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Poverty Forecasting Analysis in Bengkulu Province in 2025-2027

Kartika Yuni Hartati Situngkir[1*], Barika[2]
Universitas Bengkulu, Indonesia
Corresponding Author: Kartika Yuni Hartati Situgkir
Kartikasitungkir033@gmail.com

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A B S T R A C T
Poverty remains a major challenge in Bengkulu Province, with a relatively high poverty rate compared to other provinces in Sumatra. This study aims to predict the poverty rate in Bengkulu Province using the Markov Chain approach for the period 2025-2027, based on historical data from 2015-2024 obtained from the Central Statistics Agency (BPS). Through the analysis of transition probabilities between poverty statuses using the Markov Chain approach, this study found that most districts/cities in Bengkulu Province showed a consistent downward trend in poverty, especially in areas such as South Bengkulu and Rejang Lebong. However, several areas, such as Central Bengkulu and Seluma, still experience quite high poverty rates, and are even predicted to increase in the coming years. This indicates that these areas require more attention in poverty alleviation policies. The results of this prediction are expected to be a reference for the government in formulating more effective poverty alleviation policies, with a focus on increasing access to education, health, and job creation. Thus, this study provides an important contribution to more targeted policy planning to reduce poverty levels in Bengkulu Province.

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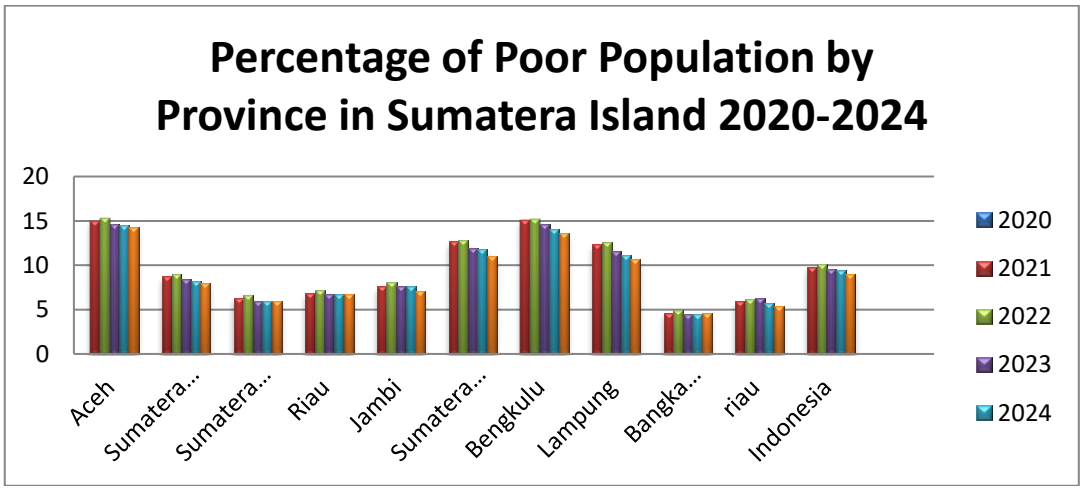
INTRODUCTION

Poverty is a problem that still occurs in several countries, including Indonesia, to this day (Ferezagia, 2018), poverty is an indicator that can determine the level of economic development in a country (Please accept, 2020) poverty has an impact on both urban and rural communities (Suharti, 2022). The increase in poverty rates can be influenced by various factors such as community income levels, unemployment, health, education, access to goods and services, geography and environment (Noeryanti et al, 2019).

Poverty remains a major issue in Indonesia, so government policies and strategies always prioritize its handling (Muryani et al, 2021). According to the Central Statistics Agency (BPS), the number of poor people in Indonesia has reached 26.16 million people or equivalent to 9.54% of the total population of Indonesia.The number of poor people on Sumatra Island as of March 2022 reached 5.737 million people. Of the ten provinces on Sumatra Island, four provinces are included in the category with the highest percentage of poverty rates according to the Central Statistics Agency (2023), namely: Aceh Province (14.45%), Bengkulu Province (14.04%), South Sumatra Province (11.78%), and Lampung Province (11.11%) (Suhendi, 2024).



Source: BPS

Bengkulu Province is a province with a relatively high poverty rate compared to other provinces on the island of Sumatra (The Matondang, 2017). According to the Central Statistics Agency (BPS), the number of poor people in Bengkulu province reached 292.93 thousand people, this number decreased by 14.43% compared to the number of poor people in 2021 which was 291.79 thousand people.

Poverty is not a new problem, but it remains a major issue to date. This is reflected in the placement of poverty as the first goal in the SDGs, namely ending poverty in all its forms everywhere. The target is to create a policy framework at the national, regional and international levels that is based on pro-poor and gender-sensitive strategies, in order to encourage investment in poverty alleviation efforts (Mutmainnah & Paddu, 2022).

Efforts to reduce poverty require forecasting to predict the number of poor people in the coming year so that it can be known how much the number of poor people will decrease or increase so that the government can take a strategy in determining the right policies in economic development (Bappenas, 2004). This will help the government in preparing a plan to determine the right policy in overcoming poverty (Please accept,2020).

One of the techniques to predict the number of poverty in the future is by using Macrov chain analysis (Masuku et al, 2018). Macrov chain is a mathematical technique that can be used to estimate changes for the future in dynamic variables based on changes in variables in the past. This technique can also be used to analyze future events mathematically (Syafruddin et a, 2014l).

Previous research by Malau (2023) predicted poverty in districts and cities in Medan using this method. Similar research was also conducted by Silalahi (2020), who estimated the poverty rate using ARIMA modeling. However, there has been no previous research discussing poverty prediction in Bengkulu Province using macro chain analysis.

From the background above, the formulation of the problem in this study is how the results of poverty predictions for districts and cities in Bengkulu province using Markov chain analysis. With the aim of finding out the number of poor people in districts/cities in Bengkulu province in the next few years, with the help of the R data program tool used in this study using secondary data, namely publication data from the Central Statistics Agency (BPS) of Bengkulu province in the period 2013-2022 (9 years).

LITERATURE REVIEW

According to Mubyarto (1998) poverty is a condition where a person or area cannot improve their life to a more decent level or achieve a decent standard of living.

Sumodiningrat (1999) classifies poverty into three categories:

1. Absolute poverty, where income is below the poverty line and unable to meet basic needs.
2. Relative poverty, which occurs when the poverty situation is above the poverty line and is based on the distance between poor and non-poor groups in a community.
3. Structural poverty, which occurs when individuals or groups are reluctant to improve their living conditions until assistance is provided to move them out of those conditions.

Analysis of the factors causing poverty or determinants of poverty was conducted by Ikhsan (1999). Ikhsan grouped these factors into four categories: human capital, physical productive capital, employment status, and village characteristics. Human capital in a household affects the household's ability to obtain employment and income. Indicators that are often used include the number of years of schooling of family members, the education of the head of the family, and the number of family members. In general, the higher the level of education of family members, the greater the likelihood that the family will work in the formal sector with a higher income.

A stochastic process is a sequence of events that follows the laws of probability. A value is said to follow a stochastic process when it changes randomly over time. If future events can be predicted with certainty based on past experience, the sequence is called deterministic. Conversely, if past experience can only provide a probability structure for future events, then the sequence is called stochastic.(Nurman, 2021).

Markov chains were introduced by Andrei A. Markov (1856-1922) and first published in 1906. Markov analysis is a quantitative method used to calculate the probability of a change occurring based on the probability of change over a period of time. This method is used to estimate the probability of future events by analyzing the current probability. One of the main goals of Markov analysis is to predict future events (Render, 2006).

According to (Berkum and Nijenhuis, 2020), the Markov model can be used to assess economic transitions and their impact on poverty status continuously. Through a multi-period approach, they show how changes in economic status can be projected based on historical transition patterns.

(Hamilton, 1994) assumes that the macro chain model:

1. Markov Property: State changes depend only on the current state.
2. Homogeneity: Transition probability is constant over time.
3. Finite State: A limited status, such as "poor" or "not poor."
4. Positive Transition Probability: Value between 0 and 1 and amounts to one per state.
5. Absorbing Condition: Certain conditions are permanent.
6. No Direct External Influence: The transition is not influenced by external factors.

If a Markov chain {Xt,t=0, 1, 2, ...} has a state space of {0, 1, ...M}, then the probability of the system being in state$i$after being in the state$j$in previous observations it was symbolized by P (Howard and Rorres, 2004).

$$Kt(j) = Kt(j\text{-}1)P \tag{1}$$

Where :

$Kt(j)$ = probability of an event at a time$tt(j)$

P = Transition probability

t(j-1) = Time to$(j\text{-}1)$

t(j) = Time j

A matrix is a set of numbers arranged in a square array bounded by square brackets or regular brackets. The numbers in a matrix are called matrix elements, where the horizontal arrangement of numbers is called rows and the vertical arrangement of numbers is called columns. The size of a matrix is expressed in rows times columns, namely (mxn), in general a matrix can be written in the following form (Gella, 2020).

$$\begin{bmatrix} \alpha_{11} & \alpha_{12} & \dots & \alpha_{1n} \\ \alpha_{21} & \alpha_{22} & \dots & \alpha_{2n} \\ \dots & \dots & \dots & \dots \\ \alpha_{m1} & \alpha_{m2} & \dots & \alpha_{mn} \end{bmatrix} \tag{2}$$

The types of matrices are square matrices, diagonal matrices, triangular matrices, scalar matrices, symmetric matrices, row matrices, pool matrices, zero matrices and identity matrices (Nurman, 2021). Addition and subtraction of matrices

$$Cij = \alpha ij \pm bij \quad (3)$$

Matrix multiplication

$$\sum_{k=1}^{m} \alpha ij.\, bkj \quad (4)$$

Previous research by (Malaul,2023) predicts poverty using Markov chain analysis with the results of the percentage of poverty in several districts as follows: Simalungun Regency is 20.71%, Samosir Regency is 20.77%, Karo Regency is 21.01%, Nias Regency is 19.06%, and Dairi Regency is 18.36%. The results of the study (Ningsi, 2023) estimates that poverty rates in several regions for 2022-2025 show variations. In Pandeglang Regency, poverty is estimated to increase by 2% in 2022, 0.46% in 2023, and 0.02% in 2024-2025. Lebak Regency increased by 2% in 2022, decreased by 0.66% in 2023, and 0.01% in 2024-2025. Tangerang Regency decreased by 4% in 2022, increased by 0.99% in 2023, and decreased by 0.01% in 2024-2025. Serang Regency increased by 1% in 2022, and decreased by 0.83% in 2023-2025.

METHODOLOGY

Data Analysis

The data used in this study is secondary data obtained through the official website of the Central Statistics Agency (BPS). The datat is the percentage of poor people in Bengkulu province according to district and city with a time span of 2015-2024(Bengkulu, 2024).

Markov Chain

The steps of the Markov chain to calculate future probabilities are as follows:

The first stage in this study is collecting data, where the research data uses the publication of the Bengkulu Central Statistics Agency. The data consists of the percentage of poor people in districts/cities in Bengkulu Province in 2015-2024. In data collection, a preprocessing stage is carried out to adjust the data to the research process.

The second stage is to calculate the transition probability.donethrough calculating the probability of transition from one change in the percentage of poor people to the next changethroughhistorical data. Probabilitytransitionpij(n) is the conditional probability that state i will change to state j after undergoing a transition.(Masuku et al., 2018).

$$Pij(n) = Xn = j|X0 = I, I, j \in [0,1,2, \dots] \quad (5)$$

Transition probability can be calculated using the following formula:

$$P_{ij} \frac{n_{ij(t)})}{n_{i(t)}} \quad (6)$$

Where:

Pij = transition opportunity
Nij(t) = value from state i to j in period t
Ni(t) = value of state i in period t

The third stage is to build a Markov model by determining the transition matrix based on the transition probability that has been calculated previously. The Markovian process uses the transition probability Pij. The condition change model in the preparation of the transition probability matrix is symbolized by P(Nawawi & Evangs Mailoa, 2024).

$$P = \begin{bmatrix} \alpha_{11} & \alpha_{12} & \dots & \alpha_{1n} \\ \alpha_{21} & \alpha_{22} & \dots & \alpha_{2n} \\ \dots & \dots & \dots & \dots \\ \alpha_{m1} & \alpha_{m2} & \dots & \alpha_{mn} \end{bmatrix} \quad (7)$$

The fourth stage is to predict the percentage of poor people bymultiplytransition matrix and initial conditions to obtain predicted results for the percentage of poor people in Bengkulu province in the upcoming time period.comesystematically.

$$K_{t(j)} = Px\ K_{t(j-1)} \quad (8)$$

Where :

$K_{t(j)}$ = Probability of an event occurring at $t(j)$
P = Transitional Probability
$T(j)$ = Time to$-j$

RESEARCH RESULT AND DISCUSSION

The percentage of poor people in Bengkulu Province from 2015 to 2024 provides an important basis for forecasting future poverty levels. The consistent downward trend in several districts such as South Bengkulu and Rejang Lebong, indicates the potential for further poverty reduction if driving factors such as infrastructure development, social assistance, and economic growth are sustained. However, the forecast also indicates that areas with high poverty, such as Kaur and Seluma may require more specific intervention strategies to drive faster declines.

Through the use of forecasting models based on historical trends and economic data, governments and policymakers can predict areas that will experience a downturn and areas that require attention due to future spikes.

Determining the Markov Chain. From the percentage data of poor people in districts/cities in Bengkulu Province in 2015-2024 using the transition probability equation and transition probability matrix as follows:

DeterminePrediction The percentage of poor people is presented in table 2. Which shows the percentage of poor people over the last 10 years. It can be seen that the percentage of poor people has fluctuated and decreased.

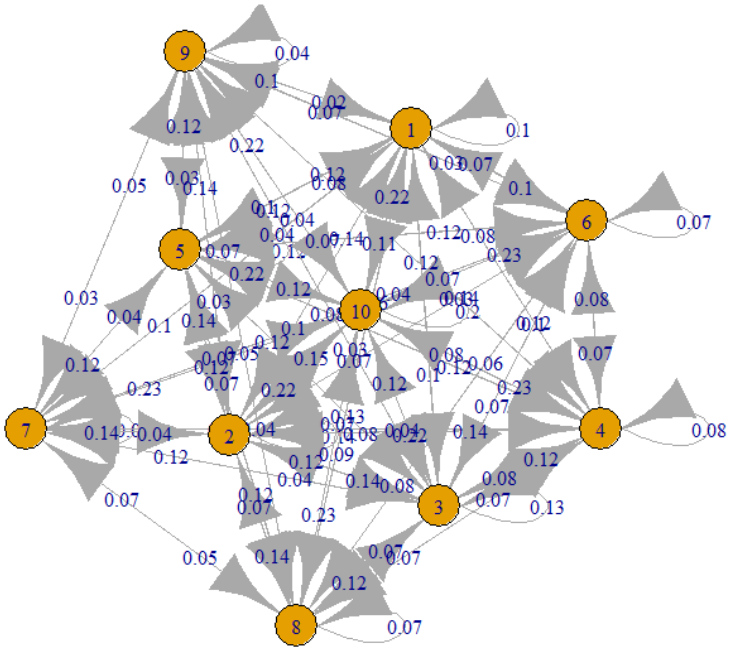
Table 2. Transition opportunities Percentage of poor population in Bengkulu Province 2015-2024

Year	Percentage of poor population in Bengkulu Province Regency/City (Percent)									
	BS	**RL**	**BU**	**KA**	**S**	**MM**	**L**	**K**	**BT**	**KB**
2015	0.131	0.103	0.085	0.131	0.132	0.077	0.071	0.097	0.048	0.121
2016	0.131	0.105	0.081	0.132	0.132	0.077	0.072	0.096	0.051	0.122
2017	0.130	0.105	0.081	0.133	0.133	0.075	0.073	0.099	0.052	0.119
2018	0.124	0.108	0.078	0.129	0.129	0.075	0.077	0.096	0.054	0.125
2019	0.124	0.106	0.078	0.126	0.126	0.071	0.078	0.098	0.058	0.121
2020	0.120	0.107	0.079	0.125	0.125	0.071	0.080	0.099	0.063	0.119
2021	0.121	0.106	0.077	0.124	0.124	0.074	0.080	0.099	0.064	0.119
2022	0.123	0.107	0.079	0.124	0.124	0.076	0.082	0.100	0.067	0.108
2023	0.125	0.105	0.080	0.127	0.128	0.073	0.079	0.101	0.067	0.105
2024	0.126	0.108	0.081	0.126	0.127	0.073	0.072	0.095	0.075	0.101

Rstudio 2024

Information :
BS = South Bengkulu
RL = Rejang Lebong
BU = North Bengkulu
KA = Head of District
S = Seluma
MM = Muko Muko
L = Lebong
K = Kepahiang
BT = Central Bengkulu
KB = Bengkulu City

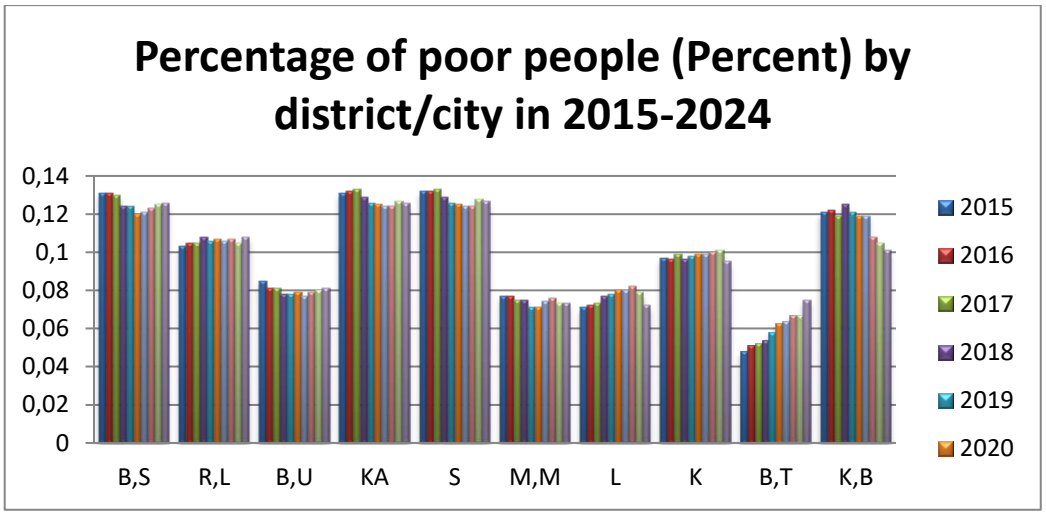
Based on the table above shows the percentage distribution of poor people in the BS table (South Bengkulu Regency) in 2013 with a chance = 0.131 or 13.1%. For the RL Value (Rejang Lebong Regency) in 2013 with a chance = 0.103 or 10.3%. And so on until the KB table (Bengkulu City) the same thing applies, which is obtained from the percentage of poor people in Bengkulu City in 2013 divided by the percentage of poor people$\frac{22,76}{173,49}$ $\frac{18,03}{173,49}$all overin 2013 in Bengkulu province, namely = 0.223.$\frac{21,14}{173,49}$



Transition Opportunity Plot

The transition above illustrates the pattern of changes in poverty levels between districts/cities in Bengkulu Province. Each node in the graph represents a particular region, and the arrows connecting the nodes indicate the direction and probability of poverty level transition from one region to another or back to the same region. The probability values listed along the arrows indicate the magnitude of the probability of poverty change. Thicker arrows indicate a greater probability of transition, while thinner arrows indicate a smaller probability.

Additionally, some nodes have arrows that circle back to themselves, indicating that it is possible that the poverty rate in the area has remained unchanged over time. The size of the node may reflect the magnitude of thepercentage of poor people in the area, with larger nodes indicating areas with a larger poor population. Overall, this graph provides a picture of the complex interactions of poverty across regions in Bengkulu, with significant variation in poverty transition opportunities across regions.



Graph 1. Probability of Percentage of Poor Population (thousands of people) by Regency/City in 2015-2024

CountPrediction of the percentage of poor people is done by transferring the probabilities that have been obtainedwithdata on the percentage of poor population. π (1) Namely in 2024, this is done by multiplyingvectorinitial state π(0) with probability matrix.

π(0) =[1 0 0 0 0 0 0 0 0 0]

To calculate the probability of an outcomeThe percentage of poor people in the second year π(2) is done by diverting from π (1) with the probability matrix and to calculate the probability of the percentage of poor people in the third year π(3) is done by diverting the results from π(2) with the probability matrix. So thatobtainedresults:

a. Prediction of the percentage of poor population in Bengkulu province in 2025 (P0)

π(1) = π(0) x Transition probability matrix

π(0) =[1 0 0 0 0 0 0 0 0 0]

$$\begin{bmatrix} 0.131 & 0.103 & 0.085 & 0.131 & 0.132 & 0.077 & 0.071 & 0.097 & 0.048 & 0.121 \\ 0.131 & 0.105 & 0.081 & 0.132 & 0.132 & 0.077 & 0.072 & 0.096 & 0.051 & 0.122 \\ 0.130 & 0.105 & 0.081 & 0.133 & 1.133 & 0.075 & 0.073 & 0.099 & 0.052 & 0.119 \\ 0.124 & 0.108 & 0.078 & 0.129 & 0.129 & 0.075 & 0.077 & 0.096 & 0.054 & 0.125 \\ 0.124 & 0.106 & 0.078 & 0.126 & 0.126 & 0.071 & 0.078 & 0.098 & 0.058 & 0.121 \\ 0.120 & 0.107 & 0.079 & 0.125 & 0.125 & 0.071 & 0.080 & 0.099 & 0.063 & 0.119 \\ 0.121 & 0.106 & 0.077 & 0.124 & 0.124 & 0.074 & 0.080 & 0.099 & 0.064 & 0.119 \\ 0.123 & 0.107 & 0.079 & 0.124 & 0.124 & 0.076 & 0.082 & 0.100 & 0.067 & 0.108 \\ 0.125 & 0.105 & 0.080 & 0.127 & 0.128 & 0.073 & 0.079 & 0.101 & 0.067 & 0.105 \\ 0.126 & 0.108 & 0.081 & 0.126 & 0.127 & 0.073 & 0.072 & 0.095 & 0.075 & 0.101 \end{bmatrix}$$

π(1)

=[0.131 0.103 0.085 0.131 0.132 0.077 0.071 0.097 0.048 0.121]

Predicting the percentage of poor people in 2025 is calculated by the following method:

P2025

=[0.131 0.103 0.085 0.131 0.132 0.077 0.071 0.097 0.048 0.121]

Pij

$$= \begin{bmatrix} 22.76 & 18.03 & 14.78 & 22.87 & 22.98 & 13.45 & 12.32 & 16.83 & 8.33 & 21.14 \\ 22.1 & 17.81 & 13.67 & 22.36 & 21.68 & 13.01 & 12.26 & 16.31 & 8.71 & 20.72 \\ 21.06 & 16.97 & 13.11 & 21.54 & 20.73 & 12.2 & 11.83 & 15.95 & 8.41 & 19.18 \\ 18.65 & 16.23 & 11.81 & 19.4 & 19.6 & 11.4 & 11.59 & 14.42 & 8.2 & 18.82 \\ 18.54 & 15.95 & 11.65 & 18.89 & 19.1 & 11.7 & 11.77 & 14.74 & 8.8 & 18.09 \\ 17.82 & 15.85 & 11.67 & 18.47 & 18.56 & 11.72 & 11.85 & 14.69 & 9.3 & 17.65 \\ 18.16 & 15.85 & 11.61 & 18.62 & 18.72 & 11.93 & 12 & 14.83 & 9.68 & 17.89 \\ 17.86 & 15.65 & 11.48 & 18.1 & 18.36 & 11.44 & 12.03 & 14.53 & 9.76 & 15.73 \\ 17.51 & 14.79 & 11.29 & 17.83 & 18 & 10.76 & 11.15 & 14.12 & 9.4 & 14.71 \\ 17.1 & 14.65 & 10.96 & 17.12 & 17.23 & 10.76 & 10.45 & 12.9 & 10.14 & 13.76 \end{bmatrix}$$

P2025=

[16.46 14.27 10.59 16.49 16.52 10.48 10.31 13.06 10.21 13.33]

The data aboveshows that in 2025 there will be a decrease in the percentage of poverty, but the Kepahiang and Central Bengkulu regions experienced an increase where it was originally at 12.9% and 10.14% to 13.06% and 10.21%. This data provides an overview of the disparity in poverty in various regions of Bengkulu, where some rural areas tend to have higher poverty rates than urban areas or districts with rapid economic development.

b. Prediction of the percentage of poor population in Bengkulu province in 2026 (P2025)

π(2)= π(1) x Transition probability matrix

π(1)

= [0.131 0.103 0.085 0.131 0.132 0.077 0.071 0.097 0.048 0.121]

π(2)

= [0.126 0.106 0.080 0.128 0.128 0.077 0.077 0.097 0.059 0.117]

Predicting the percentage of poor people in 2026 is calculated by the following method:

P2025 =[0.126 0.106 0.080 0.128 0.128 0.077 0.077 0.097 0.059 0.117]

$$\text{Pij} = \begin{bmatrix} 22.1 & 17.51 & 13.67 & 22.36 & 21.68 & 13.01 & 12.26 & 16.31 & 8.71 & 20.72 \\ 21.06 & 16.97 & 13.11 & 21.54 & 20.73 & 12.2 & 11.83 & 15.95 & 8.41 & 19.18 \\ 18.65 & 16.23 & 11.81 & 19.4 & 19.6 & 11.4 & 11.59 & 14.42 & 8.2 & 18.82 \\ 18.54 & 15.95 & 11.65 & 18.89 & 19.1 & 11.7 & 11.77 & 14.74 & 8.8 & 18.09 \\ 17.82 & 15.85 & 11.67 & 18.47 & 18.56 & 11.72 & 11.85 & 14.69 & 9.3 & 17.65 \\ 18.16 & 15.85 & 11.61 & 18.62 & 18.72 & 11.93 & 12 & 14.83 & 9.68 & 17.89 \\ 17.86 & 15.65 & 11.48 & 18.1 & 18.36 & 11.44 & 12.03 & 14.53 & 9.76 & 15.73 \\ 17.51 & 14.79 & 11.29 & 17.83 & 18 & 10.76 & 11.15 & 14.12 & 9.4 & 14.71 \\ 17.1 & 14.65 & 10.96 & 17.12 & 17.23 & 10.76 & 10.45 & 12.9 & 10.14 & 13.76 \\ 16.46 & 14.27 & 10.59 & 16.49 & 16.52 & 10.48 & 10.31 & 13.06 & 10.21 & 13.33 \end{bmatrix}$$

P2026

=[15.84 13.91 10.22 15.87 15.78 10.22 10.17 12.71 10.41 12.55]

In 2026, it is predicted that there will be a decrease in the percentage of poor people in Bengkulu province, both in cities and districts. However, there is one area that has experienced an increase, namely Central Bengkulu. The percentage of poor people in the region increased slightly from 10.21% to 10.41% in 2026. Overall, the poverty trend in the Bengkulu region shows that the majority of districts have experienced an encouraging decline, reflecting effective efforts

to overcome poverty in the area. However, this variation in trends also indicates that there are challenges in several areas that require special attention.

c. Prediction of the percentage of poor population in Bengkulu province in 2027 (P2026)

π(3) = π(2) x Transition probability matrix

π(2)

= [0.126 0.106 0.080 0.128 0.128 0.077 0.077 0.097 0.059 0.117]

π(3)

= [0.126 0.106 0.080 0.128 0.128 0.077 0.077 0.098 0.059 0.117]

Predicting the percentage of poor people in 2027 is calculated by the following method:

P2026

= [0.126 0.106 0.080 0.128 0.128 0.077 0.077 0.098 0.059 0.117]

$$\text{Pi j}=\begin{bmatrix} 21.06 & 16.97 & 13.11 & 21.54 & 20.73 & 12.2 & 11.83 & 15.95 & 8.41 & 19.18 \\ 18.65 & 16.23 & 11.81 & 19.4 & 19.6 & 11.4 & 11.59 & 14.42 & 8.2 & 18.82 \\ 18.54 & 15.95 & 11.65 & 18.89 & 19.1 & 11.7 & 11.77 & 14.74 & 8.8 & 18.09 \\ 17.82 & 15.85 & 11.67 & 18.47 & 18.56 & 11.72 & 11.85 & 14.69 & 9.3 & 17.65 \\ 18.16 & 15.85 & 11.61 & 18.62 & 18.72 & 11.93 & 12 & 14.83 & 9.68 & 17.89 \\ 17.86 & 15.65 & 11.48 & 18.1 & 18.36 & 11.44 & 12.03 & 14.53 & 9.76 & 15.73 \\ 17.51 & 14.79 & 11.29 & 17.83 & 18 & 10.76 & 11.15 & 14.12 & 9.4 & 14.71 \\ 17.1 & 14.65 & 10.96 & 17.12 & 17.23 & 10.76 & 10.45 & 12.9 & 10.14 & 13.76 \\ 16.46 & 14.27 & 10.59 & 16.49 & 16.52 & 10.48 & 10.31 & 13.06 & 10.21 & 13.33 \\ 15.84 & 13.91 & 10.22 & 15.87 & 15.78 & 10.22 & 10.17 & 12.71 & 10.41 & 12.55 \end{bmatrix}$$

P2027=

[15.23 13.55 9.86 15.24 15.04 9.97 11.63 12.37 10.61 11.77]

The predicted percentage of poor people in Bengkulu province for the next 3 years is presented in the following table:

Table 3. Predicted results of the percentage of poor people in Bengkulu province 2025-2027

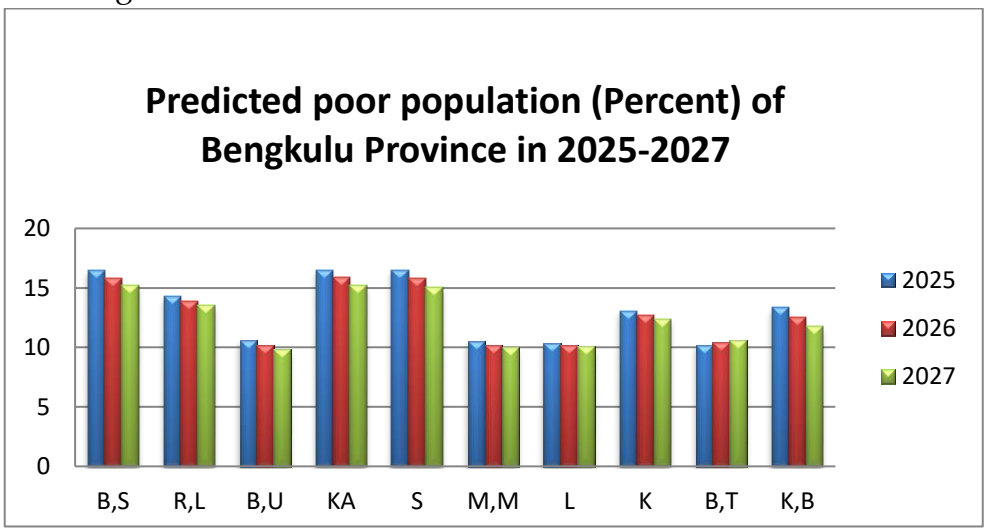
Regency	**Year**		
	2025	**2026**	**2027**
Bengkulu Selatan	16.46	15.84	15.23
Rejang Lebong	14.27	13.91	13.55
Bengkulu Utara	10.59	10.22	9.86
Kaur	16.49	15.87	15.24
Seluma	16.52	15.78	15.03
Muko-muko	10.48	10.22	9.97
Lebong	10.31	10.17	10.04
Kepahiang	13.06	12.71	12.37
Bengkulu Tengah	10.21	10.41	10.61
Kota Bengkulu	13.33	12.55	11.77
Total	**131.72**	**127.68**	**123.67**

Rstudio 2024

The table above shows the results of the predicted percentage of poor people in each district/city in Bengkulu Province for the period 2025 to 2027. Overall, there is a downward trend in poverty in most areas during this prediction period, with the total percentage of poverty decreasing from 131.72% in 2025 to 123.67% in 2027. This decline indicates an improvement in welfare indicators in the Bengkulu region, although there are variations between districts/cities.

Several areas such as South Bengkulu and Rejang Lebong show a consistent decline in poverty every year. This decline is thought to be due to increased investment in the infrastructure and social sectors which contribute to a decline in poverty rates. According to (World Bank, 2021), good infrastructure development can accelerate poor people's access to markets and public services, which has a direct impact on increasing income and welfare. On the other hand, North Bengkulu, Kaur, and Seluma also show a downward trend, although Seluma remains at a high poverty rate. This condition is most likely related to limited access to basic services such as education and health, which according to (Bappenas, 2020) are the main factors in poverty alleviation. Access to education and health can increase people's ability to participate in the economy and improve their standard of living.

In contrast, Central Bengkulu is predicted to experience an increase in poverty in 2026 and 2027, in contrast to other regions that experienced a decline. This increase may be due to high economic inequality and lack of economic diversification in the region. (Maslow, 2021) states that areas with high dependence on a particular sector are vulnerable to economic fluctuations, especially if the sector faces external challenges, such as changes in commodity prices or trade policies. In addition, Bengkulu City, as the provincial center, shows a significant downward trend in poverty. This is due to more stable economic growth in urban areas and better access to job opportunities and public services. Urbanization and concentration of employment in large cities, according to Todaro and Smith (2022), tend to have a positive impact on reducing poverty in the region.



Graph 3. Prediction results of the percentage of poor people in Bengkulu province 2025-2027

In general, the graph shows variations in poverty rates between regions, with some districts/cities having consistently higher poverty rates than others. Despite fluctuations seen in some years, the overall trend shows a downward trend in poverty rates in most regions. This decline may reflect the positive impact of government programs in reducing poverty as well as improving economic conditions in the region. In addition, the graph shows annual fluctuations indicating significant changes in poverty rates in certain years. These fluctuations may be influenced by various factors such as government policies, economic conditions, or other social factors that affect the income of people in each district/city.

Overall, the predicted decline in poverty rates is likely due to development efforts and poverty alleviation policies that have been implemented, such as improving infrastructure, social assistance, and creating jobs in various sectors. Experts such as (Chambers and Conway,.2020) emphasize the importance of an inclusive development approach that involves local community participation to achieve sustainability in poverty alleviation. The implementation of targeted policies, such as increasing access to education, improving health services, and supporting the agricultural sector, is expected to significantly reduce poverty rates in Bengkulu Province.

The results of this prediction provide an overview for the Bengkulu Provincial Government to adjust policies and strategies for poverty alleviation. In particular, more attention needs to be given to areas such as Central Bengkulu which are predicted to experience an increase in poverty. Increasing infrastructure and job opportunities in strategic sectors, such as tourism and agriculture, can be a solution to effectively reduce poverty levels in this region. In addition, continuous monitoring and evaluation of policies are important to ensure optimal and targeted results.

CONCLUSIONS AND RECOMMENDATIONS

Based on the Markov chain analysis conducted in this study, poverty in Bengkulu Province fluctuated but tended to decrease in several districts/cities. The Markov chain method is effective in predicting changes in the percentage of poor people in the future. In 2025 to 2027, most districts/cities in Bengkulu Province, such as South Bengkulu and Kaur which previously had the highest percentage of poor people, are expected to experience a decrease in the percentage of poor people. However, areas such as Central Bengkulu experienced an increase in the percentage of poor people. The percentage of poor people in these areas is still above the average percentage of poor people in Bengkulu province as a whole. This prediction can be an important reference for the government in formulating more targeted poverty alleviation policies.

Based onThe results of this study, it is important for the Bengkulu Provincial Government to pay more attention to areas that show an increase in poverty and areas that are still above the percentage are still above the provincial average, such as Kaur. The government must focus on increasing access to education and health services, as well as creating wider employment opportunities, especially in densely populated urban areas. In addition, poverty

alleviation programs that have been running need to be evaluated and adjusted to be more targeted. Collaboration between the government, the private sector, and the community is essential to create sustainable economic empowerment programs. Periodic monitoring and evaluation of the policies implemented are also important in order to be able to adjust strategies to changes in the socio-economic conditions of the community. Economic diversification and empowerment of small and medium enterprises (MSMEs) also need to be continuously encouraged to reduce economic dependence on certain sectors that are vulnerable to fluctuations, in order to reduce the percentage of poor people in the regions to a lower level compared to the provincial and national averages.

ADVANCED RESEARCH

The findings of this study highlight the utility of the Markov chain model in forecasting poverty dynamics in Bengkulu Province, revealing both regional variations and trends that are crucial for policy formulation. While areas like South Bengkulu and Kaur are expected to experience a decline in poverty rates, Central Bengkulu is projected to face a worsening situation, indicating the need for region-specific interventions. The persistence of poverty in certain districts, particularly those above the provincial average, underscores the importance of a targeted, multi-faceted approach to poverty alleviation. The study suggests that the Bengkulu Provincial Government should prioritize investments in education, healthcare, and employment opportunities, with a focus on urban areas experiencing higher population density. Furthermore, ongoing poverty alleviation programs must be critically assessed and tailored to evolving local needs, ensuring that they address the root causes of poverty rather than just its symptoms. Intersectoral collaboration between government, private sector, and civil society is essential for fostering long-term economic empowerment, with particular emphasis on the diversification of the local economy and support for micro, small, and medium enterprises (MSMEs). A robust monitoring and evaluation framework will be essential for adapting policies to shifting socio-economic realities, thus promoting sustainable poverty reduction and ensuring that no district is left behind in the broader goal of achieving inclusive prosperity.

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