JURNAL AKUNTANSI MANAJEMEN DAN EKONOMI

JOURNAL OPERATIONAL RESEARCH , MANAJEMEN AND ECONOMICS
Vol. 24, No. 3, 2022, pp. 15-21
Published online in http://jos.unsoed.ac.id/index.php/jame
ISSN: 1410-9336/E-ISSN: 2620-8482

Forecasting Analysis of MSME Sales of Nata De Coco Products in PT Shenovia Using Least Square, Moving Average, and Semi Average Methods

Dian Sudiantini[1], Sheren Novita Ara[2]

[1,2]Management, Faculty of Economics and Business, Bhayangkara University, Greater Jakarta, Indonesia

Abstract

Nata de coco is a processed product whose main component is coconut water, such as a transparent white jelly. The nata de coco company named PT Shenovia is a business unit that oversees the management of nata de coco. PT Shenovia is spread across several provinces in Indonesia, one of which is in the province of West Java. The purpose of this study was to determine the effect of sales forecasts on PT Shenovia. The data used in this study is the actual data owned by the company. The data taken is PT Shenovia's sales data from 2016 to 2021. The data is used to determine the sales forecast to be obtained in 2022. This company uses three methods in time series analysis and calculates forecasting errors using the MAPE (Mean Absolute Percent Error) method, the results obtained are the least square method of 67%, the moving average method of 2.91%, and the semi-average method of 2.27%. So it can be concluded that the best forecasting results are the moving average and semi-average methods, because they have an accuracy value of <10%, which means the ability of the forecasting model is very good.

Keywords

Forecasting; nata de coco; least square method; moving average method; semi average method

INTRODUCTION

The history of nata de coco, originally nata de coco was discovered in 1949 by a Filipino chemist who worked for the National Coconut Corporation. Production of nata de coco began in 1954, then optimized in 1970 through the efforts of a team of microbiologists. Nata de coco in Spanish means cream of coconut. In Indonesia, nata de coco is often referred to as coconut juice. Most of the processing of nata de coco in Indonesia is a home industry with pineapple as raw material or often called nata de pina. Nata de coco is a cellulose compound (dietary fiber) made from coconut water by a fermentation process using microbes, called nata seeds (Lestari, 2015). In the industrial sector, nata de coco is a type of soft drink because it contains 98% water. In addition, nata de coco is made with the addition of a sweetener solution and then packaged in such a way. Nata de coco is sold not only in the domestic market, but also in Europe, Japan, the United States, and Middle Eastern countries. Domestic market demand for nata de coco usually increases dramatically during Christmas, Eid, New Year, and other important events.

PT Shenovia is a business entity that oversees housewives in managing nata de coco according to company standards that have been set, then distributed to the market. PT Shenovia is located in the Ciasem area, Subang. The nata de coco product produced by PT Shenovia is not inferior to branded products already circulating in the market. Nata de coco produced by PT Shenovia has spread to several cities in West Java and has begun to spread to several other provinces. PT Shenovia continues to increase production and expand its marketing network. Competition in the business world is increasing sharply and can lead to a decline in sales of nata de coco if the strategy is not managed properly. One of the important factors that must be the main focus is the availability of raw materials. In planning the amount of production there are several methods that can be used, one of which is using the forecasting method (Panday, 2019).

On this occasion, a study will be conducted on the sales volume of PT Shenovia as a

✉Correspondence to : sherennovy@gmail.com[2]

Received: 7 June 2022
Accepted: 8 Aug 2022
Published: 1 Sep 2022

distributor of nata de coco. Forecasting is done using three methods in the time series analysis, namely the least square method, the moving average method, and the semi-average method. These three methods are used to choose which forecasting model seems appropriate for forecasting PT Shenovia's sales volume. In problem solving planning, it is necessary to pay attention to the root of the problem to think of ways to solve it (Sudiantini & Dewi Shinta, 2018).

The formulation of the problem in this study is whether there is an influence in sales forecasting on PT Shenovia as a producer or company that produces nata de coco?

Based on the theoretical explanation above, PT Shenovia really needs a forecasting method to predict sales and secure production, as well as planning guidance by management. Good and accurate planning can minimize excessive costs and reduce costs. With a little effort, this will affect the profits to be achieved higher. Too much inventory will cause an increase in inventory costs, while too little inventory will result in increased costs and excessive ordering frequency (Panday et al., 2020). Therefore, the authors are interested in conducting research related to sales forecasts of nata de coco with the title "Forecasting Analysis in Sales of Nata De Coco Products to PT Shenovia Using Least Square, Moving Average, and Semi Average Methods". The results of this study can also be used by PT Shenovia executives to improve performance and satisfaction, as well as create quality products.

LITERATURE REVIEW

Nata de Coco

Nata de coco is a processed product with the main content of coconut water which is fermented with Acetobacter xylinum bacteria. Nata de coco is a transparent white jelly which is a dessert with a chewy texture. Nata de coco is a healthy food with high fiber but low in calories. Nata de coco has health benefits such as lowering cholesterol, lowering blood sugar in diabetics, and controlling weight (preventing obesity).

Forecasting

Forecasting is an activity or business that uses empirical or historical data to find out what will happen (events) in the future for a particular object. To be able to predict, predict or predict something (the value of a variable) in the future, past data is needed (Permatasari, 2019). While forecasting activity is a business function that predicts sales and use of a product so as to produce the right amount of product. Time series analysis and forecasting are used by managers to predict events that are used to make decisions based on patterns that have occurred in the past, thus making the forecasts produced more accurate. The conclusion of sales forecasting according to (Wijayanti & Sc, 2003) is an estimate of future sales under certain circumstances and is based on data that has occurred in the previous year (Sudiantini et al., 2019).

The advantages of forecasting methods in the business world are accurate and professional results. In various businesses, such as the production of products and services, it is important to plan and monitor so that it will be easier for the business to move forward. According to (Helmiah & Dahriansah, 2020), there are two forecasting techniques. Qualitatively, namely an evaluation method that emphasizes one's opinion (judgment).Quantitatively, namely an evaluation method that emphasizes numerical calculations using various statistical methods. The approach used to generate forecasts has a significant impact on forecasting results.

Sales

According to (Muqtadiroh, 2015) sales is an integrated effort to develop a strategic plan that is directed at satisfying the needs and desires of buyers. Therefore, it can be concluded that selling is an activity between the seller and the buyer in the form of a product or service in which the company seeks profit or profit and the buyer receives the appropriate price. There are also several factors that affect sales, such as product quality, consumer tastes, the ability of sellers, and market competition (Saputra, 2022).

High sales facilitate rapid business growth. The higher the number of sales, the higher the company's profit. With the high profit earned from sales, of course the business will benefit and also the costs for other operations. Proper financial management is needed so that profits from sales can be allocated for business development appropriately (Munawar & Saputra, 2021).

Forecasting Method

The forecasting method is a method for planning and managing production. In

addition, forecasts are also defined as a tool to carry out an effective and efficient plan. There are several kinds of forecasting methods as follows :

Least Square Method

The least squares method or least square is one method in the form of time series data that requires past sales data to forecast future sales in order to determine results (Pamungkas, 2016). Least Square is a forecasting tool to detect trends in time series data (Supriyanto & Sutarman, 2017). So, it can be concluded that if the square of the deviation of the data value from the minimum or smallest trend line has been met, then the trend line will be located in the middle of the original data.

Equation 1:

$$Y = A + bX$$

Then to find out the coefficients a and b are sought by equations 2 and 3.

$$a = \frac{\sum Y}{n}$$

$$b = \frac{\sum t\,Y}{\sum t^2}$$

With :

Y = periodic data (time series) = estimated trend value.

a = trend value in base year.

b = average growth trend value each year.

X = time variable (day, week, month or year).

Moving Average Method

Moving average forecasting uses a moving average as a mathematical forecasting process which is a combination of high and low values, which provides a stable forecast (Paixão & Silva, 2019). This moving average method is suitable for calculating stable data and data that does not fluctuate significantly (data that changes significantly up and down). Mathematically simple moving average (predicting demand for future periods), using the formula:

$$\text{Moving Average} = \frac{\sum \text{demand n previous period}}{n}$$

1. Semi-Average Method

   According to (Budi Septiawan & Zuni Astuti, 2016), the half-average method basically consists of dividing the data into two parts, namely the first group and the second group. Then the two groups are used as the basis for calculating trends and forecasts.

$$Y' = a + b(x)$$

Forecasting Error Calculation

The selection of the forecasting method is done by comparing the error values, where the forecasting model with the smallest error value is chosen as the best and most suitable method for forecasting nata de coco sales reports at PT Shenovia. Calculations according to (Hernadewita et al., 2020) :

1. MAD (Mean Absolute Deviation)

   This is the first way to measure the overall forecasting error. Calculation of errors in general, namely the average error between forecasting and actual data.

$$MAD = \frac{\sum \text{actual} - \text{forecast}}{n}$$

2. MSE (Mean Square Error)

   The second measure of overall forecasting error. Error calculation by squaring the result of the error, both the smallest and the largest. Good for data with small variance or distribution.

$$MSE = \frac{\sum (\text{forecast error})^2}{n}$$

3. MAPE (Mean Absolute Percent Error)

   It is calculated using the absolute error in each period divided by the actual value for that period. Then, average the absolute percentage error. This method provides an indicator of the level of forecasting error relative to the true value.

$$MAPE = \frac{\sum \text{absolute percent error}}{n}$$

MAPE (Mean Absolute Percent Error) is a relative error measurement that shows the percentage of forecasting error results compared to actual demand over a certain period of time and provides information about the

percentage of error that is too high or too low (Astuti et al., 2019).

METHODS

This research is quantitative research conducted at PT Shenovia by looking for forecast data from the sales results. This data collection was carried out from 2016 to 2021, using the least square, moving average, and semi-average methods. After data collection, the researcher can perform forecasting calculations for 2022 with these three methods. After getting the forecast value, the forecast error is calculated. The calculation contains MAD (Mean Absolute Deviation), MSE (Mean Square Error), and MAPE (Mean Absolute Percent Error).

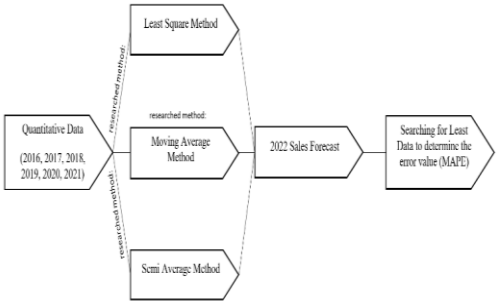

Figure 1. Research Framework

RESULTS AND DISCUSSION

The data used in this study is the actual data owned by the company. The data taken is PT Shenovia's sales data from 2016 to 2021. This data will be used for forecasting sales for the following year. The following data is collected based on actual company data from 2016 to 2021.

Table 1. PT Shenovia Sales Data 2016-2021

Year (n)	Sales (Y)
2016	15,000
2017	15,250
2018	15,125
2019	15,550
2020	15,725
2021	16,000

Source: PT Shenovia

The analysis was carried out using the least square, moving average, and semi-average methods to determine the best predictions to be used.

Table 2. Preparation of Calculation of Sales Data for Nata de Coco Products Least Square Method

Year (n)	Sales (Y)	X	XY	X^2
2016	15,000	-5	-75,000	25
2017	15,250	-3	-45,750	9
2018	15,125	-1	-15,125	1
2019	15,550	1	15,125	1
2020	15,725	3	47,175	9
2021	16,000	5	80,000	25
∑	**92,650**	**0**	**6,850**	**70**

Source: Data processed

So that the value of the constant a and constant b is obtained with the following calculations.

$$a = \frac{\sum Y}{n} = \frac{92{,}650}{6} = 15{,}441.67$$

$$b = \frac{\sum XY}{\sum X^2} = \frac{6{,}850}{70} = 97.86$$

Thus, each value of the constant number is known, namely, a is 15,441.67 while b is 97.86. Then calculate the forecast for the number of sales of nata de coco in the upcoming period, namely in 2022, with the linear equation of the line:

Y' = 15,441.67 + 97.86 (x)

By using this equation, it can be forecasted sales in 2022 with the value of x used is x = 7 so that it can be obtained:

Y'_{2022} = a + b (x)
= 15,441.67 + 97.86 (7)
= 16,126.69

Thus, it can be estimated that sales of nata de coco in 2022 are 16,126.69 packs.

Table 3. Analysis of Sales Forecasting Errors of Nata de Coco Products to PT Shenovia

Year (n)	Sales (Y)	Forecasting (Yt)	$\|Y1 - Yt\|$
2016	15,000	16,126.69	1,126.69

2017	15,250	16,126.69	876.69
2018	15,125	16,126.69	1,001.69
2019	15,550	16,126.69	576.69
2020	15,725	16,126.69	401.69
2021	16,000	16,126.69	126.69
∑	**92,650**		**4,110.14**

Source: Data processed

$$MAD = \frac{\sum |Y1-Yt|}{n}$$
$$= \frac{4,110.14}{6}$$
$$= 685.02$$
$$MSE = \frac{\sum (Y1-Yt)^2}{n}$$
$$= \frac{16,893,250.82}{6} = 2,815,541.80$$
$$MAPE = \frac{\frac{\sum |(Y1-Yt)|}{Y1}}{n} \times 100\%$$
$$= \frac{\frac{\sum(4,110.14)}{92,650}}{6} \times 100\%$$
$$= \frac{0.04}{6} \times 100\%$$
$$= 0.67 = 67\%$$

Thus, the MAD (Mean Absolute Deviation) value is 685.02 and the MSE (Mean Square Error) is 2.815.541.80. Meanwhile, MAPE (Mean Absolute Percent Error) in the least square method is 67%. In this data, the MAPE value is >50% which can be said to be inaccurate.

Table 4. Calculation of Sales Forecasting Products Nata de Coco Moving Average Method 3

Year	Sales	3 MA	Error	|Error|	Error²	%Error|
2016	15,000	–				
2017	15,250	–				
2018	15,125	–				
2019	15,550	15,125	425	425	180,625	2.73%
2020	15,725	15,308.33	416.67	416.67	173,611.11	2.65%
2021	16,000	15,466.67	533.33	533.33	284,444.44	3.33%
2022		**15,758.33**		**1375**	**638,680.56**	**8.72%**
				MAD	**MSE**	**MAPE**
				458.33	212,893.52	2.91%

The table above is based on forecasting using the moving average method of nata de coco sales that will come in 2022 as many as 15,758.33 packs. And it can be seen that the MAD (Mean Absolute Deviation) value is 458.33 and the MSE (Mean Square Error) is 212.893.52. Meanwhile, MAPE (Mean Absolute Percent Error) is 2.91%. In this data, the MAPE value is <10% which can be said to be very good or very accurate.

Table 5. Total Sales of Nata de Coco Products to PT Shenovia

Year (n)	Sales (Y)	X	Semi Total	Trend Semi Average
2016	15,000	-3		K1 = 45,375
2017	15,250	-1	45,375	3
2018	15,125	1		= 15,125
2019	15,550	3		K2 = 47,275
2020	15,725	5	47,275	3
2021	16,000	7		= 15,758.34
2022	?	9		

Source: Data processed

Is known :

n = 3

a = 15,125

$$b = \frac{(15,758.34 - 15,125)}{3}$$
$$= 211.12$$

Then it can be calculated by the equation :

Y = a + bX

The calculation is carried out with this equation in 2022, if it is known that the value of x is 9.

Y = a + bX

= 15,125 + 211.12 (9)

= 15,125 + 1,900.08

= 17,025.08

So, the estimated assets in 2022 using the semi-average method are 17,025.08 packs.

Then it is necessary to calculate the sales forecasting error of nata de coco products with the equation:

Y = 15,125 + 211.12 (X)

Table 6. Semi Average Trend Data

Year (n)	Sales (Y)	Trend Semi Average	Error	|Error|	Error²	|%Error|
2016	15,000	14491.64	508	508	258,064	3.39%
2017	15,250	14913.88	336	336	112,896	2.20%
2018	15,125	15336.12	-211	211	44,521	1.40%
2019	15,550	15758.36	-208	208	43,264	1.34%
2020	15,725	15969.48	-244	244	59,536	1.55%
2021	16,000	16602.84	-603	603	363,609	3.77%
				2,110	**881,890**	**13.64%**
				MAD	**MSE**	**MAPE**
				351.67	146,981.67	2.27%

From table 6, the forecasting results have an error size of MAD (Mean Absolute Deviation) of 351.67 and MSE (Mean Square Error) of 146.981.67. Meanwhile, MAPE (Mean Absolute Percent Error) is 2.27%. In this data, the MAPE value is <10% which can be said to be very good or very accurate.

CONCLUSION

Conclusion

Based on research conducted by the author who also acts as a researcher, the results of the comparison of the least square, moving average, and semi average methods are as follows:

1. Least square method for forecasting sales of nata de coco products to PT Shenovia in 2022 as many as 16,126.69 packs. With a forecast error value of MAPE (Mean Absolute Percent Error) of 67%.
2. The moving average method for forecasting sales of nata de coco products to PT Shenovia in 2022 is 15,758.33 packs. With a forecast error value of MAPE (Mean Absolute Percent Error) of 2.91%.
3. The semi-average method for forecasting sales of nata de coco products to PT Shenovia in 2022 is 17,025.08 packs. With a forecast error value of MAPE (Mean Absolute Percent Error) of 2.27%.
4. It can be concluded that the best forecasting results are the moving average and semi-average methods, because they have an accuracy value of <10%, which means the ability of the forecasting model is very good.

Suggestion

Management needs to consider using the moving average or semi-average method in making sales forecasts because this method is the most efficient in the calculation process, and this method is more stable. And it is necessary to calculate the forecast error.

REFERENCES

Astuti, Y., Novianti, B., Hidayat, T., & Maulina, D. (2019). Penerapan Metode Single Moving Average Untuk Peramalan Penjuaan Mainan Anak. *Seminar Nasional Sistem Informasi Dan Teknik Informatika Sensitif*, *4*(July), 255.

Budi Septiawan, R., & Zuni Astuti, E. (2016). *Perbandingan Metode Setengah Rata-Rata Dan Metode Kuadrat Terkecil Untuk Peramalan Pendapatan Perusahaan Di Blu Uptd Terminal Mangkang Semarang*. *15*(2), 132–139.

Helmiah, F., & Dahriansah. (2020). Implementation of Least Square Method for Sales Prediction in Tria Ms Glow. *International Conference on Social, Sciences and Information Technology*, *4509*, 13–18.

Hernadewita, Hadi, Y. K., Syaputra, M. J., & Setiawan, D. (2020). Peramalan Penjualan Obat Generik Melalui Time Series Forecasting Model Pada Perusahaan Farmasi di Tangerang: Studi Kasus. *Journal Industrial Engineering & Management Research (Jiemar)*, *1*(2), 35–49.

Lestari, R. W. (2015). *Srategi Pengembangan Usaha Nata de Coco PT. Daya Argo Mitra Mandiri, Jombang-Ciputat, Kota Tangerang Selatan*. *3*, 103–111.

Munawar, N. A., & Saputra, F. (2021). Application Of Business Ethics And Business Law On Economic Democracy That Impacts Business Sustainability. *Journal of Law Politic and Humanities*, *1*(3), 115–125.

Muqtadiroh. (2015). Analisis Peramalan Penjualan Semen Non-Curah (ZAK) PT. Semen Indonesia (Persero) TBK pada Area Jawa Timur. *Seminar Nasional Teknologi Informasi Dan Komunikasi (SENTIKA 2015)*, *2015*(Sentika), 310.

Paixão, K. W. M., & Silva, A. M. da. (2019). Sales forecasting in a mechanical component manufacturer: comparison between monte carlo simulation and time series analysis. *Independent Journal of Management & Production*, *10*(4), 1324. https://doi.org/10.14807/ijmp.v10i4.998

Pamungkas, D. P. (2016). Implementasi Metode Least Square Untuk Prediksi Penjualan Tahu Pong. *Jurnal Ilmiah NERO*, *2*(2), 75–81.

Panday, R. (2019). *Pengaruh Kualitas Pelayanan Dan Fasilitas Fakultas Ekonomi Terhadap Kepuasan Mahasiswa Fakultas Ekonomi Di Universitas Bhayangkara Jakarta Raya*. 1–8. https://doi.org/10.31227/osf.io/82bza

Panday, R., Rachmat, B., & Navanti, D. (2020). Evaluation of operating cost for money packaging. *International Journal of Scientific and Technology Research*, *9*(3), 6736–6741.

Permatasari, I. K. (2019). Analisis Trend Penjualan Dengan Metode Least Square Pada Apotek Swasta Surabaya. *Jurnal Mitra Manajemen*,

3(3), 283–298. https://doi.org/10.52160/ejmm.v3i3.210

Saputra, F. (2022). Analysis Effect Return on Assets (ROA), Return on Equity (ROE) and Price Earning Ratio (PER) on Stock Prices of Coal Companies in the Indonesia Stock Exchange (IDX) Period 2018-2021. *Dinasti International Journal of Economics, Finance and Accounting*, *3*(1), 82–94. http://repository.uph.edu/41805/%0Ahttp://repository.uph.edu/41805/4/Chapter1.pdf

Sudiantini, D., & Dewi Shinta, N. (2018). Pengaruh Media Pembelajaran Terhadap. *Sintesa*, *11*(1), 177–186.

Sudiantini, D., Umar, H., & Arafah, W. (2019). The Influence of Strategic Leadership Competencies and Organizational Culture on Public Service Performance with Work Climate as a Moderation Variable in Banten Provincial Government (in Lebak Regency , Pandeglang Regency , Serang Regency). *International Journal of Creative Research and Studies*, *3*(10), 92–98.

Supriyanto, & Sutarman. (2017). Penerapan Metode Least Square Untuk Sistem Peramalan Penjualan Barang Berbasis E-Commerce. *Doctoral Dissertation, Universitas Teknologi Yogyakarta*, 1–12.

Wijayanti, M., & Sc, M. (2003). *Produk Susu Kental Manis Carnation*. 1–14.