

Forecasting Analysis on the Impact of Pandemic Towards Cigarette Sales

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Abstract—The purpose of this study is to analyze sales using moving average forecasting. The method used is a quantitative method with primary data on actual sales results and forecast calculations using the moving average method. The results of this study are sales with moving average forecasting after the pandemic has increased. In contrast to the situation that actually occurs in a company where with a pandemic, sales have decreased. This difference will be the company's consideration in determining the policies that will be enforced in the company. Although forecasting results cannot be used as a benchmark for the actual situation, forecasting is useful in making decisions, so that in the next period it can determine sales planning.

Keywords—forecasting, moving average, pandemic, sales results

I. INTRODUCTION

Cigarette company by the name Gagak Hitam was founded Mr. Nawar H. Wasil and located in Bondowoso Regency, is a local cigarette factory that produces hand-rolled cigarettes with two brands, namely Gagak Hitam Kuning Istimewa and Gagak Hitam Gold, and cigarettes filters with Gagak Hitam Filter brand. This company was founded in 2004 and officially started operations in 2005. During the period between 2005 and 2020, there were many increases and decreases in sales due to internal and external factors.

2016-2019 were difficult times for the company because, in 2016 - 2018, there were a lot of illegal cigarettes circulating [1] and the company owner health condition decreased. In 2019 the owner of the company passed away. This affects sales because the management, which plays a vital role in the office, is the son of the company's owner and due to the psychological effect of losing his father figure, affects performance in the company. At the beginning of 2020, the management tried to get back up after a mourning period but was deemed sufficient. There's been a significant overhaul in management. Starting from employee rotation and adding a new management team.

When the company wants to rise, in 2020, Indonesia and the whole world was hit by a pandemic. Of course, this affects the company's condition, which is still unstable after the owner's death. Even though there is no company quarantine

period, where the company during the pandemic is still operating, the health protocol that the company must implement affects the production department. For the hand-held kretek cigarette production section, all workers who originally sat close together must be spaced ± 1 meter apart. This affects the number of workers in the production department. Decreasing workers due to the pandemic's effects resulted in reduced cigarette production and decreased sales results. To overcome this problem, the company increases working hours and overtime workers on holidays.

Companies in making decisions to increase or decrease production are deemed necessary to forecast sales. Forecasting is an attempt by a company to make future sales predictions by looking at sales data from the past. This method of predicting the company is significant for every division. For example, if in forecasting it is known that extensive sales results which require many production results, it will affect the HRD department in increasing the production workforce, the finance section in the labor cost budget and the budget for purchasing raw material supplies, the marketing department with methods or marketing support programs.

In forecasting, using the moving average method must have complete data. Not all data can be used for this forecasting approach [2]. Forecasting using the moving average method for 2,3, and 4 months has the least error [3]. Forecasting can be used to predict not only sales but can also be used to indicate the number of tourists [4], agricultural commodity forecasting [5], capital market [6], and can be used as a tool to compare the number of passengers [7].

Forecasting is an estimation process carried out in the present to predict what will happen in the future with data from the past [8]. Estimation aims to minimize the risk of mistakes that the company will make in making future decisions. Making forecasts is not easy, especially for good forecasting. This is because predicting does not provide a definite answer for every event in the future, but forecasting only provides an overview of future events so that they can make the best decisions.

Currently, forecasting covers various fields, including government, medical, socio-politics, finance, economy, and industrial business. In all areas, forecasting is an important thing to do. For example, in the industrial business sector, especially the manufacturing business, all divisions are related. If one division experiences a disturbance, it will result in other divisions. In the manufacturing business, forecasting should be a mandatory thing for companies [9] because, from this forecast, each division will make important decisions regarding its division's sustainability. In the production section of forecasting, it is essential to make a budget for raw materials, a budget for supporting materials, an inventory budget for dealing with the risk of late delivery, a budget for labor, and a budget for production needs. In the financial division, forecasting is used to predict the revenue and expenses required for the coming period [10]. This is important because companies can make decisions for cost efficiency or add to the budget they feel is lacking by looking at cost forecasting. For the marketing division, forecasting can predict sales to provide information to the finance and production divisions [11].

In education, forecasting is also used to predict future research directions [12], using neural networks [13] and is used to update insights and knowledge [14]. Forecasting has also made progress in Gardner research [15] and how is it different from forecasting each time series [16]. Forecasting can be used to predict the incomprehensible heterogeneity between individuals [17].

Sales forecasting can be an essential factor in a company's business plan [18]. This sales level forecasting is the company's expectations that must be achieved and based on past data. Sales forecasting information is vital to the finance division because sales are a source of funds. This information is essential for the production division to make a production budget that must be made [19]. In making a sales forecast, there are several ways you can do it. First, forecasting is based on the opinions of company leaders. Each leader of the branch office can determine his own sales forecast. Second, by surveying company salespeople who are directly related to consumers. Third, predict using direct surveys of buyers without intermediaries from salespeople. And the last way is the statistical method, where statistical science has provided various methods of forecasting. Among the four methods, it is the statistical method that will be used in this research.

The quantitative statistical method is a method of forecasting using data from the past with a pattern of changing data from time to time without considering other variables' influence [20]. There are several methods in statistical quantitative forecasting. First, the moving average method (moving average). This forecasting by taking observational data, looking for the standard, and the average is projected into future forecasts. Second, the Exponential Smoothing method. Third, the decomposition method, which is performed on data with the same pattern, will be repeated.

In this study, forecasting using the moving average method is used. The moving average method uses several actual data from past data to create forecasting data in the future. The moving average method has the characteristic of requiring historical data for a certain period. The longer the moving average, the smoother the moving average will be.

This study analyzes forecasting using the moving average method to predict the number of cigarette sales in the Gagak Hitam cigarette company in 2021 after going through the pandemic period based on sales data from 2005 to 2020.

II. RESEARCH METHODS

This study uses quantitative methods with the object of research is the Gagak Hitam cigarette company. The focus of the data that will be used as research is data on cigarette sales. During the 2020 period, the company experienced a pandemic's impact so that forecasts for 2021 can be used as a benchmark for companies in making decisions.

The data needed is data on cigarette sales from 2005 - 2020 with the primary data source, namely direct data collection to the Gagak Hitam cigarette company without intermediaries. Data retrieval uses the documentation method where data or records already exist for further study and processing.

To calculate moving average forecasting, this study uses the excel application. The moving average method is a method whose forecasting level is close to what will happen because it uses the average value of the company's actual data.

To calculate the moving average method using the formula [21]:

$$F_{t+1} = (Y_t + Y_{t-1} + Y_{t-2} + \dots + Y_{t-n+1}) / n$$

Where :

F_{t+1} = Forecast for the period $t + 1$

Y_t = real value for period t

n = Duration of the moving average

the value of n is the number of periods on the moving average

III. RESULTS AND DISCUSSION

Sales data from 2005 - 2020 are obtained from companies shown in Table 1 are primary data processed in this study. To facilitate the study, researchers used the quarterly sales data. Figure 1 shows a graph of cigarette sales for 2005 – 2020.

This study uses Moving Average 4 because there are some incomplete 1-year data to facilitate data processing using moving average calculations with an average of the last 4 data. The average with the previous 4 data still does not show a result close to the actual data. Therefore, the average is averaged again so that it is more relative to the real data. Furthermore, this research also considers the seasonal factor's

existence and how to eliminate the seasonal factor by calculating the standard deviation.

TABLE I. CIGARETTE SALES DATA FOR 2005 – 2020

Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2005	-	158.050	94.000	338.508
2006	911.670	840.855	560.274	635.026
2007	602.471	1.692.159	2.118.941	2.592.192
2008	2.513.656	2.807.348	3.547.897	3.075.682
2009	3.008.861	2.934.251	3.009.291	3.829.322
2010	2.530.955	2.811.318	2.360.689	3.474.057
2011	1.995.208	2.945.830	1.995.053	1.526.780
2012	1.290.070	1.286.262	1.998.245	2.830.850
2013	1.949.166	1.481.924	1.105.695	1.221.380
2014	1.218.072	1.343.672	1.307.750	1.380.925
2015	1.048.271	1.164.013	1.309.983	1.380.746
2016	1.133.148	1.358.464	1.398.894	1.524.930
2017	1.323.111	1.342.830	1.115.784	1.191.442
2018	830.323	688.486	697.941	784.291
2019	626.602	526.487	454.021	470.374
2020	323.571	144.500	191.250	-

TABLE II. REGRESSION CALCULATION RESULTS

Caption	Result
Intercept	1,4408226
T	-0,0137757
N	63

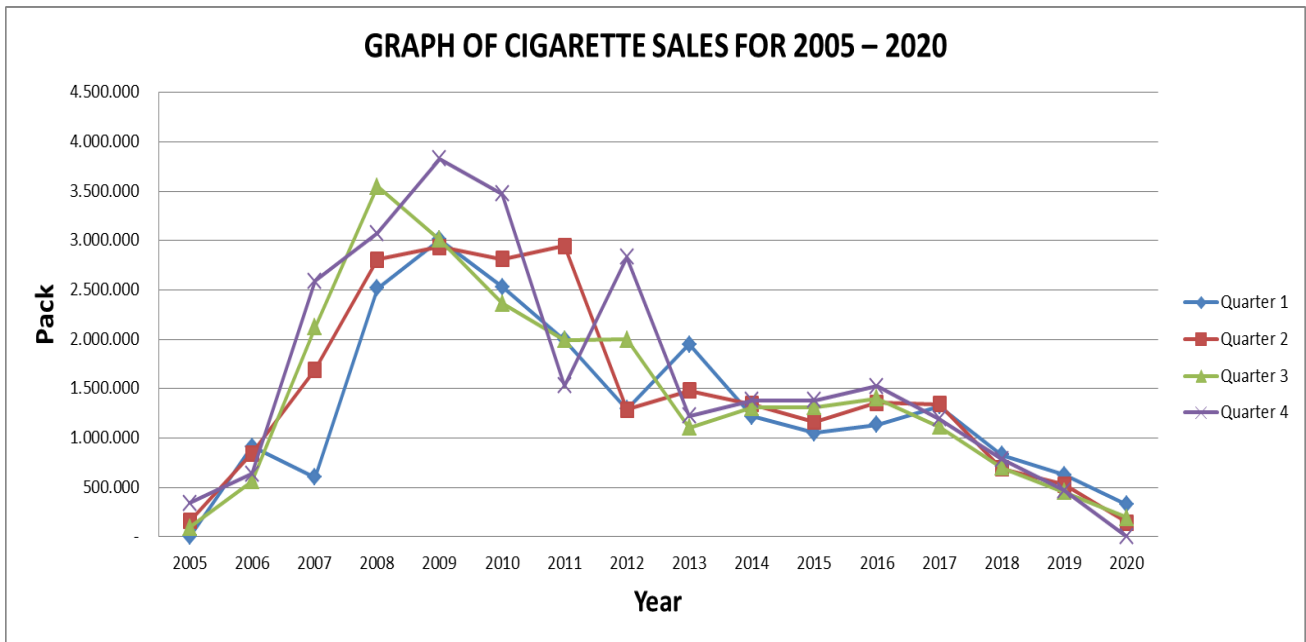


Fig. 1. Graph of cigarette sales for 2005 – 2020.

Year	Quarter	Sales	Moving Average	Center Moving Average	Seasonality (St) Irregularity	Seasonality	Deseasonality	t	Trend	Forecasting
2005	Q1	-				1.566.742	-	1	1,42705	2.235.814
	Q2	158.050				1.549.535	0,10200	2	1,41327	2.189.913
	Q3	94.000		-		1.551.732	0,06058	3	1,39950	2.171.642
	Q4	338.508	375.557	375.557	0,90135	1.566.968	0,21603	4	1,38572	2.171.378
2006	Q1	911.670	546.258	546.258	1,66894	1.566.742	0,58189	5	1,37194	2.149.482
	Q2	840.855	662.827	662.827	1,26859	1.549.535	0,54265	6	1,35817	2.104.529
	Q3	560.274	736.956	736.956	0,76025	1.551.732	0,36106	7	1,34439	2.086.138
	Q4	635.026	659.657	659.657	0,96266	1.566.968	0,40526	8	1,33062	2.085.034
2007	Q1	602.471	872.483	872.483	0,69053	1.566.742	0,38454	9	1,31684	2.063.150
	Q2	1.692.159	1.262.149	1.262.149	1,34070	1.549.535	1,09204	10	1,30307	2.019.145
	Q3	2.118.941	1.751.441	1.751.441	1,20983	1.551.732	1,36553	11	1,28929	2.000.633
	Q4	2.592.192	2.229.237	2.229.237	1,16282	1.566.968	1,65427	12	1,27551	1.998.690
2008	Q1	2.513.656	2.508.034	2.508.034	1,00224	1.566.742	1,60438	13	1,26174	1.976.819
	Q2	2.807.348	2.865.273	2.865.273	0,97978	1.549.535	1,81174	14	1,24796	1.933.761
	Q3	3.547.897	2.986.146	2.986.146	1,18812	1.551.732	2,28641	15	1,23419	1.915.128
	Q4	3.075.682	3.109.947	3.109.947	0,98898	1.566.968	1,96282	16	1,22041	1.912.345
2009	Q1	3.008.861	3.141.673	3.141.673	0,95773	1.566.742	1,92046	17	1,20664	1.890.487
	Q2	2.934.251	3.007.021	3.007.021	0,97580	1.549.535	1,89363	18	1,19286	1.848.378
	Q3	3.009.291	3.195.431	3.195.431	0,94175	1.551.732	1,93931	19	1,17908	1.829.623
	Q4	3.829.322	3.075.955	3.075.955	1,24492	1.566.968	2,44378	20	1,16531	1.826.001
2010	Q1	2.530.955	3.045.222	3.045.222	0,83112	1.566.742	1,61543	21	1,15153	1.804.155
	Q2	2.811.318	2.883.071	2.883.071	0,97511	1.549.535	1,81430	22	1,13776	1.762.994
	Q3	2.360.689	2.794.255	2.794.255	0,84484	1.551.732	1,52132	23	1,12398	1.744.118
	Q4	3.474.057	2.660.318	2.660.318	1,30588	1.566.968	2,21706	24	1,11021	1.739.657
2011	Q1	1.995.208	2.693.946	2.693.946	0,74063	1.566.742	1,27348	25	1,09643	1.717.823
	Q2	2.945.830	2.602.537	2.602.537	1,13191	1.549.535	1,90111	26	1,08265	1.677.610
	Q3	1.995.053	2.115.718	2.115.718	0,94297	1.551.732	1,28569	27	1,06888	1.658.613
	Q4	1.526.780	1.939.433	1.939.433	0,78723	1.566.968	0,97435	28	1,05510	1.653.312
2012	Q1	1.290.070	1.524.541	1.524.541	0,84620	1.566.742	0,82341	29	1,04133	1.631.491
	Q2	1.286.262	1.525.339	1.525.339	0,84326	1.549.535	0,83010	30	1,02755	1.592.226
	Q3	1.998.245	1.851.357	1.851.357	1,07934	1.551.732	1,28775	31	1,01378	1.573.109
	Q4	2.830.850	2.016.131	2.016.131	1,40410	1.566.968	1,80658	32	1,00000	1.566.968
2013	Q1	1.949.166	2.065.046	2.065.046	0,94388	1.566.742	1,24409	33	0,98622	1.545.159
	Q2	1.481.924	1.841.909	1.841.909	0,80456	1.549.535	0,95637	34	0,97245	1.506.843
	Q3	1.105.695	1.439.541	1.439.541	0,76809	1.551.732	0,71256	35	0,95867	1.487.604
	Q4	1.221.380	1.256.768	1.256.768	0,97184	1.566.968	0,77945	36	0,94490	1.480.623
2014	Q1	1.218.072	1.222.205	1.222.205	0,99662	1.566.742	0,77746	37	0,93112	1.458.827
	Q2	1.343.672	1.272.719	1.272.719	1,05575	1.549.535	0,86715	38	0,91735	1.421.459
	Q3	1.307.750	1.312.605	1.312.605	0,99630	1.551.732	0,84277	39	0,90357	1.402.099
	Q4	1.380.925	1.270.155	1.270.155	1,08721	1.566.968	0,88127	40	0,88979	1.394.279
2015	Q1	1.048.271	1.225.240	1.225.240	0,85556	1.566.742	0,66908	41	0,87602	1.372.495
	Q2	1.164.013	1.225.798	1.225.798	0,94960	1.549.535	0,75120	42	0,86224	1.336.075
	Q3	1.309.983	1.225.753	1.225.753	1,06872	1.551.732	0,84421	43	0,84847	1.316.594
	Q4	1.380.746	1.246.973	1.246.973	1,10728	1.566.968	0,88116	44	0,83469	1.307.935
2016	Q1	1.133.148	1.295.585	1.295.585	0,87462	1.566.742	0,72325	45	0,82092	1.286.163
	Q2	1.358.464	1.317.813	1.317.813	1,03085	1.549.535	0,87669	46	0,80714	1.250.691
	Q3	1.398.894	1.353.859	1.353.859	1,03326	1.551.732	0,90150	47	0,79336	1.231.089
	Q4	1.524.930	1.401.350	1.401.350	1,08819	1.566.968	0,97317	48	0,77959	1.221.590
2017	Q1	1.323.111	1.397.441	1.397.441	0,94681	1.566.742	0,84450	49	0,76581	1.199.831
	Q2	1.342.830	1.326.664	1.326.664	1,01219	1.549.535	0,86660	50	0,75204	1.165.308
	Q3	1.115.784	1.243.292	1.243.292	0,89744	1.551.732	0,71906	51	0,73826	1.145.584
	Q4	1.191.442	1.120.095	1.120.095	1,06370	1.566.968	0,76035	52	0,72449	1.135.246
2018	Q1	830.323	956.509	956.509	0,86808	1.566.742	0,52997	53	0,71071	1.113.499
	Q2	688.486	852.048	852.048	0,80804	1.549.535	0,44432	54	0,69693	1.079.924
	Q3	697.941	750.260	750.260	0,93027	1.551.732	0,44978	55	0,68316	1.060.079
	Q4	784.291	699.330	699.330	1,12149	1.566.968	0,50052	56	0,66938	1.048.902
2019	Q1	626.602	658.830	658.830	0,95108	1.566.742	0,39994	57	0,65561	1.027.167
	Q2	526.487	597.850	597.850	0,88063	1.549.535	0,33977	58	0,64183	994.540
	Q3	454.021	519.371	519.371	0,87417	1.551.732	0,29259	59	0,62806	974.575
	Q4	470.374	443.613	443.613	1,06032	1.566.968	0,30018	60	0,61428	962.557
2020	Q1	323.571	348.117	348.117	0,92949	1.566.742	0,20652	61	0,60050	940.836
	Q2	144.500	282.424			1.549.535	0,09325	62	0,58673	909.157
	Q3	191.250				1.551.732	0,12325	63	0,57295	889.070
	Q4					1.566.968		64	0,55918	876.213
2021	Q1					1.566.742		65	0,54540	854.504
	Q2					1.549.535		66	0,53163	823.773
	Q3					1.551.732		67	0,51785	803.565
	Q4					1.566.968		68	0,50407	789.869

Fig. 2. Forecasting result.

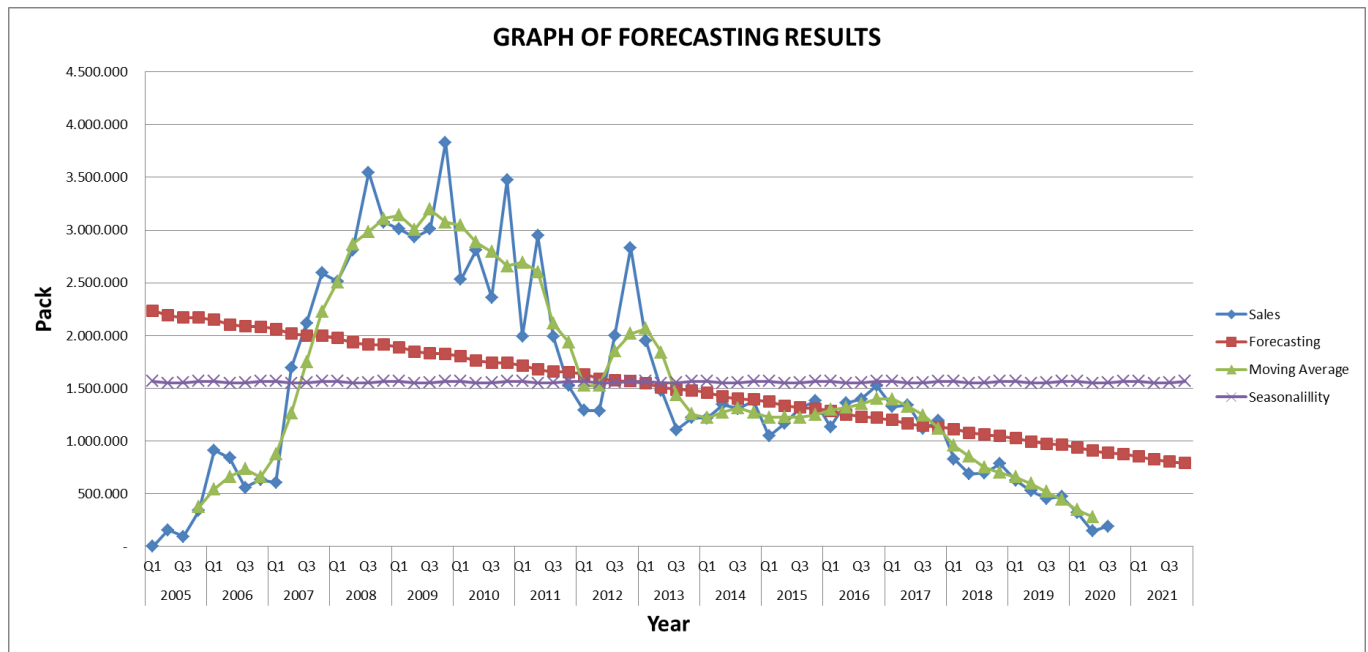


Fig. 3. Graph of forecasting results.

To find out the moving average formula's function, use one of the Excel application tools, namely regression, in the data analysis tools. The regression calculation is based on the moving average data, in which the seasonal factor t is the period. The results of regression calculations are shown in table 2. For forecasting, results are calculated using a formula based on the regression results by calculating Seasonality multiplied by trend. The results for forecasting calculations and forecasting charts are shown in figure 2 and figure 3.

Figure 2 for forecasting calculations show that for 2021, cigarette sales after the pandemic could experience an increase in sales. Although, in general, the forecasting trend is decreasing, when compared to actual sales, the forecasting results for sales have increased. This means that based on past data, this company can increase sales in 2021.

Based on figure 3, the graph shows that the forecasting trend has consistently decreased from 2005, while actual cigarette sales have shown a downward trend starting from 2016. This is due to many competitors with illegal products without excise stamps at much lower prices. Several other influencing factors were the increase in excise rates and a vat of tobacco products, with the selling price of cigarettes at the company not experiencing a growth, thus making the company experiencing difficulties in realizing the purchase of excise stamps.

IV. CONCLUSION

The results of forecasting calculations cannot be used as a measure of sales in 2021. However, forecasting results can set sales targets in 2021 by considering other company's external

and internal factors. Suggestions for further research are for forecasting in 2021 it is better to do it again with additional data for quarter 4 of 2020 and quarter 1 of 2021 because on December 15, 2020, there was a Minister of Finance Regulation (PMK) of the Ministry of Finance regarding an increase in tobacco product excise ribbon rates for 2021. This PMK has a significant effect. Significant for companies looking to stabilize sales after a pandemic. Companies' suggestion is to cooperate with the Customs and Excise Office to eradicate illegal cigarettes that are competitors to the company. The marketing department also needs promotional programs to attract customers back.

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