Selection of the Best Forecasting Method for Newspaper Demand Based on Special Event (Case Study: PT. XYZ)

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Abstract

The development of technology and information has a significant impact on society, both positively and negatively. Digitalization has resulted in many people switching from printed newspapers to digital newspapers. This could lead to demand uncertainty in the newspaper industry. At PT.XYZ, the number of newspapers produced and distributed to realtors often exceeds customer demand. In 2017, the company's return rate reached 5%. However, every January, March, and April where the Chinese New Year Festival, Dalang Cilik Festival, and World Dance Day are held, the demand will increase. This surge in demand, if not anticipated properly, can result in unfulfilled customer demands. For this reason, in this research, forecasting is carried out by considering special event factor using Holt-Winter's, Decomposition, and Exponential Smoothing Event-Based method. To decide which method is the best, the MAPE value was used as criteria. The MAPE value for Holt-Winter's, Decomposition, and Exponential Smoothing Event-Based method respectively are 0,92%, 1,05%, and 3%. Based on the MAPE value for each method, it can be seen that the most effective forecasting method is Holt's-Winter method with a MAPE value of 0.92%.

Keywords
Decomposition, Exponential Smoothing Event-Based, Forecasting, Holt-Winter's, Newspaper.

1. Introduction
The development of information and communication technology has a significant impact on society. One example of the development of information and communication technology is smartphones and the internet. Through smartphones and the internet, people can access various information easily. In addition, it becomes easier to communicate with one another. Although there are many positive impacts due to digitalization, it also has a negative impact on certain industrial sectors, such as the newspaper printing industry. The existence of digitalization resulted in low public

interest in buying printed newspapers. Many people prefer to read news through the internet because it is easier to access anywhere and anytime. In Indonesia itself, print media circulation began to decline in 2014. Meanwhile, in 2016, many print media companies stopped producing daily newspapers or magazines, such as the weekly newspapers Tempo and Galamedia as well as daily newspapers such as Sinar Harapan, Jakarta Globe, Bola, and Hai magazine (Sufyan, 2017).

PT. XYZ is one of the newspaper printing companies in Surakarta. PT. XYZ has several problems in the supply chain system, one of which is in the production and sales department. The number of people who switch from printed newspapers to digital newspapers has resulted in the circulation of newspapers being prone to fluctuate. Often, the number of newspapers produced and distributed to realtors exceeds customer demand. This can result in a high rate of return in the company. In 2017, the company's return rate reached 5%. This newspaper return will not be resold on the next day because the newspaper has the characteristic that it will only have value when the news published is new information (A'yun, 2020). The system problem in the company is described as shown in Figure 1.

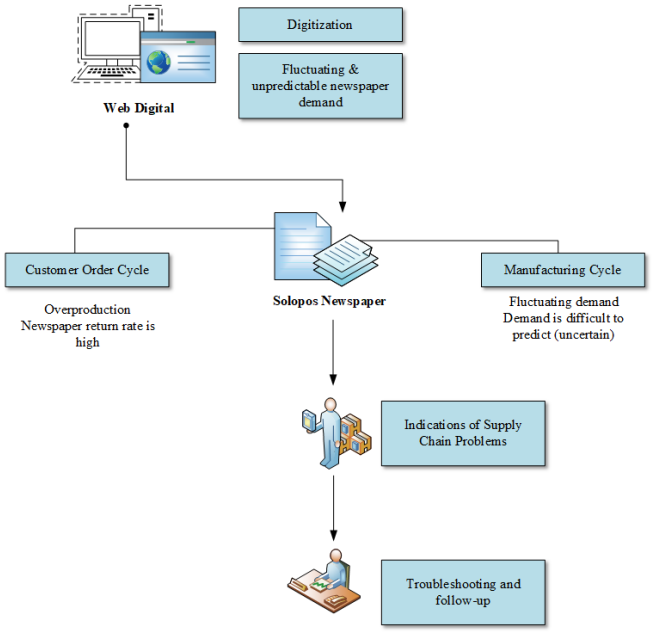

Figure 1. Description of System Problems

However, in certain months newspaper sales increase due to special events such as Festival and World Dance Day. Usually, a surge in demand for the newspapers occurs every January, March, and April, during which the Chinese New Year Festival, Dalang Cilik Festival, and World Dance Day are held. This surge in demand, if not anticipated properly, can result in unfulfilled customer demands. It can also result in losses for the company in the form of lost sales and loss of public trust. Both of these things can ultimately result in losses for the company (Geda and Kwong, 2018).

From this problem, it can be concluded that accurate production planning needs to be carried out in a company. With the forecast, the company will know how much the number of items must be produced. Besides that, accurate forecasting will minimize the lost sales and overall production cost. This could lead to increasing the company's profit. Forecasting itself has various methods and can be implemented in various industries. Quoted from the article written by Putra et al. (2009), the author forecasts the product at PT. Coca-Cola Bottling Indonesia by considering a special event. The methods used in this research are Winter's Exponential Smoothing, Decomposition, Moving Average Event-Based, and Exponential Smoothing Event-Based. Meanwhile, recently, Payu et al. (2017) implemented the forecasting methods Winter's Exponential Smoothing and Exponential Smoothing Event-Based to find out the number of incoming passengers at the Port of Gorontalo.

Based on the article by A'yun et al. (2020), in this digital era, demand for newspapers tends to fluctuate, so it is necessary to forecast with the most effective method. In the research conducted by A'yun et al (2020), the methods used are Trend Line Analysis, Double Exponential Smoothing, and Two Month Moving Average. In the study, it was stated that the demand for newspapers can increase when there is a special event. However, in the calculation of forecasting the special event factor is not considered. Therefore, in this study, the demand for newspapers was forecasted by considering special events using the methods Holt-Winter's, Decomposition, and Exponential Smoothing Event-Based. Based on the previous research, these methods were suitable for seasonal data and cases with a special event factor. To choose which method is the best, the MAPE value is used as criteria. The closer the MAPE value is to 0, the more accurate the method is. This study was conducted in order to help the company accurately forecast newspaper demand. Accurate forecasting could help them to reduce losses that were caused by understock or overstock.

2. Literature Review

2.1 Newspapers

Newspaper is the oldest mass media among other types of mass media. The existence of newspapers has started since the invention of the printing press by Johann Gutenberg in Germany (Ardianto and Erdinaya, 2004). According to Agee (Suryawati, 2011) newspaper have primary and secondary functions. The primary function of the newspaper is informing the readers of important and interesting events objectively, commenting on the news delivered and developing it into the focus of the news, and providing information for readers. Meanwhile, the secondary functions of newspapers include being a media campaign for community projects, providing entertainment to readers, as well as serving readers as friendly counselors, being agents of the information, and fighting for rights.

2.2 Digitalization

Digitalization has been identified as the most significant technological trend that is changing both, society and business (Reis et al., 2020). Digitalization arises as a result of the development of technology and information that occurs in all fields. Print media, such as newspapers, are one of the products that undergo a digitalization process. Newspaper is one of the mediums that provides information for the public. With digitalization, a lot of information can be accessed anywhere and anytime through the internet. Flew (2005) states that there are four properties of digital information, which are can be changed and adjusted in each process, can be shared in a network, can be shared in large quantities, and can be reduced.

2.3 Inventory Management

According to The American Production and Inventory Society, inventory management is a branch of business management that deals with inventory planning and control. The role of inventory management is to maintain the desired stock level of a specific product (Toomey, 2000). Inventory management's goal is to cover up the mismatch between stock and demand processes, minimize the risk of failure to supply customers, and minimize overall costs in the supply chain. If inventory is not controlled properly, the company can experience stock outs or excess inventory. Both of these things will have an impact on the costs that must be incurred by the company, such as storage costs and operating costs. Furthermore, inventory management has an impact on the company's profit margins. If customer demand cannot be fulfilled, it will result in lost sales and the company's revenue would suffer as a result. Inventory management can be done in a number of ways, one of which is through demand forecasting. (Wild, 2017).

2.4 Forecasting

Demand forecasting is an attempt to find out the number of products or a group of products in the future under certain constraints or conditions and to reduce the risks or uncertainties faced (Destiana, 2011). Forecasting consists of two types, namely qualitative forecasting and quantitative forecasting. Qualitative forecasting is carried out if there is no data that can be used or the available data does not match the forecast. Examples of qualitative forecasting are market surveys, executive opinion, and sales force mixes. Meanwhile, quantitative forecasting can be used if the numerical information in the past is available and it can be assumed that some aspects of the past patterns will continue in the future. Examples of quantitative forecasting are Holt-Winter's, Decomposition, and Exponential Smoothing Event-Based (Hyndman and Athanasopoulos, 2012).

3. Methods

The research method stage carried out in this study was in the form of data collection, data processing using 3 methods, and selecting the best forecasting method. The following is the flow of the research methodology carried out as shown in Figure 2.

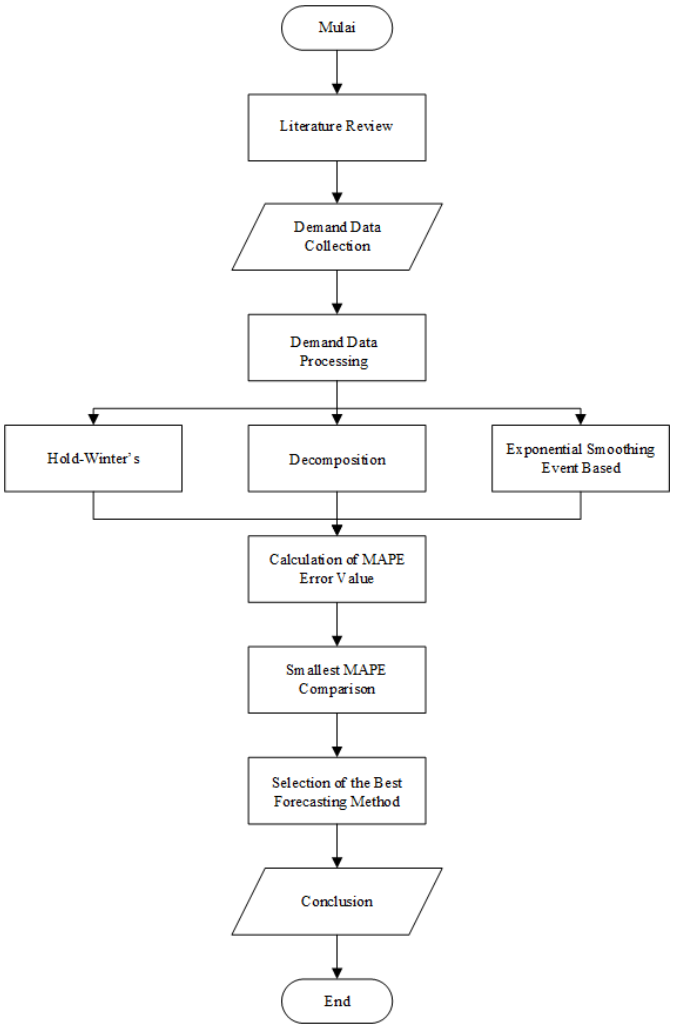

Figure 2. Research Methodology Flowchart

3.1 Holt-Winter's Method

Forecasting with the Holt-winter's method is used to predict if the data has seasonal data patterns. The purpose of this method is to facilitate calculations and obtain accurate forecasting results, considering that the Holt-Winter's method contains alpha (smoothing), betta (trend), and gamma (seasonal) weights which are calculated by trial and error to obtain forecasting results with smallest error rate. The following is the equation in the calculation of the Holt-Winter's method:

$$St = \alpha(\mathrm{Xt} - \mathrm{Imt} - \mathrm{L}) + (1-\alpha)(\mathrm{St}-1+\mathrm{bt}-1) \quad \ldots\ldots\ldots (1)$$

$$bt = \gamma\,(St - St - 1) + (1-\gamma)bt - 1 \quad \ldots\ldots\ldots (2)$$

$$Imt = \beta(Xt - St) + (1-\beta)Imt - L \quad \ldots\ldots\ldots (3)$$

$$Ft + m = St + btm + Imt - L + m \quad \ldots\ldots\ldots (4)$$

where St is overall smoothing in period t; St-1 is overall smoothing in period t-1; bt is smoothing trend in period t; bt-1 is smoothing trend in period t-1; Imt is seasonal smoothing in period t; Ft+m is forecasting in period t+m; Xt is actual data in period t; α is smoothing constant; γ is constant for trend; β constant for seasonality; L is seasonal length(number of months/quarters in 1 year); and m is number of forecasted future periods.

The advantages of the Holt-Winters method are: This method is very good at predicting data patterns which has a seasonal effect with the element concurrent trends, methods which is simple and easy to enter into in practice and competitive against more complicated forecasting models. While the weakness of the Holt-Winters method is that it takes a lot of time to determine the parameters alpha, beta and gamma by trial and error.

3.2 Decomposition Method

Forecasting with the decomposition method is carried out with four main components in forecasting future values. These components are trend, seasonal (seasonal), cycle, and error. The decomposition method is based on the assumption that the existing data is a combination of several components, simply described as follows:

$$Data = f\,(trend, cycle, seasonal) + error$$

The general mathematical equation of the decomposition approach is:

$$Xt = (Tt, St, Ct, It) \quad \text{..... (5)}$$

where Xt is time series value (actual data) in period t; Tt is trend component (trend) in period t; St is seasonal component in period t; Ct is cyclic component in period t; It is component of irregular error in period t; t is period (time); and f = pattern.

The advantages in the decomposition method are forecasting which is produced in the form of quarterly, monthly and one year ahead, the drawback in this method is that it cannot predict inventory in the form of 2 years or more. To get the results of forecasting with this method, two times the process of repeating the data, namely the trend data first generated and then getting the actual forecasting results.

3.3 Exponential Smoothing Method

Forecasting with the exponential smoothing method uses a number of new actual demand data to generate forecast values in the future. Exponential Smoothing Event-Based (ESEB) is a method whose calculation requires a special event index value.

Event Based forecasting method is a method sales approach based on special events that occur in certain periods. Which means the high and low sales will be based on the index of each event. The first step in determining influence of a special event can be measured based on the index of the event. The bigger the index, the bigger the effect on sales in each period, the special event index calculation uses the equation.The equation in calculating the index value for each event is as follows:

$$Xt = It\ x\ Ft \quad \text{..... (6)}$$

where Xt is actual data period; It is index in the period where there is a special event; and Ft is data from observations in period.

The special event index that has been obtained will be a multiplier factor to forecast demand in the next period, with the following equation:

$$Pt + 1 = Gt + 1\ x\ Ft + 1 \quad \text{..... (7)}$$

After the equations are substituted, the Exponential Smoothing Event-Based model is obtained as follows:

$$Pt + 1 = Gt + 1\,(aXt + (1 - a)Ft) \quad \text{..... (8)}$$

where Pt+1 is forecasting with event index in period t+1; Gt+1 is index group in period t+1; and α is smoothing constant (0<α<1).

The advantage of this method is that it can predict inventory with up-to-date inventory data systematically without going through the data processing stage which is iterative, and the exponential method can provide forecasts in the form of monthly yearly, up to a term of 10 years the future depends on how many years will be predicted. Disadvantages of the method Exponential Smoothing, i.e. data that is input in a large size, is sufficient difficult to observe inventory in the form of graphic image but it doesn't affect that means in research using this method.

3.4 Mean Absolute Percentage Error Method

Research requires validation data to determine whether the proposed forecasting model is better than other methods, which is indicated by a small error value. The reliability validation method used is MAPE or Mean Absolute Percentage Error. The following is the formula for calculating the forecast error:

$$\text{MAPE} = \frac{1}{n} \sum_{t=1}^{n} \frac{|Xt - Ft|}{Xt} \quad \text{..... (9)}$$

where Xt is actual data in period t; Ft is forecasting in period t; and n is time period.

4. Data Collection, Result, and Discussion

4.1 Data Collection

The data that was used in this study, refers to the paper written by A'yun et al. (2020) regarding forecasting demand for newspapers using the ARIMA method. In the reference paper, there is only demand data for January 2016 – April 2017. From this data, demand from January – December 2016 period is taken as a basis. Furthermore, the author assumes demands from 2017 – 2021. In 2017 it is assumed that demand will be decreased by 12%. Then in 2018, 2019, and 2020, the author assumes that demand is decreasing by 5%, 2%, and 1.3% respectively. Finally, in 2021 it is assumed that demand will be decreased by 6%. The data used in this study is only demands data from 2019-2021. This assumption is made based on the survey conducted by Serikat Perusahaan Pers. This survey stated that from 2008 to 2014, newspaper demand showed an upward trend. However, the increase stopped in 2014. In 2015, newspaper demand began to decrease by 8,9%. Besides that, the survey conducted by Nielsen Consumer & Media View in the third quarter of 2017 stated that the purchase rate of newspapers decreased by 20% than in 2011. Based on these two surveys, it can be seen that the demand for forecasting keeps decreasing year by year. Table 1, Table 2, and Table 3 below, shows the demand data from 2019-2021 respectively.

Table 1. Demand Data in 2019

Period	Actual Demand (Unit)
Jan-19	558894
Feb-19	526923
Mar-19	533437
Apr-19	548623
May-19	491823
Jun-19	523642
Jul-19	486872
Aug-19	527010
Sep-19	506910
Oct-19	528753
Nov-19	519302
Dec-19	501727

Table 2. Demand Data in 2020

Period	Actual Demand (Unit)
Jan-20	551628
Feb-20	520073
Mar-20	526503
Apr-20	541491
May-20	485429
Jun-20	516835
Jul-20	480543
Aug-20	520159
Sep-20	500320
Oct-20	521880
Nov-20	512551
Dec-20	495205

Table 3. Demand Data in 2021

Period	Actual Demand (Unit)
Jan-21	518531
Feb-21	488869
Mar-21	494912
Apr-21	509002
May-21	456303
Jun-21	485825
Jul-21	451710
Aug-21	488949
Sep-21	470301
Oct-21	490567
Nov-21	481798
Dec-21	465492

4.2 Forecasting Using the Holt-Winter's Method

In this forecasting method, demand data is used from January 2019 – December 2021. The following Table 4 is an example of forecasting for the period of January 2020 – December 2021 and forecasting results for the period of January – June 2022.

Table 4. Forecasting Results and the Holt-Winter's Method Error Rates for the 2020-2021 Period

Period	Demand	Level	Trend	Seasonal	Forecast	Error	MAPE
Jan-20	551628	514384.7	-6775.077	1.0724			
Feb-20	520073	514384.7	-5978.867	1.01106	513223.2057	6850.002	1.32%
Mar-20	526503	514384.7	-5276.228	1.02356	520382.9014	6119.718	1.16%
Apr-20	541491	514384.7	-4656.164	1.0527	535937.1019	5554.271	1.03%
May-20	485429	514384.7	-4108.97	0.94371	481035.0392	4394.061	0.91%
Jun-20	516835	514384.7	-3626.082	1.00476	512706.1066	4128.54	0.80%
Jul-20	480543	514384.7	-3199.943	0.93421	477155.0359	3387.517	0.70%
Aug-20	520159	514384.7	-2823.885	1.01123	516923.0578	3235.864	0.62%
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Sep-21	470301	483521.62	-1890.019	0.97266	468217.6551	2083.154	0.44%

Period	Demand	Level	Trend	Seasonal	Forecast	Error	MAPE
Oct-21	490567	483521.62	-1667.903	1.01457	488649.3462	1917.558	0.39%
Nov-21	481798	483521.62	-1471.891	0.99644	480136.2984	1661.958	0.34%
Dec-21	465492	483521.62	-1298.913	0.96271	464075.3353	1417.008	0.30%
Jan-22					517137.6896		
Feb-22					486242.2592		
Mar-22					490923.9224		
Apr-22					503532.4405		
May-22					450174.3771		
Jun-22					477993.9683		

Based on the forecasting results using the holt-winter's method, the MAPE value is 0.92%. This MAPE value is obtained from the calculation of the absolute % demand/error. Then, calculated the average of all MAPE. Furthermore, the comparison graph between actual demand and demand forecast can be seen in Figure 3.

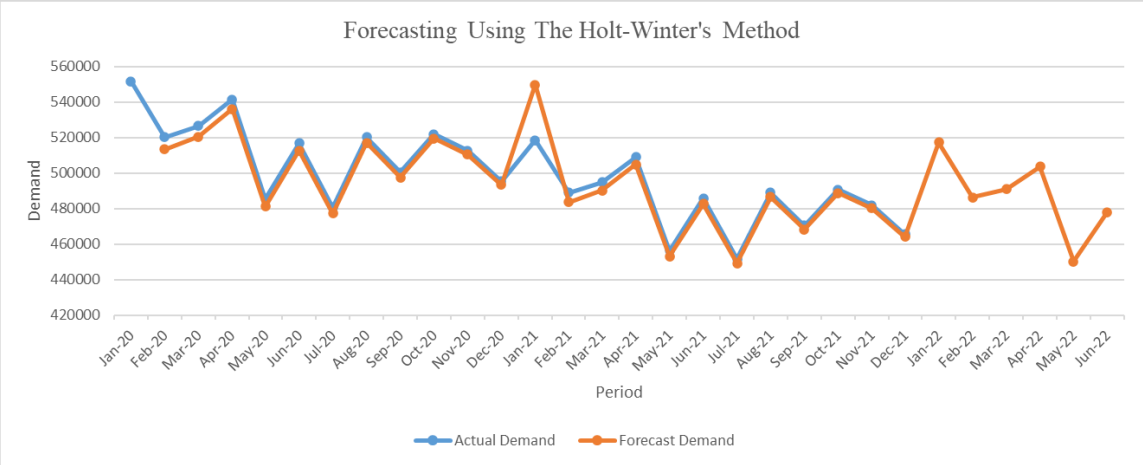

Figure 3. Comparison Graph between Actual Demand and Demand Forecast with The Holt-Winter's Method

Based on the graphs and tables above, it can be seen that there is a difference between the demand forecasts and the actual demand. This can be proven by the MAPE indicator which shows a value of 0.92%. That is, the error value in this forecasting method is 0.92% so that there is quite a slight difference between the demand forcasted and actual demand.

4.3 Forecating Using the Decomposition Method

In this forecasting method, demand data is used from January 2019 – December 2021. Table 5 below, shows the example of forecasting for the period of January 2019 – December 2021 and forecasting results for the period of January – June 2022.

Table 5. Forecasting Results and the Decomposition Method Error Rates for the 2019-2021 Period

Period	Actual Demand	Seasonal Index	Trend	Forecast	Absolute % Error
Jan-19	558894	1.0543	533795	562771	0.69%
Feb-19	526923	0.9970	532224	530623	0.70%
Mar-19	533437	1.0125	530654	537265	0.72%
Apr-19	548623	1.0445	529083	552653	0.73%
May-19	491823	0.9394	527512	495541	0.76%
Jun-19	523642	1.0033	525941	527676	0.77%

Period	Actual Demand	Seasonal Index	Trend	Forecast	Absolute % Error
Jul-19	486872	0.9358	524370	490713	0.79%
Aug-19	527010	1.0162	522799	531267	0.81%
Sep-19	506910	0.9805	521228	511067	0.82%
Oct-19	528753	1.0260	519657	533194	0.84%
Nov-19	519302	1.0108	518087	523705	0.85%
Dec-19	501727	0.9796	516516	505988	0.85%
Jan-20	551628	1.0543	514945	542897	1.58%
Feb-20	520073	0.9970	513374	511829	1.59%
. . .	. . .	. . .	. . .	. . .	. . .
Jul-21	451710	0.9358	486669	455432	0.82%
Aug-21	488949	1.0162	485098	492956	0.82%
Sep-21	470301	0.9805	483527	474101	0.81%
Oct-21	490567	1.0260	481956	494511	0.80%
Nov-21	481798	1.0108	480386	485595	0.79%
Dec-21	465492	0.9796	478815	469055	0.77%
Jan-22		1.0543	477244	503149	
Feb-22		0.9970	475673	474241	
Mar-22		1.0125	474102	480009	
Apr-22		1.0445	472531	493582	
May-22		0.9394	470960	442417	
Jun-22		1.0033	469389	470938	

Based on the forecasting results using the decomposition method, the MAPE value is 1.05%. This MAPE value is obtained from the calculation of the absolute average % error. In Figure 4, the comparison graph between actual demand and demand forecast can be seen.

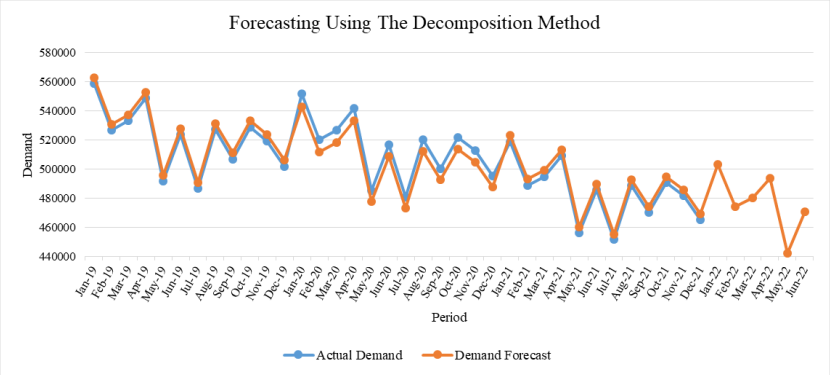

Figure 4. Comparison Graph between Actual Demand and Demand Forecast with The Decomposition Method

Based on the graphs and tables above, it can be seen that there is a difference between the demand forecasts and the actual demand. This can be proven by the MAPE indicator which shows a value of 1.05%. That is, the error value in this forecasting method is 1.05% so that there is quite a slight difference between the demand forcasted and actual demand

4.4 Forecasting using Exponential Smoothing Event-Based Method

In this forecasting method, demand data is used in January 2019 – December 2021. Table 6 below, shows an example of forecasting in 2021 and forecasting results for the period January – March 2022.

Table 6. Forecasting Results and the ESEB Method Error Rate before the index for the 2019-2021 Period

Period	Actual Demand	Demand forecast	Error	Absolute Error	MAD	Absolute % Error	Index
Jan-19	558894	506355.37					1.10
Feb-19	526923	520523.79	6399.423411	6399.42	6399.42	1%	1.01
Mar-19	533437	522249.56	11187.745626	11187.75	8793.58	2%	1.02
Apr-19	548623	525266.63	23356.849446	23356.85	13648.01	4%	1.04
May-19	491823	531565.42	-39742.622556	39742.62	20171.66	8%	0.93
Jun-19	523642	520847.77	2794.218958	2794.22	16696.17	1%	1.01
Jul-19	486872	521601.31	-34729.421456	34729.42	19701.71	7%	0.93
Aug-19	527010	512235.61	14774.447469	14774.45	18997.82	3%	1.03
Sep-19	506910	516219.92	-9310.086926	9310.09	17786.85	2%	0.98
Oct-19	528753	513709.21	15044.266574	15044.27	17482.12	3%	1.03
Nov-19	519302	517766.30	1535.969791	1535.97	15887.51	0%	1.00
Dec-19	501727	518180.51	-16453.439476	16453.44	15938.95	3%	0.97
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Jan-21	518531	507386.41	11144.242750	11144.24	16006.63	2%	1.02
Feb-21	488869	510391.75	-21522.930718	21522.93	16227.29	4%	0.96
Mar-21	494912	504587.52	-9675.058281	9675.06	15975.28	2%	0.98
Apr-21	509002	501978.39	7023.504584	7023.50	15643.73	1%	1.01
May-21	456303	503872.46	-47569.105522	47569.11	16783.92	10%	0.91
Jun-21	485825	491044.20	-5219.629131	5219.63	16385.15	1%	0.99
Jul-21	451710	489636.59	-37926.587314	37926.59	17103.20	8%	0.92
Aug-21	488949	479408.68	9540.703257	9540.70	16859.25	2%	1.02
Sep-21	470301	481981.59	-11680.776605	11680.78	16697.42	2%	0.98
Oct-21	490567	478831.56	11735.347880	11735.35	16547.06	2%	1.02
Nov-21	481798	481996.30	-198.045149	198.05	16066.20	0%	1.00
Dec-21	465492	481942.89	-16450.551068	16450.55	16077.18	4%	0.97
Jan-22		477506.57					
Feb-22		477506.57					
Mar-22		477506.57					
ALPHA	0.269676						

From the results of forecasting using the exponential smoothing event-based method before the index, the calculation of the MAPE value using Microsoft Excel software is 3%. Next, the index values are grouped, as shown in Table 7.

Table 7. Index Group on Exponential Smoothing Event-Based Method

Special Event	Year	Index	Index Group
Chinese New Year	2019	1.10	1.07
	2020	1.07	
	2021	1.02	
Dalang Cilik Festival	2019	1.02	1.00
	2020	1.01	
	2021	0.98	
World Dance Day	2019	1.04	1.03
	2020	1.03	
	2021	1.01	

Next, the forecast is carried out again by considering the index value in the exponential smoothing event-based method for the period January 2019-March 2022, as shown in Table 8.

Table 8. Forecasting Results and ESEB Method Error Rate after index Period 2019-2021

Period	Actual Demand	Demand Forecast (Before)	Index	Demand Forecast (After)	Error	Absolute Error	MAD	Absolute % Error
Jan-19	558894	506355.37	1.07	540022.14	18871.83	18871.83		3%
Feb-19	526923	520523.79	1	520523.79	6399.42	6399.42	14500.21	1%
Mar-19	533437	522249.56	1.00	523836.30	9601.01	9601.01	14500.21	2%
Apr-19	548623	525266.63	1.03	541387.95	7235.53	7235.53	14500.21	1%
May-19	491823	531565.42	1	531565.42	-39742.62	39742.62	14500.21	8%
Jun-19	523642	520847.77	1	520847.77	2794.22	2794.22	14500.21	1%
Jul-19	486872	521601.31	1	521601.31	-34729.42	34729.42	14500.21	7%
Aug-19	527010	512235.61	1	512235.61	14774.45	14774.45	14500.21	3%
Sep-19	506910	516219.92	1	516219.92	-9310.09	9310.09	14500.21	2%
Oct-19	528753	513709.21	1	513709.21	15044.27	15044.27	14500.21	3%
Nov-19	519302	517766.30	1	517766.30	1535.97	1535.97	14500.21	0%
Dec-19	501727	518180.51	1	518180.51	-16453.44	16453.44	14500.21	3%
. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Jan-21	518531	507386.41	1.07	541121.74	-22591.09	22591.09	14500.21	4%
Feb-21	488869	510391.75	1	510391.75	-21522.93	21522.93	14500.21	4%
Mar-21	494912	504587.52	1.00	506120.60	-11208.14	11208.14	14500.21	2%
Apr-21	509002	501978.39	1.03	517384.95	-8383.06	8383.06	14500.21	2%
May-21	456303	503872.46	1	503872.46	-47569.11	47569.11	14500.21	10%
Jun-21	485825	491044.20	1	491044.20	-5219.63	5219.63	14500.21	1%
Jul-21	451710	489636.59	1	489636.59	-37926.59	37926.59	14500.21	8%
Aug-21	488949	479408.68	1	479408.68	9540.70	9540.70	14500.21	2%
Sep-21	470301	481981.59	1	481981.59	-11680.78	11680.78	14500.21	2%
Oct-21	490567	478831.56	1	478831.56	11735.35	11735.35	14500.21	2%
Nov-21	481798	481996.30	1	481996.30	-198.05	198.05	14500.21	0%
Dec-21	465492	481942.89	1	481942.89	-16450.55	16450.55	14500.21	4%
Jan-22		477506.57	1.07	509255.23				
Feb-22		477506.57	1	477506.57				
Mar-22		477506.57	1.03	492162.05				
ALPHA	0							

From the results of forecasting using the exponential smoothing event-based method after the index, the calculation of the MAPE value using Microsoft Excel software is 3%. Figure 5 and Figure 6 below, shows a comparison chart between actual demand and forecasting demand.

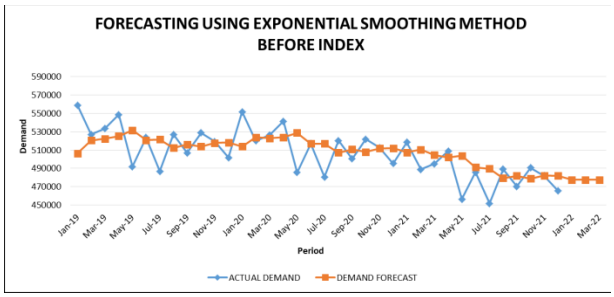

Figure 5. Comparison Graph between Actual and Forecasting Exponential Smoothing Event-Based Method before Index

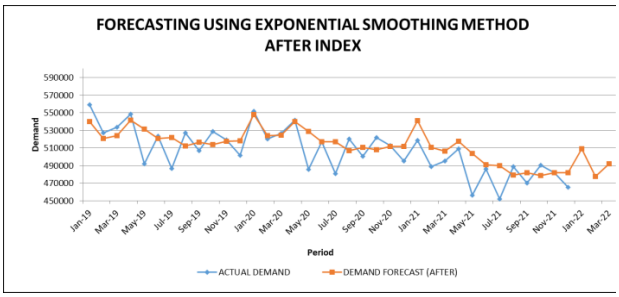

Figure 6. Comparison Graph between Actual and Forecasting Exponential Smoothing Event-Based Method after Index

6. Conclusion

In this study, demand forecasting for Solopos newspapers was carried out by comparing the Holt-Winter's, Decomposition, and Exponential Smoothing Event-Based methods. The data used in this forecast is demand data for the Solopos newspaper from 2019-2021. To compare which method is the best for forecasting, an indicator in the form of the MAPE value is used. Based on the calculation results, the MAPE values for the Holt-Winter's, Decomposition, and Exponential Smoothing Event-Based methods are 0.92% each; 1.05%; and 3%. From the three methods, it can be seen that the Holt's-Winter method has the smallest MAPE value. With MAPE value of 0.92% which is the amount of error resulting from forecasting. The more accurate MAPE value is in the forecasting process (ingesting a value of 0). Therefore, it can be concluded that the Holt's-Winter method is the best method for forecasting Solopos newspaper demand. This method could be used by the company to forecast the newspaper's demand more accurately in order to reduce losses.

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