

# Jurnal 5 Natalia

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## Prediction Of Tiger Shrimp Supply Using Time Series Anlysis Method Case Study CV.Surya Perdana Benur

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### ABSTRACT

Prediction of demand for tiger shrimp buyers using data from the company CV. Surya Perdana Benur. The process is carried out with the models in the *Autoregressive Integrated Moving Average* method. Tiger shrimp is a marine animal that is now widely cultivated by big company in Indonesia. Tiger shrimp has important economic value, so its existence must be maintained as part of Indonesian germplasm. The problem now faced by many tiger shrimp companies is the inadequate availability of goods for consumers. This time series data method is useful for predicting the availability of goods for consumers who want to buy goods at the company CV. Surya Perdana Benur. This time series data method is useful for predicting the availability of goods for consumers who want to buy goods at the company CV. Surya Perdana Benur. *Autoregressive (AR)*, *MovingAverage (MA)*, and *Autoregressive Integrated Moving Average (ARIMA)* model and will be evaluated through *Mean Absolute Percent Error (MAPE)*. The initial process that will be carried out after the data is processed is model identification, estimation of model parameters, residual inspection, using forecasting models if the model has been fulfilled will be evaluated using MAPE until the results come out 14875.593875 to be able to predict the next buyer demand.

#### Keyword :

ARIMA, AR, MA, Tiger Shrimp , ACF, PACF

### 1. Introduction

Prediction is the process of estimating the value or event that will occur in the future (Sanjaya, Sugiarto and Gamal 2015). Until now, tiger prawns have become a fishery commodity that has good business opportunities because they are very popular with local consumers and foreign consumers (Amri 2003). Currently in Indonesia there are more vannamei shrimp farming which is easy to produce. Therefore, vannamei shrimp is currently the prima donna of shrimp farming in Indonesia. Tiger prawns have important economic values, so that their existence must be maintained as part of Indonesia's germplasm(Amri 2003). Therefore, in the management of tiger prawns, it must consider the suitability of the location and the conservation of tiger prawn resources, especially the parent parent from nature. Tiger shrimp production has increased from 2010 to 2015 (Mohammad, Sri and Elfitasari 2015). Nowadays tiger prawns need a suitable place to keep production going, such as CV Surya Perdana Benur. CV Surya Perdana Benur company which is located in the tiger shrimp hatchery. Established on June 14, 2004 at Jalan Sosial Dalam, Lamaru, Balikpapan. Has a land area of 4,640. Sometimes the purchase of tiger prawns is unpredictable and tiger prawn entrepreneurs cannot provide tiger prawns when demand increases, because of the difficulty of cultivating tiger prawns. With the data from CV Surya Perdana Benur helping the tiger prawn business in predicting buyer demand by analyzing future demand from the data analysis that has been collected. Prediction is one of the methods used in data mining. Prediction works by predicting everything related to production, supply, demand, and the use of technology in the business field. This time-series analysis method will greatly assist tiger prawn entrepreneurs in predicting buyer demand in the coming cycle. The method used in this prediction process is the *Autoregressive Integrated Moving Average (ARIMA)*. The ARIMA method makes full use of past and present data to produce accurate short-term forecasts (Simanjutak 2015).

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### 2. Research Method

This research was conducted to predict the demand for tiger shrimp buyers in certain cycles. Collecting data in the form of a role about the nature, circumstances, certain activities and the like

(Simanjutak 2015). Before carrying out this prediction process, it is necessary to have data for the prediction stage. The data to be analyzed is data from CV Surya Perdana Benur. The data used for analysis is data for the period 2017-2019. Because there are many problems with the availability of goods that are not sufficient to meet all buyers' requests at certain times, in the end this research will be very useful for companies to find out future buyer demands. Cyclic data patterns occur when the data are influenced by fluctuations. The method used to predict the demand for tiger prawns is the ARIMA method.

## 2.1 ARIMA Forecasting Method (Autoregressive Integrated Moving Average)

ARIMA is a combination of Autoregressive (p) and Moving Average (q) with differencing order (d), mathematically  $(1-B)^d Z_t$  (Kusumaningrum 2012). ARIMA model can be said to be a pattern approach method that predicts the movement of the sales price index through the sales price index movement pattern itself (Murwaningsari 2015). The analysis using the ARIMA method consists of several steps that are used to process past and present data. Then the variables that have been carried out by the modeling process, first begin with a stationary check process in variance and mean then plot ACF and PACF to get an ARIMA model which may then be carried out by the process of parameter estimation and diagnostic check or "white noise" to get the best ARIMA model, which is then used to get the forecast value of each variable (Utomo and Azhari 2017).

## 2.2 ARIMA Implementation

ARIMA model to predict the price of staples is implemented using the arima function in the python programming language to return the ARIMA model with the best specified p, d, and q orders.

## 2.3 Data Stationarity Test

Before stepping into the ARIMA modeling stage, it is mandatory to know in advance about the stationarity of the data. Data must be stationary before modeling. If the process is non-stationary then to make it stationary a difference / transformation must be carried out and then identified (Rahayu 2006). Because the process must be with stationary data.

## 2.4 Differencing Process

The process of data differentiation is needed to make data stationary. This stage is carried out before doing ARIMA modelling.

## 2.5 AR (Auto Regressive) Model

AR will estimate future values based on past values. The first sequence of AR processes is represented as AR (1), meaning that the past values are directly related to the current values. The current value based on the previous two values is the AR (2) process (Sanjaya, Sugiarto and Gamal 2015). AR is a variable regression on itself. A pure Auto Regressive (AR) model is a model where  $Y_t$  depends only on its own lag. That is,  $Y_t$  is a function of 'lag  $Y_t$ '.

$$Y_t = \alpha + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \dots + \beta_p Y_{t-p} + \epsilon_t \quad (1)$$

In general, future values are correlated with several recent values. Thus, to foresee  $y_t$  (h) often not all of the values listed need y to be used (Rasyidi 2017).

## 2.6 MA Model (Moving Average)

The MA (q) model is a model for predicting  $Y_t$  as a function of past prediction errors. Then the MA equation is:

$$Y_t = \alpha + \epsilon_t + \phi_1 \epsilon_{t-1} + \phi_2 \epsilon_{t-2} + \dots + \phi_q \epsilon_{t-q} \quad (2)$$

## 2.7 ARIMA Model

ARIMA has four main steps in building a model, namely Identification, Estimation, Diagnostic & Forecast (Bandyopadhyay 2016). With four steps, the first tentative model parameters are identified through the ACF and PACF graphs then the coefficients are determined and find out the possible models, the next step is to validate the model and finally use simple statistics and confidence intervals to determine the validity of the forecast and the performance of the trajectory model. ARIMA model is chosen when data differentiation process is needed (Mulyati, Fadilah, and Saleh 2019). ARIMA model is denoted as ARIMA (p, d, q). This model is a combination of the ARMA model (p, q) and the differencing process, that is.

$$\beta_p(B)(1 - B)^d Y_t = \phi_0 \phi_q(B) e_t \quad (3)$$

### 2.8 Autocorrelation (ACF)

The model ACF have =  $\text{corr}(X_t, X_{t+k})$  related to each other (Bandyopadhyay 2016). Here  $X_t$  is the current data and  $X_{t+k}$  is the observation period to (k).

### 2.9 Partial Autocorrelation (PACF)

Yet another important characteristic is partially correlated autocorrelation function (PACF)  $X_{t+k}$  dengan  $X_t$ . PACF defined for positive lag only, its value also lies between -1 and +1. Both characteristics, ACF & PACF are equally important, but ACF is relatively easier to compute than PACF (Bandyopadhyay 2016).

### 2.10 Evaluation

To test whether the results are good for forecasting, several evaluations are used to test the data. MAPE and RMSE are data evaluation calculations to determine whether the ARIMA model is good or not.

## 3. Result and Discussion

### 3.1 Time Series Data Forecasting uses the Autoregressive Integrated Moving Average (ARIMA) Method

The data to be used comes from CV Surya Perdana Benur for the application of the ARIMA method, the period to be used is from 2017 - 2019. The first step that will be taken is to identify the model first by analyzing whether the data is stationary or not. The way to find out is by looking at the ACF (An autocorrelation) and PACF (A partial autocorrelation) data plot from the original data.

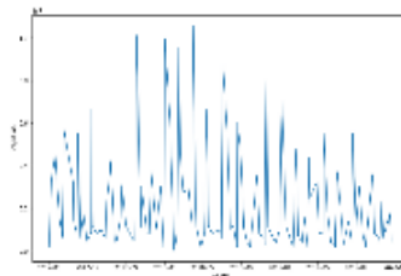


Figure 1. Tiger Shrimp Sales Data

Data cannot be said to be stationary. Then the differencing process must be carried out to make the data stationary. Stationary data is needed to minimize errors in the data model.

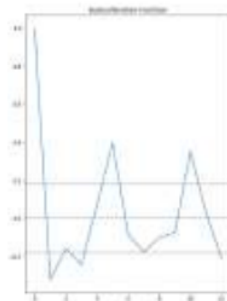


Figure 2. ACF Graphic

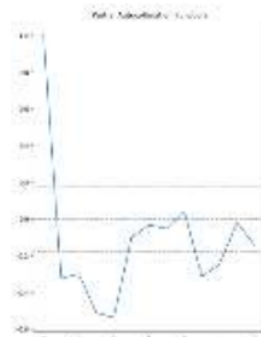


Figure 3. PACF Graphic

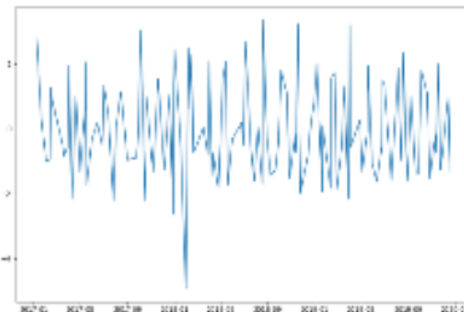


Figure 4. Differencing Data Plot

Figure 4 is a plot of tiger shrimp sales data after the first differencing data and seasonal lag 12. From this plot, it can be seen that the data has been stationary in mean and variance after the first differencing and seasonal lag 12 because the data fluctuates horizontally along the time axis and the mean value of  $d = 1$ ,  $D = 12$ . After the first differencing and the seasonal lag 12, the next step is estimating the model parameters by using trial and error, namely testing several different values. Estimation of parameters can be done by looking at the ACF and PACF data charts after the first differencing and seasonal lag 12 (Ukhra 2014). After see the sales data, it has gone through a differencing process and the data has become stationary.

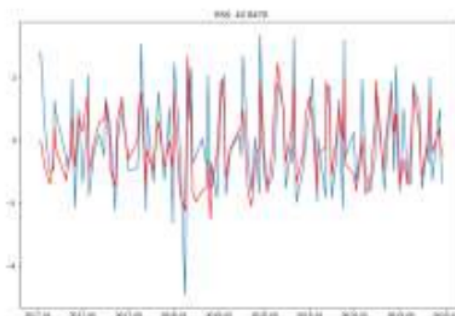


Figure 5. AR Process Data Plot

Figure 5 shows the data that has been processed with the ARIMA model.

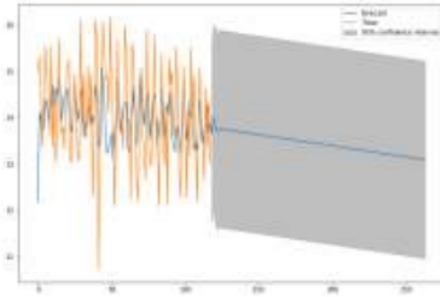


Figure 6. AR Model Prediction Plot

Figure 6 is a graphic result that has been processed using the ARIMA method.

Table 1. ARIMA Model RSS Results

Model	RSS
AR (2,1,0) <sup>12</sup>	3.5577
MA (0,1,2) <sup>12</sup>	40.5237
ARIMA(2,1,2) <sup>12</sup>	42.8470

It has been determined that the AR, MA, ARIMA models show the results as in table 1. Then the AR model is determined which has the smallest value, which means it has a good enough value to start the next process. Followed by the evaluation process using Mean Absolute Percent Error (MAPE) and Root Mean Square Error (RMSE).

Table 2. MAPE and RMSE Model AR Evaluation

Evaluasi	Hasil
MAPE	14875.593875
RMSE	871422.870428

Table 2 shows the evaluation results of the Mean Absolute Percent Error (MAPE) and Root Mean Square Error (RMSE) to determine whether or not a prediction is good. In the end, the smallest error value is MAPE 14875.593875.

**4. Conclusions**

this research results obtained in predicting buyer demand using the ARIMA (Autoregressive Integrated Moving) method can be processed with 3 previous models, namely AR, MA and ARIMA. Selected the best AR model to get results, namely 14975.593875 with MAPE evaluation. Here we can find out the prediction of buyer demand.

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