Implementation of Trend Moment Method in Egg Forecasting System in Sukamulia Farm

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ABSTRACT.
The needs of the egg become a problem at certain times. Sukamulia Farm is one of farms that produces an egg in South Sumatra. By implementing Trend Moment Method in forecasting system, Sukamulia farm can predict how many of egg that is needed by the customer in a certain time. The trend moment method that used in this research is based on historical demand. As a result, this forecasting method can produce a recommendation quantity of purchase in fulfillment the need of broiler-egg by involving seasonal index. This study use Mean Square Error to analyze error of forecasting. The result of MSE of this study is 19399,5833

Keywords: trend moment, forecasting, egg

Introduction
Increasing population and public awareness of the importance in consuming high nutritioun food, as well as increasing development in the livestock sector is one of the factors underlying the increasing need for animal protein consumption. In this case, the livestock sector has an important role in providing community needs.
The broiler egg is one of a source of animal protein that is widely consumed by various groups of people because the price is affordable and easy to obtain. Commodity sales of broiler eggs in Indonesia still frequently fluctuate. This fluctuation can occur when breeders make the wrong anticipation, it will cause overproduction and make a supply in the market was declined.
The level of demand for livestock products such as chicken eggs can be influenced by certain factors or seasons or periods. Economic and non-economic factors together influence consumer behavior and purchasing power.
By using the factors that influence the demand for broiler eggs can be used as a reference to predict the needs of broiler eggs in the future and a forecasting system can be built by observing and analyzing patterns of monitoring results from farm historical data to then be processed in order to produce a system forecasting that can predict the future state[5][6][7].

Literature References

Forecasting.
Forecasting is data in the past that is used for the purposes of estimating future data. Thus, forecasting is an estimation of future demand based on a number of forecasting variables, often based on historical time-series data. [1][2] Demand forecasting of a product and services for the future is very important in planning and monitoring products. Operational management use forecasting to make a decision that related to the selection process, capacity planning, facility layout and for sharing decisions that are continuous regarding planning, scheduling, and inventory. Forecasting can be divided into two; qualitative forecasting and quantitative forecasting. Quantitative forecasting methods can be divided into two parts; time series forecasting method, and casual method, while qualitative methods are divided into exploratory and normative methods. Quantitative forecasting techniques are very diverse. Quantitative techniques developed from various disciplines and for various purposes. Each technique will have been chosen has its own characteristics, accuracy, level of difficulty and costs that must be considered.

Pattern of data.
The analysis of forecasting should be based on the existing pattern of data. There are four data patterns that are commonly used in forecasting techniques.[2]

Horizontal Pattern.
The horizontal pattern occurs when data has fluctuation with the average of data. The sample of data that categorized in this pattern is product whose sales have not increased or decreased over a period of time[3]. The structure of data can be described as figure 1

Figure 1. Horizontal Pattern
**Seasonal Pattern.**

The seasonal pattern occurs when data values are influenced by seasonal factors[3]. The structure of data can be described as figure 2.

**Cyclical Pattern.**

The Cyclical pattern occurs when data is affected by long-term economic fluctuations such as those related to business cycles[3]. The structure of data can be described as figure 3.

**Trend Pattern.**

The trend pattern occurs when there is a long-term secular increasing or decreasing of data[1], [4]. The structure of data can be described as figure 4.

**Trend Moment Method.**

In the application of Trend Moment method can be done using historical data from one variable, the formula used in drafting of this method[3]:

\[
Y = a + b \times X 
\]

Where:
- \( Y \) = Trend or variable value to be predicted
- \( a \) = number of constants
- \( b \) = slope or trend line coefficient
- \( X \) = time

To find \( a \) and \( b \) values in the formula above, it is used in a mathematical manner (linier regression) with the completion of the substitution method and method of elimination[3]:

\[
a = \frac{(\Sigma y)(\Sigma x^2) - (\Sigma x)(\Sigma xy)}{n(\Sigma x^2) - (\Sigma x)^2} 
\]

\[
b = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{n(\Sigma x^2) - (\Sigma x)^2} 
\]

Where:
- \( \Sigma y \) = Sum of the sales data
- \( \Sigma x \) = Sum of time periods
- \( \Sigma xy \) = sum of sales data times by time period
- \( N \) = amount of data

Once the forecast has been obtained from forecasting with the Trend Moment method, it will be corrected against seasonal influences using the season index. Calculation of the season index [2]:

\[
\text{Seasonal index} = \frac{\text{Period Average}}{\text{Overall Average}} 
\]

To get the result of the final prediction after being influenced by the season index, it will use the following calculations [2]:

\[
Y^* = \text{Seasonal Index} \times Y 
\]

Where:
- \( Y^* \) = result of forecast by using Trend Moment method which has been influenced by the season index.
- \( Y \) = result of forecast by using Trend Moment.

After that, identify the smallest mistake used in this Trend Moment method using MSE (Mean Square Error), the formula among others [2]:

\[
MSE = \frac{\sum e^2}{n} 
\]

Where the value of \( E \) is the difference between the \( Y \) value and the forecasting \( (Y^*) \). Models that have the smallest MSE are the most well-modeled equations.

**Summary**

Forecasting calculations with the trend moment method start with data demand of eggs in Sukamulia farm that show in Table 1.
From Table 3 above, to get final result of forecasting that influenced by seasonal indexed, the next step this study using formula (4) to get seasonal index. Table 4 shows result of seasonal index of each next 12 months.

| Month       | 2017 | 2018 | Average | Seasonal Index |
|-------------|------|------|---------|----------------|
| January     | 520  | 600  | 560     | 0.9787         |
| February    | 650  | 580  | 615     | 1.0749         |
| March       | 540  | 650  | 595     | 1.0399         |
| April       | 810  | 1240 | 1025    | 1.7914         |
| May         | 600  | 550  | 575     | 1.0050         |
| June        | 500  | 422  | 463     | 0.8057         |
| July        | 650  | 320  | 485     | 0.8477         |
| August      | 620  | 420  | 520     | 0.9088         |
| September   | 320  | 570  | 445     | 0.7777         |
| October     | 420  | 500  | 460     | 0.8046         |
| November    | 500  | 600  | 550     | 0.9613         |
| December    | 550  | 600  | 575     | 1.0500         |
| Overall Average | 572,167 |

From table 2, the prediction of next 12 months demand shows in table 3 below. Based on table 3, it shows MAPE (Mean Absolute Percent Error) is 20%, Bias (Mean Error) is 0, and MSE (Mean Squared Error) is 30770.06
Table 5. Forecasting calculation Results

| Series     | X   | Y = a + b.X | Seasonal Index | Prediction | e (Y - prediction) | e²   |
|------------|-----|-------------|----------------|------------|---------------------|------|
| January 2019 | 24  | 549         | 0.9787         | 537        | 12                  | 144  |
| February 2019 | 25  | 547         | 1.0749         | 588        | -41                 | 1681 |
| March 2019   | 26  | 545         | 1.0399         | 566        | -22                 | 484  |
| April 2019   | 27  | 543         | 1.7914         | 972        | -430                | 184.900 |
| May 2019     | 28  | 541         | 1.0050         | 544        | -3                  | 9    |
| June 2019    | 29  | 539         | 0.8057         | 434        | 105                 | 11.025 |
| July 2019    | 30  | 537         | 0.8477         | 455        | 82                  | 6.724 |
| August 2019  | 31  | 535         | 0.9088         | 486        | 49                  | 2.401 |
| September 2019 | 32  | 533         | 0.7777         | 415        | 119                 | 14.161 |
| October 2019 | 33  | 532         | 0.8040         | 427        | 104                 | 10.816 |
| November 2019 | 34  | 530         | 0.9613         | 509        | 20                  | 441  |
| December 2019 | 35  | 528         | 1.0050         | 530        | -3                  | 9    |

From Table 5, there is error (e) with positive and negative forecast error. To avoid those problem, this study use MSE (Mean Squared Error) that shows below:

\[
\text{MSE} = \frac{1}{n} \sum e^2
\]

MSE = 232.795 / 12
MSE = 19.399,5833

**SUMMARY**

The main objective of the implementing forecasting method is to help Sukamulia farms to increase the productivity of poultry products especially for broiler egg. As the result, from historical data (24 months), it can predict next 12 months by using linear regression forecasting method. This study use seasonal index to predict more accurate. Because, the demands of broiler egg depend on seasonal, such as holiday, feast day, and event. To analyze the error of forecasting data, this study use Mean Square Error (MSE). The result of MSE Forecasting Egg demands in Sukamulia Farm is 19.399,5833

**REFERENCES**

[1] U. Gunter and I. Önder, “Forecasting international city tourism demand for Paris: Accuracy of uni- and multivariate models employing monthly data,” *Tour. Manag.*, vol. 46, pp. 123–135, 2015.

[2] A. Saayman and I. Botha, “Non-linear models for tourism demand forecasting,” *Tour. Econ.*, vol. 23, no. 3, pp. 594–613, 2017.

[3] D. R. Anderson, D. J. Sweeney, T. A. Williams, J. D. Camm, and R. K. Martin, *An Introduction to Management Science: Quantitative Approaches to Decision Making*, 13th ed. South-Western College Publishing, 2011.

[4] S. Shen, G. Li, and H. Song, “Effect of seasonality treatment on the forecasting performance of tourism demand models,” *Tour. Econ.*, vol. 15, no. 4, pp. 693–708, 2009.

[5] Putra P, Firdaus MA, Farhan M. Penerapan Teknologi Virtual Reality Photography Pada Sistem Informasi Objek Wisata. Computer Engineering, Science and System Journal. 2019 Jan 31;4(1):70-3.

[6] Ermatita E, Zalika I, Putra P. Penentuan Prioritas Pengembangan Industri Kecil dan Menengah di kota Palembang Metode Weighted Product (WP)(studi kasus: Dinas Perindustrian, Perdagangan dan Koperasi Kota Palembang. SEINASI-KESI. 2019 Nov 27;2(1):15-23.

[7] Winiarni R, Putra P. Perancangan Pengamanan Sistem Informasi Electronic Medical Record (Emr) Dengan Metode Sha-512 Studi Kasus Pada Klinik Jb Palembang. In Annual Research Seminar (ARS) 2017 Feb 5 (Vol. 2, No. 1, pp. 212-215).