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Forecasting the Number of Poor People in West Nusa Tenggara in 2025-2029: Time Series Analysis with ARIMA Model

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Abstract: This study aims to predict the number of poor people in West Nusa Tenggara (NTB) Province in the period 2025-2029 using the ARIMA (Autoregressive Integrated Moving Average) model. A quantitative-experimental approach is applied by utilizing data on the number of poor people from 2015 to 2024 obtained from the Central Statistics Agency (BPS). The ARIMA (1,1,1) model is used to forecast future poverty trends. The forecasting results show a significant decrease in the number of poor people, with an estimated number of poor people of 680,937 thousand in 2025 and 609,465 thousand in 2029. The model shows high accuracy, as evidenced by the Mean Squared Error (MSE) value of 21.0527 and the Mean Absolute Percentage Error (MAPE) of 0.53%. These findings provide valuable insights in the formulation of poverty alleviation policies, particularly in relation to more targeted budget allocations. These forecasting results can also be used to strengthen and expand poverty alleviation programs, with an emphasis on areas that still face high poverty rates in NTB.

Keywords: Poverty Forecasting, ARIMA Model, Poor Population

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A. INTRODUCTION

Forecasting the number of poor people has a very important role in assessing the economic dynamics and social welfare in a region, including in West Nusa Tenggara (NTB) (Hauzan et al., 2021). The high level of poverty has a direct effect on the quality of life of the community and hinders socio-economic progress (El Keshky et al., 2020). Therefore, in order to design effective policies for poverty alleviation, it is crucial for the government and related parties to have a tool that can predict the poverty rate with a high degree of accuracy (Gawusu et al., 2024). In this case, time series forecasting models such as ARIMA (Autoregressive Integrated Moving Average) are one of the efficient approaches in estimating changes in poverty rates based on historical data, so as to provide an appropriate basis for public policy making (Ivanda & Szs, 2025).

Various time series forecasting methods, such as linear regression, exponential models, and ARIMA, can be applied to predict the poverty rate (Adeyinka & Muhajarine, 2020). Linear regression is effective for identifying linear relationships between variables, but is less able to cope with non-linear patterns and complex temporal dependencies (Insani et al., 2025). Meanwhile, the exponential model is suitable for data that shows a trend, but is less flexible in handling unstable variations (Nugrahani & Risfandy, 2022). In contrast, the ARIMA (Autoregressive Integrated Moving Average) model is superior in handling non-stationary time series data and is able to capture temporal dependence well, using autoregressive,

integration, and moving average components. Therefore, ARIMA is considered more appropriate for poverty forecasting, given its ability to handle more complex and dynamic data.

Several previous studies show that ARIMA models have been widely applied in predicting poverty rates in various regions (Kusumawardana & Hidayati, 2022) reported that ARIMA was able to predict the poverty rate in West Java quite accurately, with an error rate (MAPE) of 8% in the prediction period 2022-2025. In addition, research by (Azzahra et al., 2025) also shows good performance, where the ARIMA model produces a MAPE value of 3.543% in forecasting poverty reduction in Yogyakarta. Nonetheless, the findings from (Prianda & Widodo, 2021) revealed that under certain conditions, other models such as neural networks have better accuracy than ARIMA in predicting the poverty ratio. Therefore, the selection of forecasting methods should be adjusted to the characteristics and patterns of the data being analyzed.

The ARIMA model is often combined with other methods to improve the accuracy of forecasting the poverty rate. One example is shown in research conducted by (Syaharuddin et al., 2021), who studied the application of the SARIMA (Seasonal Autoregressive Integrated Moving Average) model and managed to obtain an R-squared value of 98% in predicting the poverty rate in West Java Province. These results show that an approach that considers the seasonal component is able to provide more precise predictions, especially in areas where poverty patterns are influenced by seasonal fluctuations. Nevertheless, the application of the ARIMA model and its variants is still limited in a number of provinces in Indonesia, including in West Nusa Tenggara (NTB). This condition shows the need for further studies to analyze poverty dynamics more comprehensively. In addition, future research development is expected to integrate more socioeconomic variables to improve the accuracy of forecasting results.

This study aims to fill the gap of previous studies by focusing the analysis on forecasting the number of poor people in West Nusa Tenggara (NTB) Province for the period 2025-2029 through the application of the ARIMA model. Although the ARIMA model has been widely used in related research in various provinces, this study is expected to contribute in producing predictions that are more in line with the specific socioeconomic conditions in the NTB region. In general, this study aims to produce accurate forecasts of poverty trends in NTB, so that they can be used as a foundation in the formulation of poverty alleviation policies as well as more effective and sustainable regional development planning.

B. METHOD

This research applies a quantitative-experimental approach with the aim of forecasting the number of poor people in West Nusa Tenggara (NTB) Province in the period 2025-2029 through the application of the ARIMA (Autoregressive Integrated Moving Average) model. This approach was chosen because it is able to analyze numerical data structured in the form of time series, so that it can produce more accurate predictions. The general formula of ARIMA is as follows:

$$\Phi_p(B)(1-B)^d Y_t = \Theta_q(B)_{\epsilon_t} \qquad (1)$$

Description:

- Y_t = data value at time t (time series data)
- $\Phi_p(B) = 1 - \phi_1 B - \phi_2 B^2 - \cdots - \phi_p B^p$ → polynomial autoregressive (AR) ordo p
- $(1-B)^d$ → differencing operator to make the data stationary, where d is the degree of differencing.
- $\Theta_q(B) = 1 + \theta_1 B + \theta_2 B^2 + \cdots + \theta_q B^q$ → polynomial moving average (MA) ordo q
- ϵ_t = error or residual at time t
- B = lag operator, meaning $B\mathrm{Y}_t = \mathrm{Y}_{t-1}$

This study aims to identify historical patterns in poverty data from 2015 to 2024 and project future poverty trends by utilizing ARIMA statistical models that have proven effective. In order for the developed model to produce valid and reliable predictions, complete and verified data are required. The source of data in this study comes from secondary data obtained from the Central Bureau of Statistics (BPS) of West Nusa Tenggara Province and the Central BPS, especially those related to the number of poor people in NTB in annual format. The inclusion criteria used in this study are data that has been verified and consistent throughout the observation period. In contrast, the exclusion criteria included incomplete data, data that were only partial estimates, and data that had undergone revisions without a clear explanation of the methodology used. The initial stage of this research begins with the collection and processing of annual poverty data that will be used in the construction of the ARIMA model.

This research starts by collecting annual poverty data from 2015 to 2024, which will then be tabulated to ensure its completeness and consistency. Once the data is ready, a forecasting model using the ARIMA algorithm will be built to predict the number of poor people in the period 2025-2029. The prediction results will be tested for accuracy using the MSE (Mean Squared Error) and MAPE (Mean Absolute Percentage Error) parameters, which are useful for measuring the extent to which the model is able to predict data that is not yet available. The forecasting results will later be used to provide more appropriate policy recommendations in the effort to alleviate poverty in West Nusa Tenggara Province. The complete procedure is in Figure 1.

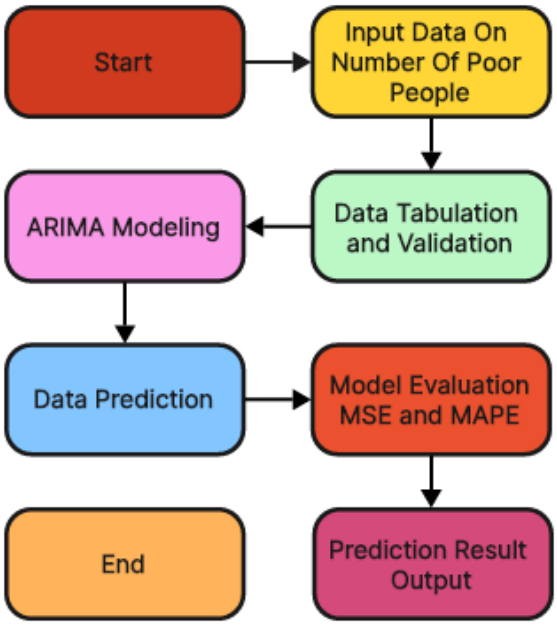

Figure 1. Computing System Design Procedure

C. RESULTS AND DISCUSSION

1. Data Description

Based on the descriptive statistics of the number of poor people in West Nusa Tenggara (NTB) Province for the period 2015 to 2024, there are relatively moderate fluctuations with an average number of poor people of around 754.83 thousand people. The minimum value recorded was 709.01 thousand people, while the maximum value reached 823.89 thousand people. This shows that there is a variation in the number of poor people each year, although the difference between the highest and lowest values is not so significant. The standard deviation of 39.14 indicates that the data is spread with a fair degree of variation, but does not show an extreme spread. To identify whether there is a particular trend, either increasing or decreasing, a more in-depth analysis of the annual data sequence is needed. In general, this data illustrates stability with moderate fluctuations in the number of poor people in NTB throughout the 2015-2024 period. The following descriptive statistics can be seen in Table 1.

Table 1. Descriptive Data

Data Descriptive Statistics	Value
N (Number of Years)	10
Minimum	709.01
Maximum	823.89
Average (Mean)	754.8270
Standard Deviation	39.13729

2. Forecasting Results and Decision Making

The results of forecasting the number of poor people in West Nusa Tenggara (NTB) Province for the period 2025 to 2029 obtained through the application of the ARIMA model provide an estimate of the number of poor people in each year. The data can be used as a basis for policy formulation for poverty alleviation in the future, which is presented in Table 2.

Table 2. Forecasting Results of the Number of Poor People in NTB in 2025-2029

Year	Forecasting the Number of Poor People (Thousand)
2025	680.938
2026	657.715
2027	638.504
2028	622.612
2029	609.465

The following graph illustrates the results of forecasting the number of poor people in West Nusa Tenggara (NTB) Province for the period 2025 to 2029, which includes actual data as well as projections using the ARIMA model. This graph illustrates the trend in the number of poor people as well as the projection for the next five years.

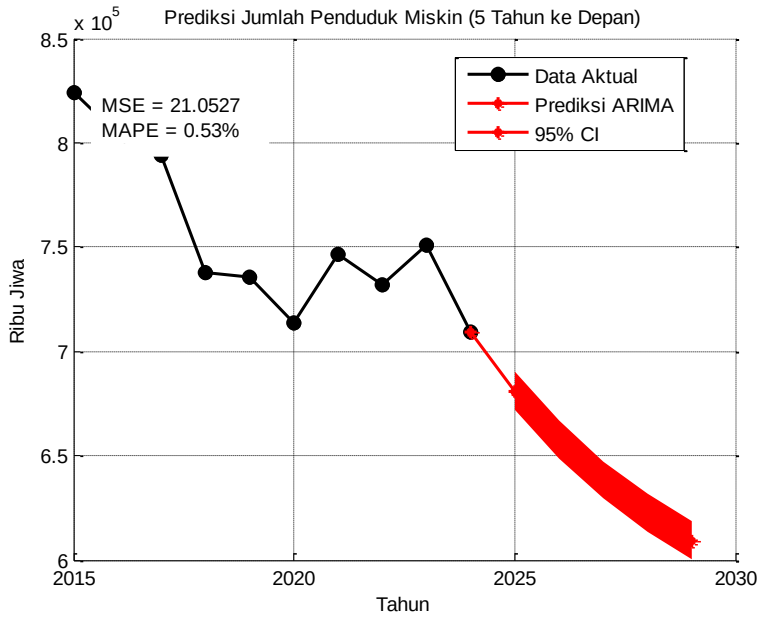

Figure 2. Actual and Predicted Data Approach

The results of forecasting with the ARIMA (1,1,1) model for the period 2025-2029 show a significant downward trend in the number of poor people in West Nusa Tenggara (NTB) Province each year. In 2025, the predicted number of poor people is estimated to reach 680,937 thousand people, and this figure is projected to decline further to reach 609,465 thousand people in 2029. This downward trend indicates the relative success of various poverty alleviation programs implemented by the government and related agencies. The ARIMA (1,1,1) model applied in this study can be expressed with the following mathematical equation:

$$(1 - 0.8272B)(1 - B)Y_t = (1 + 7.7463B)\varepsilon_t \qquad (2)$$

This model shows good prediction performance with a Mean Squared Error (MSE) value of 21.0527 and a Mean Absolute Percentage Error (MAPE) of 0.53%. The low MSE value indicates that the average squared prediction error is relatively small. Meanwhile, the very low MAPE underlines that the difference between the forecasting value and the actual data is almost insignificant, thus confirming the high level of accuracy of the model. The results of this forecast indicate that the policy that needs to be implemented is to strengthen and expand existing poverty alleviation programs, with the main focus on regions that still show high poverty rates. The forecast also provides insight for the government in designing a more targeted budget allocation, by prioritizing regions that need more intensive handling. Although there is a downward trend in the number of poor people, it is important to continue monitoring regularly so that the policies taken remain relevant to the conditions on the ground. Therefore, these forecasting results provide a strong foundation for more effective decision-making in formulating poverty alleviation policies in NTB in the long term.

D. CONCLUSIONS AND SUGGESTIONS

Based on the application of the ARIMA (1,1,1) model, the results of the projection of the number of poor people in West Nusa Tenggara (NTB) Province for the period 2025 to 2029 show a continuous decline, with the predicted number of poor people reaching 680,937 thousand in 2025, and is estimated to decrease to 609,465 thousand in 2029. The Mean Squared Error (MSE) value of 21.0527 and Mean Absolute Percentage Error (MAPE) of 0.53% indicate a very good level of accuracy in this forecasting model. These projections provide a deeper understanding of poverty trends in NTB for the next five years and can be a strong basis for designing poverty alleviation policies that are more targeted, targeted, and sustainable. Compared to the research conducted by (Mizan et al., 2019) which recorded an MSE of 1,989,563,779 and a MAPE of 3%.

Although the ARIMA (1,1,1) model is able to project the number of poor people with high accuracy, this study still has limitations because it does not involve external variables that influence poverty dynamics, such as inflation, unemployment rate, public investment, and regional social spending. Therefore, further research is needed that develops a multivariate-based forecasting model by integrating these macroeconomic variables, in order to obtain more comprehensive and accurate results. Topics such as "Development of a Multivariate-based Poverty Forecasting Model with the Integration of Macroeconomic Variables in West Nusa Tenggara Province" are important to research in the future. Alternative model approaches such as ARIMAX, SARIMA, or machine learning-based methods can also be considered to support the formulation of more adaptive and targeted poverty alleviation policies.

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