Analyzing the Pandemic Effect on Time series Prediction of Demand and Sales Manufacturing Product

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Abstract—The purpose of this study is to predict the demand and sales of plastic products in 2021 accompanied by the Covid 19 pandemic. This research is a quantitative descriptive study using time series forecasting methods and data analysis using Microsoft Excel. The data used as research is sales and monthly demand data for the years 2018-2020, totaling thirty-six data. Data collection was done by using documentation method. Analysis of the 2018-2020 data shows fluctuating demand and sales data. The 2018-2020 sales data research revealed fluctuations in demand and sales, influenced by the general annual season and the impact of the Covid 19 pandemic. Analysis of the demand forecast for 2021 gives the highest demand results in December and the lowest demand in June. Forecasting sales, the highest result in October, and the lowest sales in June. This means that fluctuations in demand and sales are affected by seasonality and government regulations. Based on this analysis, it can be concluded that forecasting using the time series forecasting method gives inaccurate results because there are many unexpected events, one of which is the Covid-19 pandemic which causes the local government to issue new regulations for sellers of examples of changes in selling prices. Therefore, the company must prepare the right strategy to deal with events that do not match expectations.

Keywords—demand forecasting, sales forecasting, time series forecasting

I. INTRODUCTION

Recasting can provide estimates or predict the size of all short-term or long-term demand. In connection with the preparation of a sales plan, the information obtained from sales forecasting will provide a useful overview of the prospects for demand for these products in the market. Whether or not the sales prospect of a product is basically not only based on ability or the use of the right forecasting method. Forecasting results in practice are almost never absolutely correct. This is because circumstances and events in the future are uncertain.

However, if all the important influencing factors have been taken into account and the relationship model of these factors is well determined, then the forecast results will be close to the actual conditions, so it must be done carefully, especially the selection of methods to be used in a particular case. Forecasting sales in a company is needed not only for the short term but also for the long term.

With sales forecasting, the company can make the right policies or decisions for its production. According to Deitiana [1], every company always faces the future in its activities in order to achieve its vision and mission. In achieving optimal decisions on company business activities, appropriate, systematic, and accountable methods are needed. One of the tools needed is the forecasting method. According to Shahabuddin [2], forecasting is important in planning and serves as input to many other business decisions. Such decisions will be better off using correct forecasting.

PT. Hamifaro, located in Jombang Regency, is a manufacturing company engaged in product recycling and selling recycled products. This company specializes in processing plastic products. The products produced are plastic bags, pelled or caisen, which are plastic raw materials and crazer products. For all products manufactured to order. Therefore, forecasting is very important for PT. Hamifaro so that the production amount is not excessive or insufficient. From the description above the writer gets an idea that sales forecasting is very important in determining the amount of production of PT. Hamifaro, so that there is no accumulation of production which results in a loss in production costs and there is no shortage of production which results in unfulfilled consumer demand.

Previous research on this topic discussed that forecasting gives less accurate results due to unexpected events. However, forecasting demand and sales by the company is used as a formulation of corporate strategy in the future. In research Nurlifa and Kusumadewi [3] states that in forecasting using moving average forecasting, not all data sources can be used for forecasting calculations that are close to forecasting, while in research Rahmawati et al. [4] with the results of the study that the number of tourist arrivals foreigners to Indonesia in the next year have increased but still follow the trends and seasons of previous years, in this study Navalina et al. [5] it is

explained that fish income in the Special Region of has the smallest value because researchers conclude that geographic location affects yield and quality fish, while several other provinces have good fishery products due to their supportive geographic location.

Thus the purpose of this study, is to focus on analysing the pandemic effect on time series prediction of demand and sales manufacturing products. By using sales and demand data every month from 2018-2020. Quantitative data analysis was carried out to predict plastic sales in the next period using the time series forecasting method.

A. Time Series Forecasting

Forecasting is an essential tool in efficient and effective planning. Therefore, every company that carries out business activities can definitely predict what will happen in the future. A prediction is considered good if it approaches the truth. There are several definition provided by experts, as regarding the notion of forecasting, as stated by Heizer et al. [6], which are: "Forecasting (Forecasting) is an art and science in predicting events in the future. Forecasting will involve taking historical data (such as last year's sales) and projecting them into the future using a mathematical model ". Forecasting is an estimate of something that has not happened [7].

Forecasting is an estimate, but by using the technique - a particular technique [8]. Better predictions can be informed decisions.

B. Moving Average Forecasting

Moving average forecasting (moving average) uses a number of actual past data to produce forecasts. Mathematically, a simple moving average (it is a prediction of future demand)

C. Trend Forecasting

Trend projection (trend projection) is a technique of adjusting trend lines on a series of past data, then projecting the lines in the future for mid-term or long-term forecasting.

II. RESEARCH METHODS

The descriptive approach is to conduct data collection activities and data analysis with the aim of making descriptive, describing, and explaining the relationship between the phenomena being investigated. Descriptive research in this study was conducted to determine sales for the next year. This type of research is quantitative descriptive, with the data used, are sales data and demand for PT. Hamifaro, every month from 2018 until 2020, a total of 36 data were collected using the documentation data collection method, with quantitative data types and secondary data sources. Descriptive research is research conducted to determine whether one or more independent variables are variables without making comparisons or connecting with other variables.

According to Christian and Winston [9] the moving average formula:

$$\frac{\Sigma \, demand \ n \ previous \ period}{n} \tag{1}$$

Where n is the number of periods on the moving average. When a trend or pattern is detected, weights can be used to place more emphasis on the current value. This practice makes forecasting techniques more responsive to changes because the closer period gets heavier weight. The weighted moving average can be described mathematically as follows:

Moving average with weighting formula

$$\frac{\Sigma \, (\text{weight in n period}) \, (\text{demand})}{\Sigma \, \text{weight}} \tag{2}$$

Forecasting trend projection,

$$\hat{y} = a + bx \tag{3}$$

$\hat{y}$ = calculated value of the variable to be

predicted (dependent variable)

a = y-axis cross

b = rate of change in y for the change in x

x = independent variable

Based on the income of the experts, the writer can say that the forecast is an estimate of the future that will come with the involvement of past data on a certain time period

A. Data Analysis Technique

Quantitative data analysis was carried out to predict plastic sales in the next period using the time series forecasting method. Historical data on plastic sales for the period of January 2018 until December 2020, processed with Microsoft Excel. The quantitative forecasting method with the time series model consists of the moving average approach and trend projection.

III. RESULTS AND DISCUSSION

The first step was to create a test plot for plastic product sales data for the January 2018 - December 2020 period using Excel software. This graph is useful for viewing stationary data. The results of the sales data pattern test and the demand for plastic products:

TABLE I. DATA SALES FOR PLASTIC PRODUCTS IN 2018-2020 (IN IDR)

MONTH	2018	2019	2020
January	850,679,405	654,808,925	958,887,255
February	136,986,560	663,746,951	700,442,610
March	676,563,600	698,445,750	751,247,715
April	641,960,940	676,778,990	792,312,915
May	664,553,475	790,147,625	664,553,475
June	269,720,625	400,696,300	704,767,549
July	578,792,275	694,647,600	762,388,005
August	500,197,350	589,968,375	643,326,985
September	544,995,850	645,573,725	654,472,770
October	562,699,325	835,679,710	681,935,145
November	553,066,750	671,508,510	627,613,975
December	589,279,050	733,297,840	Rp94,142,800

Source: PT Hamifaro monthly sales date.

TABLE II. DATA DEMAND FOR PLASTIC PRODUCTS IN 2018-2020 (IN KILOGRAMS)

Month	2018	2019	2020
January	32169.3	33515.1	37770.1
February	8239	34124	37752.6
March	34578	35658.6	37383.8
April	33269.5	35109.7	30148.9
May	55396.3	41788.9	55396.3
June	16004.4	20887.4	40121.7
July	53361.1	35845.6	42946
August	27956.2	30715.4	35115
September	30546.8	33693.1	50662.5
October	28853.3	43902.8	35199.4
November	28586.3	35591.4	34728.2
December	30056.4	59083.3	7516.8

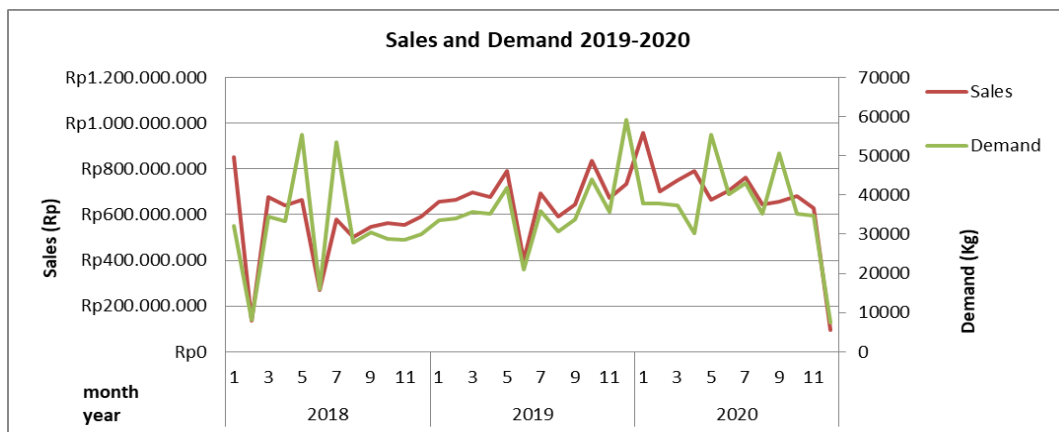Source: PT Hamifaro's monthly demand data

Fig. 1. Sales and demand data for plastics in 2018-2020.

A. Forecast Results Using the Seasonal Trend Method

The results of the sales forecast for plastic products for the next 12 months, starting from January 2021 to December 2021, can be seen below.

TABLE III. RESULTS OF DEMAND FORECAST

Month	2021
Jan	37087.2
Feb	37795.2
Mar	39029.9
Apr	34931.4
May	52249.2
Jun	32823.3
Jul	42971.7
Aug	36438.8
Sept	47940.1
Oct	44466.6
Nov	35357.7
Des	58512.8

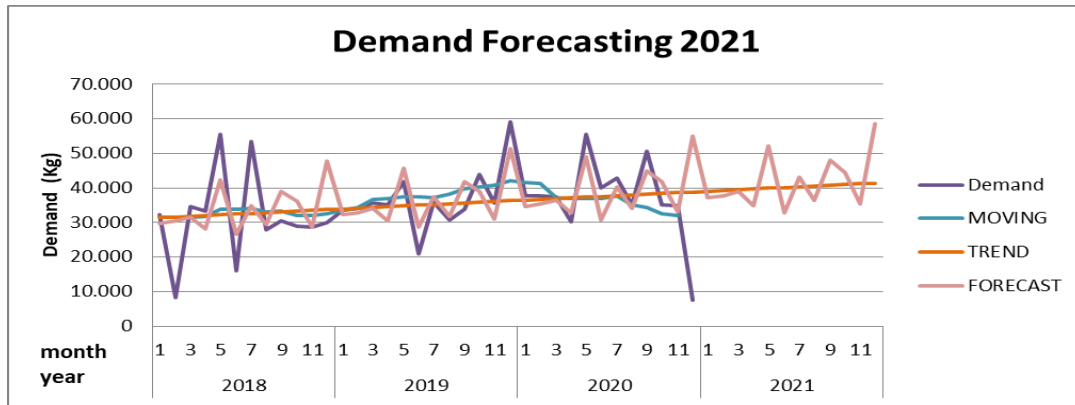Source: Demand data processed by excel.

Fig. 2.   Comparison of actual data and demand forecast results.

Based on the table and figure above, it could be It appears that the forecasts for plastic demand the product fluctuates considerably every month. That The highest demand forecast in 2021 occurs in December, with plastic demand 58512.8 kg. While the lowest demand is in 2021 occurred in June amounting to 32,823.3 kg. From Table III and Figure 2, it can be seen that demand forecast shows that there will be a spike demand for plastics in May and December. Cause the possibility of a jump from local government policies aimed at the welfare of the community and increasing local revenue (PAD) [10]. With the outbreak of Covid-19, files the level of production demand fluctuates. By predicting what might happen in the future, the company has an adequate inventory plan anticipating the high demand for plastic products in certain months.

TABLE IV.   RESULTS OF SALES FORECAST.

Month	2021
January	IDR 780,734,953
February	IDR 677,042,109
March	IDR 735,892,357
April	IDR 754,033,476
May	IDR 748,646,051
June	IDR 591,654,452
July	IDR 782,453,020
August	IDR 671,343,442
September	IDR 721,676,121
October	IDR 857,713,105
November	IDR 645,533,532
December	IDR 714,587,216

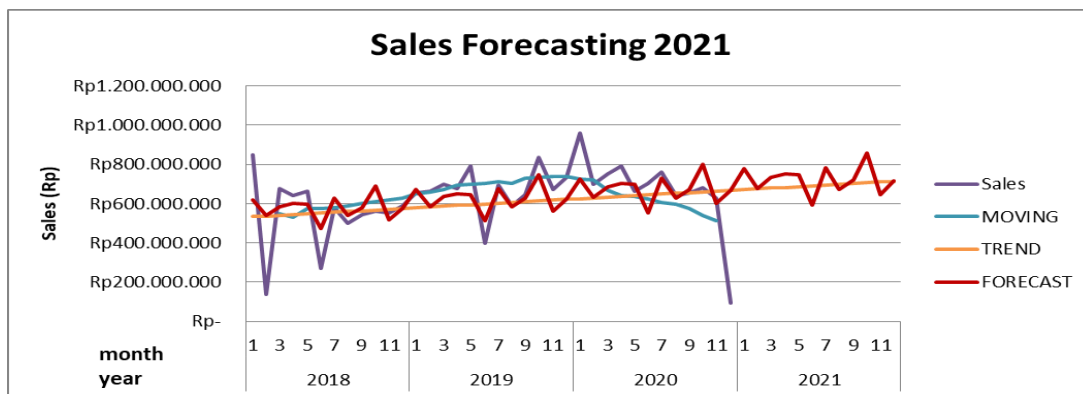Source: Sales data processed by excel.

Fig. 3.   Comparison of actual data and sales forecast results.

Meanwhile, the projection of plastic sales in 2021 will experience an increase in sales in October by Rp. 857,713,105, and the lowest demand occurred in June amounting to Rp. 591,654,452. In predicting plastic sales in 2021 will experience fluctuations but not significantly every month. From March 2020 until the end of the year, the Covid-19 outbreak had a significant impact on the level of sales of plastic products. By forecasting the future of the company that is profitable because the company can plan future sales strategies so that it can take advantage of opportunities well.

Similar research that discusses the analysis of the effect of sales and demand seen from time series estimates, [11] states that forecasting sales and demand for ice cream products using the time series method and trend forecasting methods show results that tend to be stable, as for the decline in sales and

demand as the summer changes to the rainy season from September to December is called the closing trend. In a study [12], based on forecasting fluctuating drug sales every month, it can be seen that drug demand from drug sales dependency factors in one month will increase if there are national holidays such as holidays, Christmas and new year.

From the results of forecasting the demand and sales of PT Hamifaro's plastic products, it can be seen from the tables and figures that high demand will certainly result in high sales revenue because many unexpected factors have occurred, such as disasters, disease outbreaks, and local government regulations the company must follow the regulations have to raise prices or lower prices.

IV. CONCLUSIONS AND SUGGESTIONS

The data pattern test reveals that data demand and sales trends are highly dynamic, indicating situations and trends. In forecasting using time series forecasting, the results showed that the demand and sales of plastic products increased in certain months, which shows the effect, the highest demand forecast occurred in December and the highest sales in October. As for suggestions for companies, the right forecasting method can be achieved by looking at data patterns, forecasting accuracy, and forecasting errors. Poor forecasting methods that ignore high forecast errors become inventory level errors. Therefore, the use of this forecasting technique will help in the demand for supply of plastic products. The completeness of this study has not carried out the incorporation of forecasting methods, including the selection method, so that further research can be carried out to combine the forecasting method in the selection method, which will allow better results from individual methods.

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