Tibuana
Journal of applied Industrial Engineering-University of PGRI Adi Buana
p-ISSN 2622-2027
e-ISSN 2622-2035

The Application of Time Series Forecasting Method to Estimate National Salt Demands

Imron Rosyadi NR[1], Erwin Prasetyowati[2], and Rina Susanti[3]
[1,2,3] Department of Industrial Engineering, Faculty of Engineering, Universitas Madura
imron.rosyadi@unira.ac.id

***Abstract*— Salt is one of the most important commodities for domestic use and as a raw material for industry. It is essential to make an estimate salt requirement to meet them appropriately. The purpose of the study was to estimate salt needs using the time series forecasting method and to identify the most effective technique for salt needs forecasting. Forecasting analysis uses Naive, Moving Average, Weighted Moving Average, Exponential Smoothing, Exponential Smoothing with Trend, and Trend Projection methods. Forecasting accuracy is tested using MAD, MSE, and MAPE. Based on the results, the Trend Projection is the most effective time series forecasting technique for predicting salt requirements. This method was selected due to its lowest error rate value (MAD of 0.16, MSE of 0.04, and MAPE of 4.28%) compared to other methods. According to projected estimates, the amount of salt required in 2024 would be 4.86 million tons.**

***Keywords*: Forecasting, Time Series, Trend Projection, Exponential Smoothing, Moving Average, Weighted Moving Average.**

I. INTRODUCTION

Salt is a strategic and essential commodity as a staple for household consumption and as an industrial raw material. Salt functions as a preservative, flavor enhancer, as well as to improve the appearance and texture of food (Noviasari et al., 2023). According to Akbar et al. (2023), the national salt demand will reach more than 4 million tons in 2022. Based on the salt balance from the Coordinating Ministry for Economic Affairs processed by BPS, the total national salt demand in 2022 will reach 4.5 million tons. A total of 3.7 million tons of salt is used as raw materials and industrial auxiliary materials. Industrial sectors that use salt include: chlor-alkali plants (cap), various foods, fish salting, tanning, mining, animal feed, water treatment, soap and detergent, pharmaceuticals and cosmetics, as well as textiles and others.

The demand for salt in Indonesia has increased every year. According to Putri & Sugiarti (2021), As the population grows and industrialization advances, so does the demand for salt more increasing. Data from BPS, the Ministry of Industry, and PT Garam show that the national salt demand increased from 2011 to 2021, from 3.2 million tons in 2011 to 4.6 million tons in 2021. The demand for salt is generally rising, yet occasionally decrease from the previous year. For instance, the demand for salt fell by 0.9 million tons from 2021 to 4.51 million tons in 2022.

The national salt demand must be predicted so that the government can prepare production and reserves to meet these needs. Prediction of salt needs can be done by forecasting future needs based on data from previous years. Forecasting is essential to support decisions such as inventory management, production planning, procurement, and others (Pritularga et al., 2023). Meanwhile, according to Arnold et al. (2012), forecasting is used for business strategic plans, production plans, and production master schedules. And according to Puspita (2023), forecasting is one way to control production. Forecasting is a method of estimating the future using data from the past. Forecasting is both a science and an art of understanding the prediction of future events (Heizer et al., 2017). Forecasting is a computational analysis methodology that employs both qualitative and quantitative methodologies to predict future events utilizing future data references to reduce effect uncertainty. Forecasting can be used for short-, medium-, and long-term planning. (Maretania et al., 2021). According to Badi'ah & Handayani (2020), forecasting is used as a tool in effective and efficient planning, as well as to determine future resource needs and to make informed decisions.

p-ISSN 2622-2027
e-ISSN 2622-2035

Hernadewita et al., (2020), forecasted generic drug sales using the time series forecasting method obtains the results of forecasting generic drug sales for the next period. Kusuma et al. (2020), said that the Linear Exponential Smoothing approach is a more accurate way to predict batik sales than the forecasting method used by batik managers. Nadhira et al. (2021), compared the demand forecasting of Softex 1400-M using the Single Exponential Smoothing and Single Moving Average methods. The findings demonstrate that the Single Moving Average approach is the most effective one with a MAPE of 12.82%. Demand forecasting can support to prevent excess or shortage of product stock. Meanwhile, Samosir et al. (2022) forecasted to determine the need for drugs to improve services using the Trend Projection method. Asyrof-H & Rahmawati (2023), used the Exponential Smoothing, Weighted Moving Average, and Single Moving Average methods to predict the demand for delivery services. According to the results, the Single Exponential Smoothing approach was the most effective since it produced the most accurate results with the smallest MAPE was 5.48. Meanwhile, Tamtama & Riantisari (2024) forecasted the demand for car washes using the Exponential Smoothing, Single Moving Average, and Weighted Moving Average methods, with the smallest MAPE result being the Weighted Moving Average method where the MAPE value is 21.41%. Several studies using forecasting methods show that the difference in forecasting objects and data influences the difference in the selection of the most appropriate method. Therefore, in conducting forecasting, it is necessary to test several forecasting methods to get the best results.

Previous research related to forecasting salt includes forecasting the price, production, demand, and sales of salt. The research was only conducted on micro sectors such as companies or certain regions. As well as Habibi & Riksakomara (2017), forecasted the price of salt for consumption at PT. Garam Mas uses Artificial Neural Network Feedforward-Backpropagation. Mahrus et al. (2021), forecasted the quantity of salt produced in Madura using the Double Moving Average and Exponential Smoothing methods. Badi'ah & Handayani (2020), analysed the forecast of demand for iodized consumption salt products in UD Garam Samudra using Linear Regression, Exponential Smoothing, Moving Averages, Weighted Moving Averages, and Naive Method. Sari et al. (2022), used the Least Squares approach to forecast salt sales in CV. Saltindo Megajaya. This study used time series forecasting methods (Naive Approach, Moving Averages, Weighted Moving Averages, Exponential Smoothing, Exponential Smoothing with Trend Adjustment and Trend Projections) to forecast the National salt demands. The purpose of this study is to find the most effective time series forecasting method for projecting future national salt demands.

II. RESEARCH METHOD

Forecasting is the beginning of a plan. Before planning, forecasting must be done to know what will happen over the next few periods (Arnold et al., 2012). According to Kusmindari et al (2019), forecasting is a process to predict several future needs. Forecasting uses historical data to project it into the future with mathematical models. Forecasting is carried out with two approaches, namely (1) quantitative forecasting uses a variety of mathematical models derived from associative variables or historical data, and (2) qualitative forecasting incorporates elements like value systems, emotions, personal experiences, and intuition in decision-making (Heizer et al., 2017).

This study employs a quantitative forecasting methodology based on time series. The time series forecasting method makes estimates based on past data. When there is little variation in the fundamental demand pattern from year to year, this approach is very suitable (Chopra & Meindl, 2016). According to, Luciano & Yuliarty (2020), the time series method is concerned with the value of a variable that is arranged periodically throughout the time in which demand forecasting is projected, for example weekly, monthly, quarterly and yearly. Time series quantitative forecasting method according to Heizer et al. (2017) includes:

p-ISSN 2622-2027
e-ISSN 2622-2035

1. **Naive Approach**
   The naive approach is the most straightforward forecasting method that assumes that demand will be the same in the future as it is now (Heizer et al., 2017). This approach is the most objective and cost-efficient forecasting method Hernadewita et al (2020).

   Demand in the following period = Demand in the current period (1)

2. **Moving Average (MA)**
   Moving averages is forecasting method that predict the upcoming period by averaging the values of previous data from multiple recent periods. If it is expected that market demand is constant over time, this strategy can be helpful. The following is the mathematical expression for a simple moving average (Hernadewita et al., 2020; Heizer et al., 2017):

   $$MA = \frac{\Sigma\ d\ \ \ i\ p\ \ \ n\ p}{n} \quad (2)$$

   Where *n* is the moving average's number of periods.

3. **Weighted Moving Average (WMA)**
   Weighted moving average is a forecasting method used when a trend or pattern is identified; weighting allows the most recent number to be given greater weight. By giving greater weight to more recent periods, this strategy improves the forecasting technique's responsiveness to changes. A moving average with weighting can be mathematically represented as follows (Hernadewita et al., 2020; Heizer et al., 2017):

   $$WMA = \frac{\Sigma\ (W\ \ f\ \ p\ \ n)\ D\ \ i\ p\ \ n)}{\Sigma\ W} \quad (3)$$

4. **Exponential Smoothing**
   Exponential smoothing is a method that uses exponential functions to weight data to forecast moving averages with different weightings. This approach is very simple to use and requires very little historical data. The following is the basic exponential refinement formula (Hernadewita et al., 2020; Heizer et al., 2017; Chopra & Meindl, 2016):

   $$F_t = F_{t-1} + \alpha\,(A_{t-1} - F_{t-1}) \quad (4)$$

   o

   $$F_t = \alpha\,(A_{t-1}) + (1-\alpha)F_{t-1} \quad (5)$$

   Where:

   Ft = new forecasting
   Ft_{-1} = previous forecasting
   A = constant for smoothing ($0 \le \alpha \le 1$)
   At_{-1} = the previous period's actual demand

5. **Exponential Smoothing with Trend Adjustment**
   Exponential smoothing forecasting method that incorporates trend adjustment is called exponential smoothing with trend adjustment. This technique is applied when there is a trend in the forecasted data. The formula for exponential smoothing with trend correction is as follows: (Hernadewita et al., 2020; Heizer et al., 2017):

   Forecasting by trend (*FITt*) =
   Exponential smoothing forecasting (*Ft*)
   + Exponential smoothing trend (*Tt*)
   (6)

   The two smoothing constants needed for the exponential smoothing method with trend correction are α for the average and β for the trend. The following formula is used to determine averages and trends for each period:

   $$F_t = \alpha\,(A_{t-1}) + (1-\alpha)(F_{t-1} + T_{t-1}) \quad (7)$$

   $$T_t = \beta\,(F_t - F_{t-1}) + (1-\beta)T_{t-1} \quad (8)$$

   Where:
   Ft = forecasting using serialized data that has been

p-ISSN 2622-2027
e-ISSN 2622-2035

exponentially smoothed out in the period *t*
Tt = trend with a smoothed exponential over period *t*
At_{-1} = previous period's actual demand
Ft_{-1} = previous forecasting
A = constant for smoothing ($0 \leq \alpha \leq 1$)
B = smoothing constant for trend ($0 \leq \beta \leq 1$)

6. Trend Projection

Trend projection is a forecasting method that projects trend lines into the future for medium- or long-term forecasting after modifying the lines on a collection of historical data. This approach examines trends as a linear, or straight, line. The following equation can be used to express the trend line in the trend projection approach (Puspita, 2023; Samosir et al., 2022; Hernadewita et al., 2020; Heizer et al., 2017):

$$\hat{y} = a + b \qquad (9)$$

Regression line slope (*b*):

$$b = \frac{\sum x \; - n\bar{x}\bar{y}}{\sum x^2 - n\bar{x}^2} \qquad (10)$$

Y axis cut-off point (*a*):

$$a = y - b \qquad (11)$$

Where:
$\hat{y}$ = the calculated value of the variable that needs to be forecasted (bound variable)
a = axis intersecting *y*
b = regression line slope
x = independent variable
y = bound variable
$\bar{x}$ = average value *x*
$\bar{y}$ = average *y*-value
n = quantity of data or observations

Measure of Forecasting Results' Accuracy

The measure of the forecasting accuracy is a measure of forecasting error, or the degree of discrepancy between the forecasted and actual demand (Kusmindari et al., 2019). The measures of forecasting results' accuracy of the used in this study include (Samosir et al., 2022; Hernadewita et al., 2020; Heizer et al., 2017):

1. MAD (Mean Absolute Deviation)
   The value is determined by summing the forecast error's (deviation) absolute values and dividing the outcome by the number of data periods (n), namely:
   $$M = \frac{\sum|A \quad - F(\qquad |}{n} \qquad (12)$$
2. MSE (Mean Square Error)
   MSE is the mean squared difference among the actual and predicted values. The following is the formula:
   $$M = \frac{\sum(A \quad - F(\qquad)^2}{n} \qquad (13)$$
3. MAPE (Mean Absolute Percent Error)
   MAPE is the mean absolute difference among the actual and predicted values, represented as a percentage of the actual values for *n* periods. MAPE's formula is:
   $$M = \frac{100}{n}\sum_{t=1}^{n}\frac{|\text{Actual}_t - \text{Forecast}_t|}{\text{Actual}_t} \qquad (14)$$

III. RESULT AND DISCUSSION

The national salt demand from 2011-2023 has increased, where the demand for salt in 2011 was 3.2 million tons and in 2023 as much as 4.7 million tons. In general, the demand for salt is increasing, but sometimes there is a decrease from the previous year. Figure 1 illustrates the decline from 3.9 million tons in 2014 to 3.4 million tons in 2015, 4.2 million tons in 2018, 4 million tons in 2019, 4.6 million tons in 2021, and 4.5 million tons in 2022. Salt needs are always changing (not the same every year) so that good estimates are needed so that salt needs can be met properly.

p-ISSN 2622-2027
e-ISSN 2622-2035

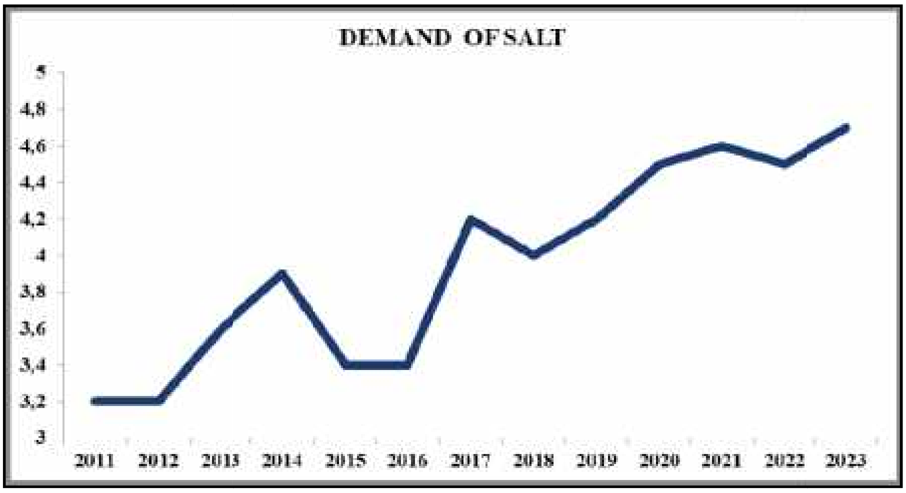

Figure 1: National Salt Demand Data 2011-2023
Source: PT. Garam, BPS, and the Ministry of Industry (2024)

Table 1. Results of Salt Demand Forecasting Calculation

Period	Demand	Forecast											
		Naive	MA (N=2)	MA (N=3)	MA (N=4)	WMA (N=2)	WMA (N=3)	WMA (N=4)	ES (α=0,2)	ES (α=0,5)	ES (α=0,8)	EST	TP
2011	3,2												3,2
2012	3,2	3,20							3,20	3,20	3,20	3,20	3,31
2013	3,6	3,20	3,20			3,2			3,20	3,20	3,20	3,20	3,44
2014	3,9	3,60	3,40	3,33		3,44	3,4		3,28	3,40	3,52	3,50	3,57
2015	3,4	3,90	3,75	3,57	3,48	3,78	3,67	3,6	3,40	3,65	3,82	3,83	3,70
2016	3,4	3,40	3,65	3,63	3,53	3,6	3,59	3,57	3,40	3,53	3,48	3,55	3,82
2017	4,2	3,40	3,40	3,57	3,58	3,4	3,5	3,52	3,40	3,46	3,42	3,44	3,95
2018	4	4,20	3,80	3,67	3,73	3,88	3,8	3,77	3,56	3,83	4,04	4,01	4,08
2019	4,2	4,00	4,10	3,87	3,75	4,08	3,94	3,88	3,65	3,92	4,01	4,05	4,21
2020	4,5	4,20	4,10	4,13	3,95	4,12	4,14	4,06	3,76	4,06	4,16	4,19	4,34
2021	4,6	4,50	4,35	4,23	4,23	4,38	4,31	4,28	3,91	4,28	4,43	4,46	4,47
2022	4,5	4,60	4,55	4,43	4,33	4,56	4,49	4,43	4,05	4,44	4,57	4,61	4,60
2023	4,7	4,50	4,55	4,53	4,45	4,54	4,53	4,5	4,14	4,47	4,51	4,57	4,73
2024		4,70	4,60	4,60	4,58	4,62	4,62	4,60	4,25	4,58	4,66	4,69	4,86

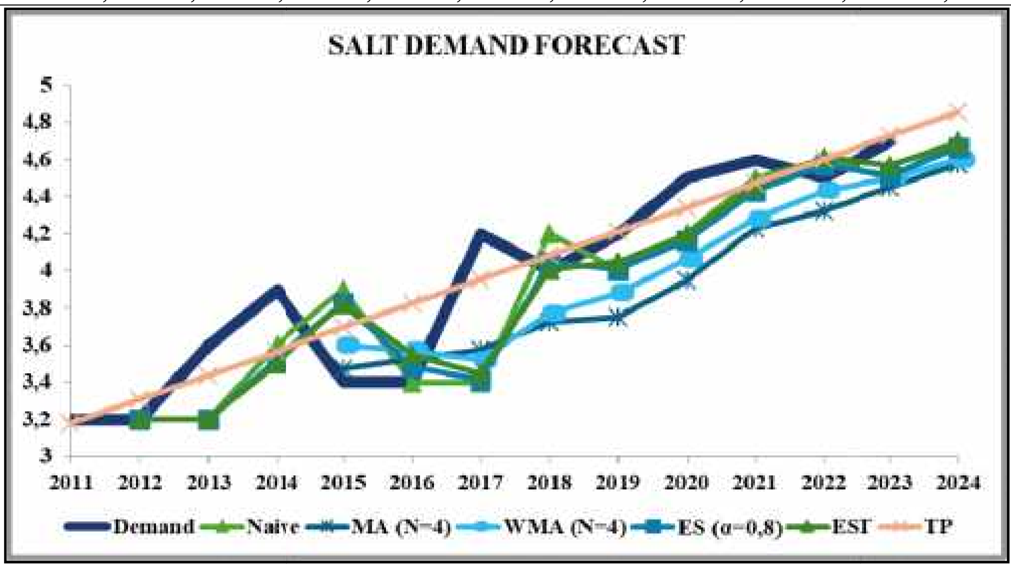

Figure 2: Comparison of Forecast Result with Salt Demand Data

p-ISSN 2622-2027
e-ISSN 2622-2035

Table 2. Forecast Accuracy Measurement Results

Method	Forecast	MAD	MSE	MAPE
Naive	4,70	0,26	0,11	6,47%
Moving Average (N=2)	4,60	0,31	0,14	7,88%
Moving Average (N=3)	4,60	0,32	0,13	7,88%
Moving Average (N=4)	4,58	0,32	0,14	7,55%
Weighted Moving Average (N=2)	4,62	0,30	0,13	7,53%
Weighted Moving Average (N=3)	4,62	0,30	0,12	7,24%
Weighted Moving Average (N=4)	4,60	0,29	0,11	7,00%
Exponential Smoothing (α=0,2)	4,25	0,40	0,25	9,52%
Exponential Smoothing (α=0,5)	4,58	0,27	0,12	6,66%
Exponential Smoothing (α=0,8)	4,66	0,24	0,10	5,90%
Exponential Smoothing with Trend	4,69	0,25	0,11	6,27%
Trend Projection	4,86	0,16	0,04	4,28%

The results of the salt requirements calculation utilizing the time series forecasting approach, which includes *the Naive, Moving Average, Weighted Moving Average, Exponential Smoothing, Exponential Smoothing with Trend*, and *Trend Projection* methods are shown in Table 1. The results of the calculation show that in the Trend Projection method, there is an increase in salt demand in 2024 by 4.86 million tons, compared to the need in 2023 of 4.7 million tons. In the Naive method, the forecast results in 2024 are the same as the salt demand in 2023, because of this approach, the demand for the anticipated value for the upcoming period is the same as that for the prior period. Meanwhile, the forecast results of other methods will decrease in 2024. The forecast results on the Moving Average (MA) method with n = 2 and 3 of 4.6 million tons and n = 4 of 4.58 million tons. Meanwhile, in the Weighted Moving Average (WMA) method with n = 2 (weights 0.4 and 0.6) and n = 3 (weights 0.2, 0.3, and 0.5) as much as 4.62 million tons and n = 4 (weights 0.1, 0.2, 0.3, and 0.4) as much as 4.6 million tons, where n is the moving average's number of periods. Exponential Smoothing (ES) with α = 0.2 is 4.25 million tons, α = 0.5 is 4.58 million tons, and α = 4 is 4.66 million tons. Meanwhile, in Exponential Smoothing with Trend (EST) with, α = 0.5 and β = 0.5 as much as 4.69 million tons.

Measure of Forecasting Results' Accuracy

A measure forecasting results' accuracy is necessary to measure forecasting errors or the degree of discrepancy among predicted and actual demand. Table 2 displays the results of the forecasting error calculation for each time series approach utilized in the study. A comparison of the forecast results of the six methods with the actual salt requirement value can be seen in Figure 2. The demand for salt increases every year even though sometimes there is a decrease, but in general there is an increase in salt demand so that it is very consistent with forecasting methods that have a trend. Based on the analysis of the six methods, the most suitable method to forecast salt demand is the Trend Projection method because the forecast value every year increases, in contrast to other methods that decrease at the end of the period. According to outcomes of the forecasting error computation, this approach also possesses the lowest error value when compared to other approaches.

IV. CONCLUSIONS

Based on the study's findings, time series forecasting approach generates a forecast value of 4.86 million tons for salt demand in 2024. Salt demand increased by 0.16 million tons from salt demand in 2023. From the six time series forecasting techniques utilized in this study, namely Naive Approach, Moving Average, Weighted Moving Average, Exponential Smoothing, Exponential Smoothing with Trend, and Trend Projection. The most effective forecasting technique salt demands is the Trend Projection method. This approach has the lowest error rate value among the others, with a MAD of 0.16, MSE of 0.04 and MAPE of 4.28%.

REFERENCES

Akbar, M. A., Adrian, F., & Rahmatillah, L. F. (2023). Potensi dan Tantangan Produksi Garam Nasional. *ARMADA: Jurnal Penelitian Multidisiplin*, *1*(12), 1433–1438. https://doi.org/10.55681/armada.v1i12.1085

Arnold, J. R. T., Chapman, S. N., & Clive, L. M. (2012). *Introduction to Materials Management*, 7th Edidion. New Jersey: Pearson Prentice Hall.

Asyrof-H, M., & Rahmawati, N. (2023). Application of the Single Moving Average, Weighted Moving Average and Exponential Smoothing Methods for Forecasting Demand at Boy Delivery. *Tibuana*, *6*(1), 32–37. https://doi.org/10.36456/tibuana.6.1.6442.32-37

Badi'ah, R., & Handayani, W. (2020). Analisis Peramalan Permintaan Produk Garam Konsumsi Beryodium Pada UD Garam Samudra. *Journals of Economics Development Issues (JEDI)*, *3*(2), 309–323. https://doi.org/10.32672/jse.v8i1.5523

Chopra, S., and Meindl, P. (2016). *Supply Chain Management: Strategy, Planning, and Operation*, 6th Ed. Boston: Pearson Education, Inc.

Habibi, M. Y., & Riksakomara, E. (2017). Peramalan Harga Garam Konsumsi Menggunakan Artificial Neural Network Feedforward-Backpropagation (Studi Kasus PT. Garam Mas, Rembang, Jawa Tengah). *JURNAL TEKNIK ITS*, *6*(2), 2337-3520. http://dx.doi.org/10.12962/j23373539.v6i2.23200

Heizer, J., Render, B., and Munson, C. (2017). *Operations Management: Sustainability and Supply Chain Management.* 12th Ed. Boston: Pearson Education, Inc.

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), 2722–8878. https://doi.org/10.7777/jiemar.v1i2

Kusmindari, D., Alfian, A., dan Hardini, S. (2019). *Production Planning and Inventory Control*. Yogyakarta: Deepublish.

Kusuma, N., Roestam, M., & Pasca, L. (2020). The Analysis of Forecasting Demand Method of Linear Exponential Smoothing (A Case Study in Batik Fendy Product, Klaten, Indonesia). *International Journal of Educational Administration, Management, and Leadership*, *1*(1), 7- 18. http://dx.doi.org/10.21831/jep.v16i2.33714

Lusiana, A., & Yuliarty, P. (2020). Penerapan Metode Peramalan (Forecasting) pada Permintaan Atap di PT X. *Industri Inovatif: Jurnal Teknik Industri*, *10*(1), 11-20. https://doi.org/10.36040/industri.v10i1.2530

Mahrus, M., Yulianto, T., & Faisol, F. (2021). Perbandingan Metode Exponential Smoothing dan Moving Average Pada Peramalan Jumlah Produksi Garam di Madura. *Zeta - Math Journal*, *6*(1), 17–23. https://doi.org/10.31102/zeta.2021.6.1.17-23

Maretania, I., Alfadjri, M. R., Paramesywarie, P. U., & Nurcahyo, R. (2021). Comparison of Double Exponential and Single Exponential Smoothing Accuracy in Krakatau Steel Demand Forecasting Fitted Model. *Proceedings IEOM India Conference*, 356-364. https://www.ieomsociety.org/proceedings/2021india/87.pdf

Nadhira, A. T. S., Gadisku, C. A., & Peranginangin, S. M. (2021). Demand Forecasting Comparison of Softex 1400-M using Single Moving Average Method and Single Exponential Smoothing Method. *Proceedings of the International Conference on Industrial Engineering and Operations Management,* 452-459. https://index.ieomsociety.org/index.cfm/article/view/ID/8067

Noviasari, T., Nuzula, N. I., Efendy, M., Febrianto, A. A., & Darmadi, A. (2023). Peramalan Curah Hujan Terhadap Produktivitas Garam di Gersik Putih Sumenep. *Jurnal Kelautan Tropis*, *26*(1), 9–18. https://doi.org/10.14710/jkt.v26i1.16139

Pritularga, K. F., Svetunkov, I., & Kourentzes, N. (2023). Shrinkage estimator for exponential smoothing models. *International Journal of Forecasting*, *39*(3), 1351–1365. https://doi.org/10.1016/j.ijforecast.2022.07.005

Puspita, K. (2023). Implementasi Metode Trend Projection Dalam Peramalan Persediaan Gas LPG Pada PT. Sintora Putra Gasindo. *Jurnal Manajemen sistem Informasi (JURMINSI)*, *1*(2), 61-65. https://doi.org/10.51920/jurminsi.v1i2.142

Putri, O., & Sugiarti, T. (2021). Perkembangan dan Faktor yang Mempengaruhi Permintaan Volume Impor Garam Industri di Indonesia. *Jurnal Ekonomi Pertanian Dan Agribisnis*, *5*(3), 748–761. https://doi.org/10.21776/ub.jepa.2021.005.03.13

p-ISSN 2622-2027
e-ISSN 2622-2035

Sari, I., Yusda, R. A., & Sapta, A. (2022). Peramalan Prediksi Penjualan Garam Pada CV. Saltindo Megajaya Dengan Metode Least Square. *Jurnal Teknik Informatika dan Sistem Informasi (JATISI)*, *9*(4), 3607–3618. https://doi.org/10.35957/jatisi.v9i4.2805

Tamtama, N. N., & Riantisari, R. (2024). Analisis Peramalan Permintaan Melalui Metode Moving Average, Weighted Moving Average dan Exponential Smoothing (Studi Kasus Pada Exist Auto Detailing). *Primanomics: Jurnal Ekonomi & Bisnis*, *22*(1), 109–120. https://doi.org/10.31253/pe.v22i1.2685

William, S., Samosir, B., Sarkis, I. M., Simanullang, H. G., & Artikel, H. (2022). Peramalan Penggunaan Obat Di Puskesmas Hatonduhan Dengan Metode Trend Projection, *METHOTIKA : Jurnal Ilmiah Teknik Informatika*, 2(2), 11-17. http://ojs.fikom-methodist.net/index.php/METHOTIKA