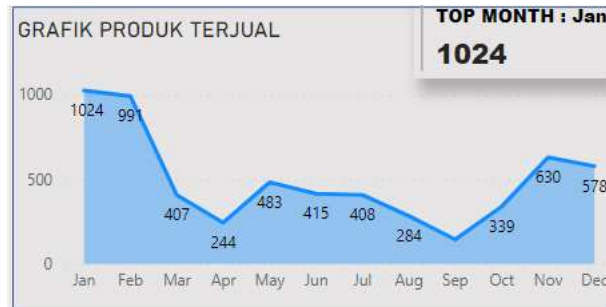

Figure 8. *SEQ * ARABIC 2. Sales chart* 2020 - 2021

2. Total income in 2020-2021

The largest income from 2020-2021 occurred in January of 82,318,000 rupiah and the lowest in September of 15,863,000 rupiah. So, the total revenue generated in 2020-2021 is 521,000,000 rupiah.

Figure 9. *SEQ *ARABIC 3. Income chart 2020 - 2021*

3. Best-selling product categories

From the total sales for 2020-2021, the best-selling product categories are the cosmetic and body care, household, health, and agrocomplex categories with sales of 2693, 1388, 1108, and 759 *items*.
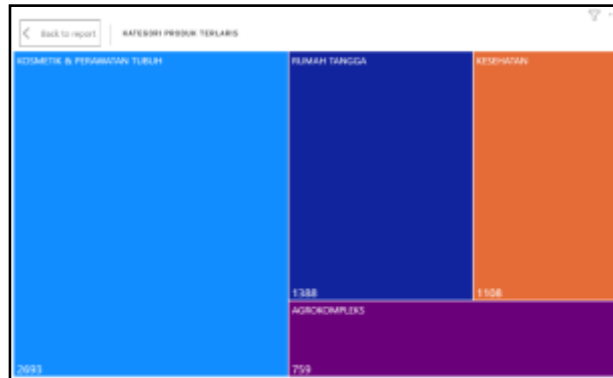

Figure 10. *SEQ * ARABIC 4. Product category*

4. Top 5 best selling products

Top 5 best selling products in 2020 - 2021 namely Nasa Toothpaste, Moreskin : Clean & Glow Cream, Grece Anti Perspirant, Quwless : Liquid Hygiene For Man, and Shanas : Shampoo 3 in 1.
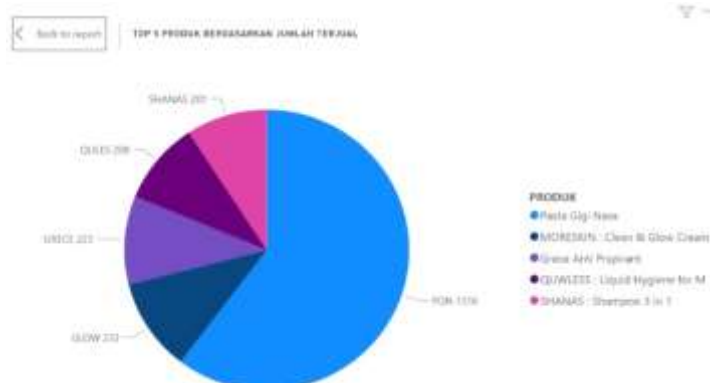

Figure 11. SEQ * ARABIC 5. Top 5 best selling products in 2020 – 2021

b. method *double exponential smoothing*

Based on the analysis, it was found that the 5 best-selling products in sales in 2020-2021 were Nasa Toothpaste, Moreskin: Clean & Glow Cream, Grece Anti Perspirant, Quwless: Liquid Hygiene For Man and Shanas: Shampoo 3 in 1, so the sales would be predicted for these five products. For example, the manual calculation process uses Nasa Toothpaste sales data.

Table 1. Toothpaste sales data Nasa

PGN	Year	Month											
		1	2	3	4	5	6	7	8	9	10	11	12
	2020	222	190	53	45	34	0	0	0	0	0	3	0
	2021	60	250	92	50	55	53	67	31	36	15	17	43

1. Determine the single exponential smoothing

$$S't = \alpha Xt + (1 - \alpha)S't{-}1$$
$$S'_1 = X_1 = 222$$
$$S'_2 = \alpha X_2 + (1 - \alpha)S'_{2\text{-}1}$$
$$= 0{,}5(190) + (1{-}0{,}5)222$$
$$= 206$$
$$S'_3 = \alpha X_3 + (1 - \alpha)S'_{3\text{-}1}$$
$$= 0{,}5(53) + (1{-}0{,}5)206$$
$$= 129{,}5$$
$$S'_4 = \alpha X_4 + (1 - \alpha)S'_{4\text{-}1}$$
$$= 0{,}5(45) + (1{-}0{,}5)129{,}5$$
$$= 87{,}5$$
$$S'_5 = \alpha X_5 + (1 - \alpha)S'_{5\text{-}1}$$
$$= 0{,}5(45) + (1{-}0{,}5)87{,}5$$
$$= 60{,}625$$

so on until the calculation of S'_t for t = 24, which is as follows:
$$S'_{24} = \alpha X_{24} + (1 - \alpha)S'_{24-1}$$
$$= 0{,}5(43) + (1{-}0{,}5)22{,}68$$
$$= 32{,}84$$

2. Finding double exponential smoothing
$$S't = \alpha S't + (1 - \alpha)S''t{-}1$$
$$S''_1 = X_1 = 222$$
$$S''_2 = \alpha S'_2 + (1 - \alpha)S''_{2\text{-}1}$$
$$= 0{,}5(206) + (1{-}0{,}5)222$$
$$= 214$$
$$S''_3 = \alpha S'_3 + (1 - \alpha)S''_{3-1}$$
$$= 0{,}5(129{,}5) + (1{-}0{,}5)214$$
$$= 171{,}75$$
$$S''_4 = \alpha S'_4 + (1 - \alpha)S''_{4-1}$$
$$= 0{,}5(87{,}5) + (1{-}0{,}5)171{,}5$$
$$= 129{,}5$$
$$S''_5 = \alpha S'_5 + (1 - \alpha)S''_{5-1}$$
$$= 0{,}5(60{,}625) + (1{-}0{,}5)129{,}5$$
$$= 95{,}06$$

so on until the calculation of S''_t for t = 24, which is as follows:
$$S''_{24} = \alpha S'_{24} + (1 - \alpha)S''_{24-1}$$
$$= 0{,}5(32{,}84) + (1{-}0{,}5)30{,}82$$
$$= 31{,}83$$

3. of the exponential constant

$$a_t = 2S't - S''t$$
$a_1 = 222$
$a_2 = 2(206){-}214 = 198$
$a_3 = 2(129.5){-}171.75 = 87.25$
$a_4 = 2(87.5){-}129.5 = 45$
$a_5 = 2(60{,}625) -95.06 = 26.18$

And so on until the calculation of S"$_t$ for t = 24, which is as follows:

$a_{24} = 2(32.84) - 31.83 = 33.85$

4. coefficient value *trend*

$$b_t = \frac{\alpha}{1-\alpha}(S' - S''_t)$$

$$b_1 = \frac{0,5}{1-0,5}(S'_1 - S''_1)$$

$$= \frac{0,5}{1-0,5}(222 - 222) = 0$$

$$b_2 = \frac{0,5}{1-0,5}(S'_2 - S''_2)$$

$$= \frac{0,5}{1-0,5}(206 - 214) = 8$$

$$b_3 = \frac{0,5}{1-0,5}(S'_3 - S''_3)$$

$$b_4 = \frac{0,5}{1-0,5}(S'_4 - S''_4)$$

$$= \frac{0,5}{1-0,5}(87,5 - 129,5) = 42,25$$

$$b_5 = \frac{0,5}{1-0,5}(S'_5 - S''_5)$$

$$= \frac{0,5}{1-0,5}(60,625 - 95,06) = 34,43$$

And so on until the calculation of b_t for t = 24, which is

$$b_{24} = \frac{0,5}{1-0,5}(S'_{24} - S''_{24})$$

$$= \frac{0,5}{1-0,5}(32,84 - 31,83) = -1$$

5. calculations Performed forecasting

Forecasting is calculated for the next 1 month

$$F_t + m = at + bt\ m$$
$$F_{24} + 1 = a_{24} + b_{24}(1)$$
$$= 33,85 + (-1)$$
$$= 32,85$$

After getting the values of S'_t, S''_t, a$_t$, and b_t, with alpha = 0, 5 then the forecasting results will be obtained for Nasa Toothpaste products, Moreskin: Clean & Glow Cream, Grece Anti Perspirant, Quwless: Liquid Hygiene For Man and Shanas: Shampoo 3 in 1. Following are the forecasting results for these products.

- **Nasa Toothpaste**
    Based on the prediction results using power BI and manual calculations with the best result $= 0.5$, it is obtained that the sales prediction for Nasa toothpaste products in the following month will be sold as many as 33 *items*.
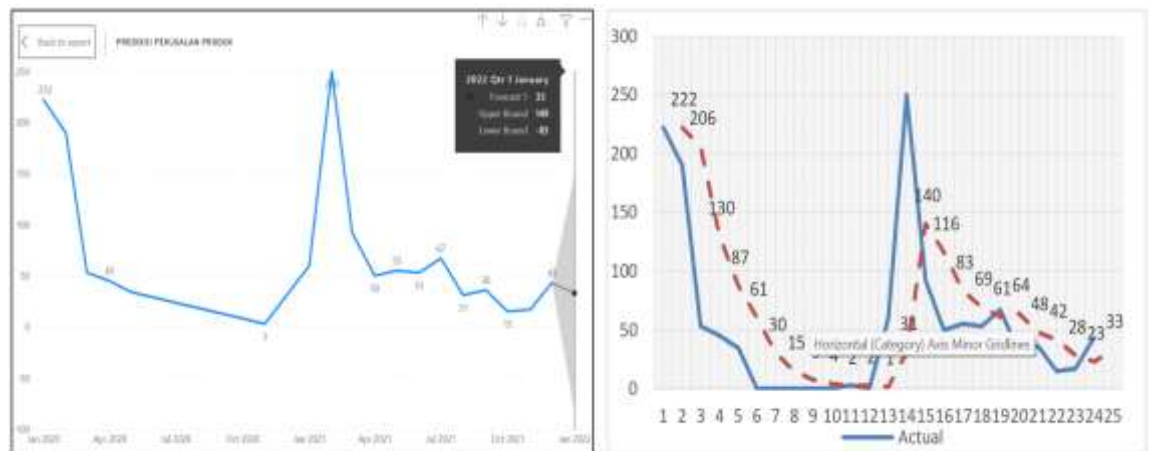
Figure 12. *SEQ * ARABIC 6. Nasa Toothpaste forecasting chart using power BI and manual calculations*

- **Moreskin : Clean and Glow Cream**

Based on the prediction results using power BI and manual calculations with the best result $\alpha = 0,5,$ it obtained that the sales prediction for the product Moreskin : Clean and Glow Cream in the following month will be sold as many as 2 *items*.
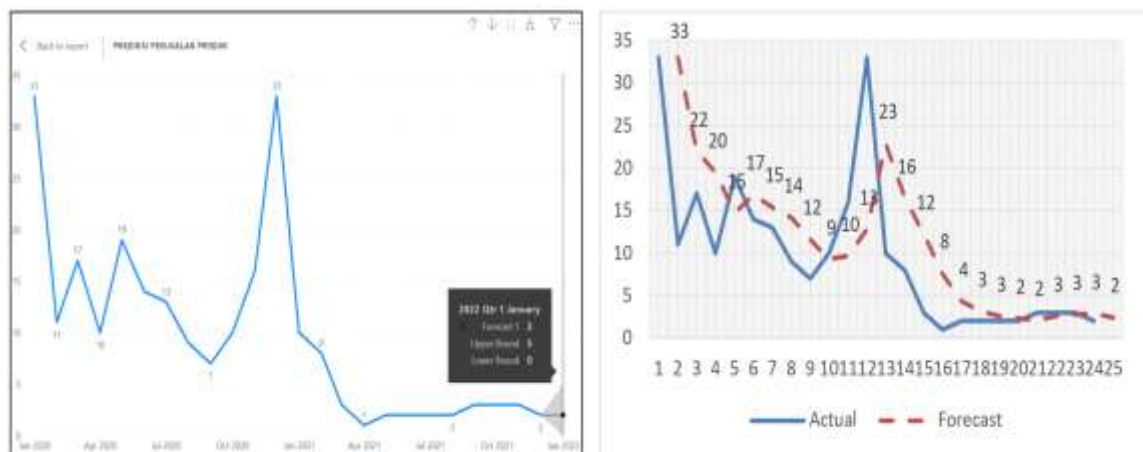

Figure 13. *SEQ * ARABIC 7. Moreskin forecasting chart : Clean and Glow Cream using power BI and manual calculations*

- **Grece Anti Perspirant**

Based on the prediction results using power BI and manual calculations with the best results, namely $= 0.5$, it is obtained that sales of Grece Anti Perspirant products in the following month will sell 3 *items*.
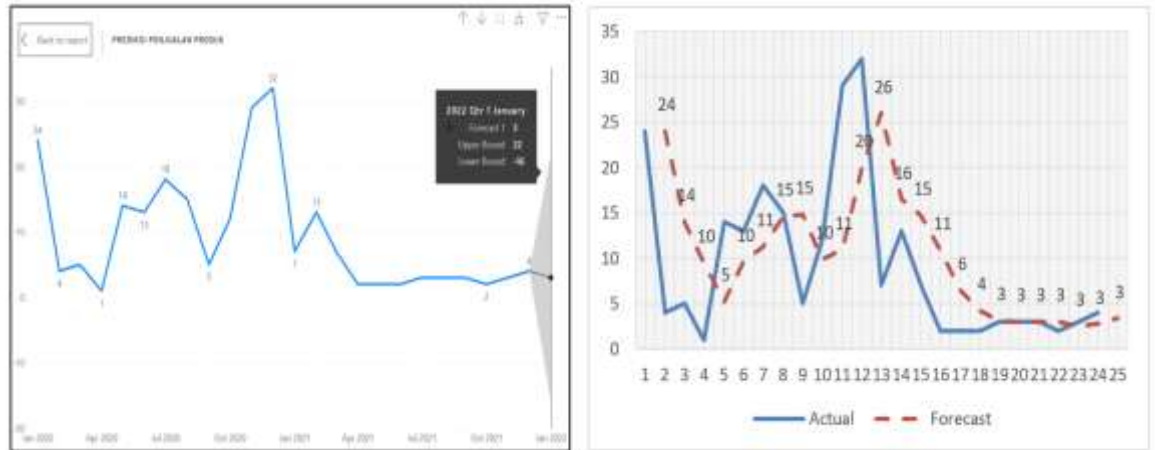

Figure 14. *SEQ * ARABIC 8. Grece Anti Perspirant forecast graph using power BI and manual calculations*

- **Quwless : Liquid Hygiene For Man**

Based on the prediction results using power BI and manual calculations with the best result $= 0.5$, it is obtained that the sales prediction for *quarless : liquid hygiene for man* in the following month will be sold as many as 2 *items*.
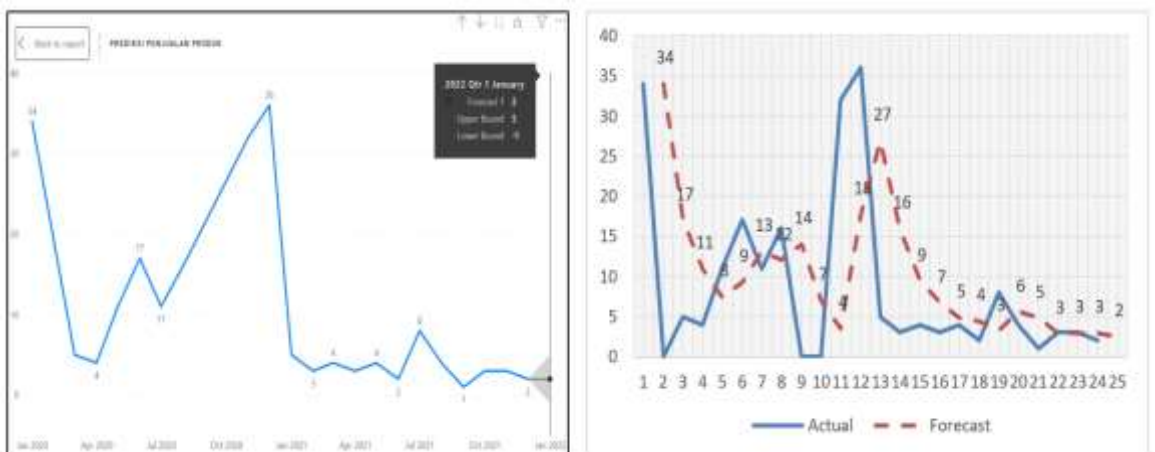

Figure 15. *SEQ * ARABIC 9. Quwless forecasting chart: Liquid Hygiene For Man using power BI and manual calculations*

- **Shanas: shampoo 3 in 1**

Based on the prediction results using power BI and manual calculations with the best result $= 0.5$, it is obtained that the sales prediction for the product shanas : shampoo 3 in 1 next month will be sold as many as 4 *items*.
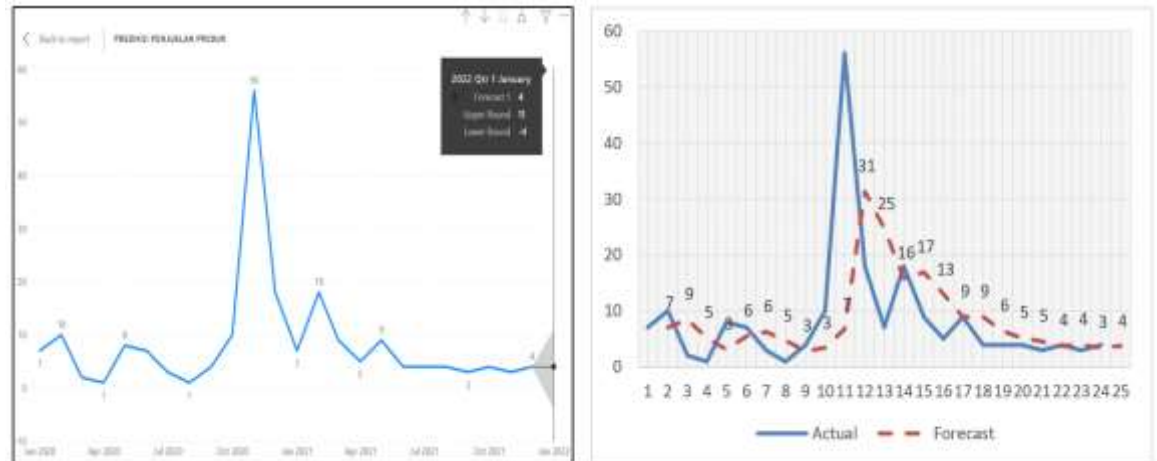

Figure 16. *SEQ *ARABIC 10. Shanas forecasting chart: shampoo 3 in 1 using power BI and manual calculations*

IV. Conclusion

Based on the results of the application of the *exponential smoothing* visualization *dashboard* using Microsoft *power business intelligence* in analyzing sales transaction data for Stockis BG.3005 Muara Enim, it can be concluded:

1. The resulting dashboard displays information visualization about product sales quantity, revenue, best-selling products, and number of customers which will facilitate Stockist BG.3005 Muara Enim in evaluating business developments.
2. Sales and revenue in 2020-2021 experienced a significant decline so that it formed a *trend* downward
3. Top 5 products of PT. The best-selling Natural Nusantara at Stockis BG.3005 Muara Enim are Nasa Toothpaste, *Moreskin: Clean & Glow Cream, Grece Anti Perspirant, Quwless: Liquid Hygiene For Man,* and *Shanas: Shampoo 3 in 1.*
4. The results of the application of the *double exponential smoothing* on the five products best-selling using $= 0.5$ to calculate forecasting for the 25th period of January 2022, namely Nasa Toothpaste = 33 *items*, *Moreskin: Clean & Glow Cream = 2 items, Grece Anti Perspirant = 3 items, Quwless: Liquid Hygiene For Man = 2 items,* and *Shanas : Shampoo 3 in 1 = 4 items.* Prediction results with manual calculation of *double exponential smoothing* and Microsoft *power BI* obtained the same value.

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