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The influence of natural factors on poverty in West Halmahera

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Abstract: Poverty remains one of the persistent social issues faced by governments in many regions, including coastal and small island communities. The poverty experienced in these areas is driven by a combination of natural, social, and economic factors. Dynamic environmental conditions, such as seasonal changes, extreme weather, wide geographic dispersion between sea and land, isolation due to limited accessibility, and vulnerability to natural disasters, often trap coastal populations in a cycle of poverty. Data from West Halmahera Regency indicates that poverty levels have shown little improvement up until 2023. This research focuses on a sample of 390 poor residents from the region, utilizing Confirmatory Factor Analysis (CFA) and Principal Component Regression Analysis (PCRA) to examine the factors affecting poverty. The findings reveal that within the Natural Capital variable (X1), the most significant indicators are the distance from the house to a clean water source (X4), with a coefficient of 0.894, the condition of the water source near the residence (X5), with a coefficient of 0.884, and accessibility to clean water sources (X3), with a coefficient of 0.89. West Halmahera, being a coastal and mountainous region, suffers from an unequal distribution of essential infrastructure, particularly in areas far from the district capital. Clean water infrastructure remains absent in many areas, and even in mountainous regions where water piping exists, geographic challenges hinder functionality. Addressing these issues requires collaboration between local governments, the private sector, universities, and the community. Solutions may include programs that incorporate local wisdom and focus on infrastructure development, sustainable water management, and environmentally friendly practices. Such initiatives could enhance access to clean water, improve the local economy, and ultimately reduce poverty in West Halmahera.

Keywords: *Confirmatory factor analysis, Local wisdom, Poverty alleviation, Poverty, West Halmahera regency.*

1. Introduction

Poverty is a phenomenon and a reality that has not been eliminated in this world and is one of the fundamental problems in the development of a country, so it must be the center of attention for all parties. Although poverty is difficult to eliminate, it cannot be ignored because it can cause impacts such as social crimes and other problems.(Maipita 2014) Likewise, according to Chambers, social inequality, access to resources, education and transportation are closely related to poverty. Limited access to water resources, health facilities and sanitation causes people to be unable to escape poverty. Various literatures have revealed that poverty occurs more in coastal areas or small islands. This is related to natural, social and economic conditions. According to Azhar in (Tahawila 2014), dynamic natural conditions such as changing seasons and weather, a fairly wide range of natural control between the sea and islands, isolation due to limited accessibility and vulnerability to natural disasters in coastal areas cause poor people to remain in the cycle of poverty. According to (Mussadun 2016) shows that natural conditions such as seasonal factors and coastal damage are the causes of natural poverty. West Halmahera is a region that has the characteristics of an archipelago. Based on data from the Central Statistics Agency, it is known that the number of poor people until 2022 is 7.31%.

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Table 1.
Population, number of poor people, percentage of poor people in West Halmahera Regency 2010-2022.

Years	Total population	Number of poor people	% Poor people
2010	100.424	12.860	12.81
2011	102.845	13.400	13.03
2012	103.128	11.100	10.76
2013	106.791	10.500	9.83
2014	108.769	10.440	9.60
2015	110.717	10.810	9.76
2016	112.722	9.840	8.73
2017	114.502	9.900	8.65
2018	116.513	10.140	8.70
2019	118.287	10.130	8.56
2020	132.349	10.560	7.98
2021	134.630	10.590	7.87
2022	137.541	10.060	7.31
2023	136.700	10.530	8.74

Statistical data from West Halmahera Regency shows that the number of poor people in 2010 was 12.8 thousand people (12.81 percent), and increased in 2011 to 13.03 percent or 13.4 thousand people. Furthermore, from 2012 to 2017, the number of poor people tended to decrease to 9.9 thousand people. However, starting in 2018, it increased again until 2023. This indicates that whatever poverty alleviation program has been carried out has not had a significant positive impact on reducing poverty rates in the region and has not met the target of the Sustainable Development Goals (SDGs) where the growth of the poor population is zero percent. (Murniati et al. 2021)Based on the government program in West Halmahera, several activity programs have been carried out, but in 2023 poverty has increased again, therefore based on these data, it is important for this study to determine the current poverty level in West Halmahera Regency and to determine the influence of what factors cause poverty in West Halmahera Regency.

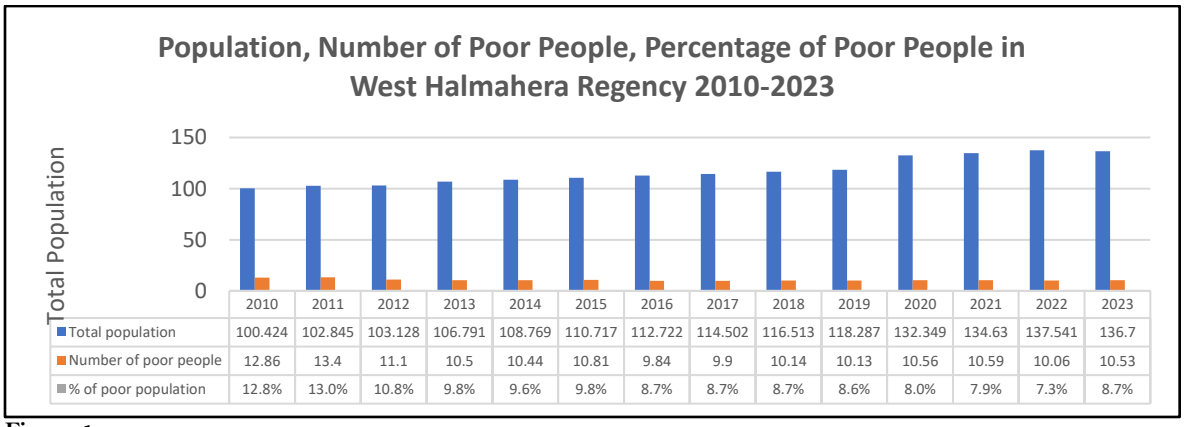

Figure 1.
Population, number of poor people, percentage of poor people in West Halmahera Regency 2010-2022.

Gap Research in this study with others, namely according to (Itang 2015) Low education levels cause a person to lack certain skills needed in their lives and Lazy attitudes (being passive or relying on fate) cause a person to be indifferent and unenthusiastic about working. Meanwhile, according to (Rejekiningsih 2011) that the cause of poverty is that the majority of household heads have low education (graduated elementary school), work as laborers, according to (Permatasari et al. 2022)

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Reducing poverty and inequality as well as economic growth between regions still requires hard work from stakeholders in North Maluku. According to (Hasan et al. 2021) that the potential of the Halmahera region is rich in natural resources and if managed properly is believed to be able to attract investors to invest. The largest natural resource potentials are mining, fisheries and marine affairs, tourism, and agrocomplexes. (Khusaini et al. 2022)With this research, poverty alleviation and benefits for the community can be carried out so that their lives improve and poverty can be reduced so increase economic growth.(Murniati 2021)

2. Literature Review

2.1. Poverty Theory

Poverty is a condition where a person or group of people are unable to fulfill their basic rights to maintain and develop a dignified life. (Walker and Bantebya-Kyomuhendo 2014); (Pathak 2010) The basic rights in question are the fulfillment of food, health, education, employment, housing, clean water, a sense of security from violence or threats, and the right to participate in socio-political life. The development strategy is to accelerate the elimination of extreme poverty, and accelerate the development of basic infrastructure, especially clean water and sanitation Badan Perencanaan Pembangunan Nasional (Bappenas; 2022). According to Akhmadi (2020), poverty is a complex, multidimensional phenomenon and cannot be easily seen from an absolute number. The concept of poverty has a broad meaning according to the concepts and perceptions adopted. Meanwhile, according to (Elwan 1999); (Benevolenza and DeRigne 2019), natural poverty is poverty caused by natural factors, such as disability, illness, age and natural disasters.(Yoon 2020) Meanwhile, structural poverty is poverty caused by man-made factors, such as unfair economic policies, uneven distribution of production assets, corruption and collusion, and the world economic order that tends to only benefit certain groups and cultural poverty occurs due to cultural factors, such as laziness, lack of discipline and wastefulness.

2.2. Measure of Poverty

One of the indicators of the success of development programs and government policies according to(Maipita 2014) in (Naukoko and Mandeij 2022) is the measure of poverty. As an indicator of welfare, poverty needs to be measured periodically. Poverty measurement uses two approaches, namely quantitative and qualitative approaches. The quantitative approach measures poverty in one dimension (namely the economic dimension and the income dimension) and multidimensionally. While the qualitative approach is a participatory poverty measurement. The quantitative approach answers "how many people are poor" while the qualitative approach can answer the question "why are they poor". Based on the causes of poverty from several sources, it can be concluded that the cause of natural poverty is poverty caused by the surrounding natural conditions and the availability of physical infrastructure facilities that can be utilized by the community. This type of poverty can be explained through natural capital and physical capital.

3. Methods

3.1. Research Approach

This research uses a quantitative research approach that is strengthened by a qualitative descriptive approach to solve a number of problems in this study.(Maski, Noor, and Ekawaty 2024) This research uses research instruments in data collection. The research phenomenon is classified into several research variables(Maski, Murniati, and Ashar 2023). The object of this study is the phenomenon of poverty in West Halmahera Regency

3.2. Population and Research Sample

The population in this study was the poor population in West Halmahera Regency. The sample was selected using purposive sampling. This sampling technique is a sampling technique by means of self-assessment of samples among the selected population based on certain characteristics that are considered to be closely related to the characteristics of the previously known population (Sugiyono and Lestari 2021). The population in this study was the number of poor people in West Halmahera Regency,

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which was 10,530 people. If the number of samples to be taken uses the Slovin Formula (Ismail, Pernadi, and Febriyanti 2022), the number of samples is as follows:

$$n = \frac{N}{N(e)^2 + 1}$$

Description:
n = Number of samples sought
N = Number of populations
e = sampling error rate of 5%.

The number of samples is as follows:

$$n = \frac{10.060}{10.060(0{,}5)^2 + 1}$$

n = 384,73 = 385 peoples

3.3. Types and Sources of Data

This study requires data as a source of information to support the research. The data used in the study are primary data and secondary data. (Rahtomo and Murniati 2023) Primary data is data that contains facts or information obtained directly from the results of interviews using questionnaires from individuals or individuals through field research from the objects being studied.Secondary data is data obtained indirectly. Secondary data is obtained from agencies/services/institutions related to this study that provide supporting data for the research. Secondary data is in the form of regional planning documents, research reports and other documents that are published or unpublished. While data collection techniques are one of the strategic steps in research. Errors in data collection can cause the data obtained not to meet the desired standards. Data collection techniques with literature studies and observations and data collection through questionnaires to research objects. The measurement scale is the Likert Scale, which changes qualitative perceptions and attitudes into quantitative data that can be processed statistically, making it easier for researchers to analyze and draw conclusions from the data obtained.

3.4. Operational Definition of Variables

This study aims to determine the influence of natural factors on poverty in West Halmahera. For the purposes of statistical analysis, the research variables are divided into two variables, namely endogenous and exogenous variables. The endogenous variable is poverty while the exogenous variable is natural factors. The endogenous and exogenous variables used in this study are as follows:

Table 2.
Operational definition of variables.

Variables	Indicators
1. Poverty (Y)	Poverty is an endogenous/dependent variable. The indicator that explains poverty is the amount of income of the poor per month.
2. Natural capital (X1)	1. Land area managed (X_1) 2. Soil fertility level (X_2) 3. Accessibility to clean water sources (X_3) 4. Distance from house to clean water source (X_4) 5. Condition of water sources near residence (X_5) 6. Need to access forest (X_6) 7. Impact of mining on water conditions (X_7)

3.5. Validity Test

The validity test in this study uses the product moment correlation test. The validity test criteria are if the correlation coefficient value generated from the analysis results for each item (rxy) is greater than the rtable product moment value at the $\alpha = 0.05$ level so that rtable = 0.1381, then this means that the item is declared valid with the following criteria:

Uji Validitas

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$$r_{xy} = \frac{n(\sum x_i y_i) - (\sum x_i)(\sum y_i)}{\sqrt{(n(\sum x_i^2) - (x_i)^2)(n(\sum y_i^2) - (y_i)^2)}}$$

Where:
rxy = Product Moment correlation coefficient
n = number of respondents
xi = score of each item in the first trial
yi = score of each item in the next trial

3.6. Uji Reliabiltas

This study uses the Alpha Croncbach method. The instrument is said to be reliable if its reliability coefficient reaches 0.60. With the following formula:

$$r_x = \left[\frac{n}{n-1}\right]\left[1 - \frac{\sum \sigma t^2}{\sigma t^2}\right]$$

Where:
rx = reliability sought
$\sum \sigma t^2$ = Total variance of question items or questions
Σt^2 = Total Variance

3.7. Confirmatory Factor Analysis (CFA)

Confirmatory Factor Analysis (CFA) is one of the two main approaches in factor analysis. CFA is a statistical technique used to test the extent to which observed data conforms to a model hypothesized by the researcher.(Murniati et al. 2021) CFA is used to confirm whether the data conforms to a predetermined factor structure based on theory or previous research. CFA is a method with a model formed first, the number of latent variables is determined first and requires parameter identification. (Rejekiningsih 2011).Five important elements in CFA, namely latent variables, indicator variables (ξ), factor loadings (λ) in each indicator, construct relationships (ρ), and errors (δ) that cannot be explained by the indicator variables. The general model of CFA is as follows:

$X = \Lambda x\xi + \delta$
$x2 = \lambda 2\xi + \delta 2$ … … … … … … … …
$x\rho = \lambda\rho\xi + \delta\rho$ With: x1, x2 … , xp : indicators of common factor
$\lambda 1, \lambda 2, \ldots, \lambda p$: loading of pattern/model
$\delta 1, \delta 1, \ldots, \delta p$: unique factor for each error term equation.

3.8. Principal Component Regression Analysis (PCRA)

Principal Component Regression Analysis (PCRA) is a development method of regression analysis, which plays a role in connecting variations in the response variable (variable Y) with variations in several independent variables (variable X), with explanatory or predictive purposes. (Munawar 2020). Furthermore, Principal Component Regression (PCR) is a regression analysis of the dependent variable against the main components that are not correlated with each other, where each main component is a linear combination of all independent variables. PCR combines regression analysis with Principal Component Analysis (PCA). Principal Component Regression (PCR) can be stated as follows:

$$Y = w0 + w K + \varepsilon \quad (1)$$

The K value indicates the principal components involved in the PCR analysis, where the magnitude of m is smaller than the number of independent variables, namely the number p, and Y as the dependent variable. The principal components are a linear combination of the standard variables Z, so that:

$$Km = a1mZ1 + a2mZ2 + \cdots + apmZp \quad (2)$$

If $K1, K2, \ldots, Km$ in equation (2) are redistributed into the principal component regression equation, namely equation (1), then we obtain:

$$Y = w0 + wm\,(a1mZ1 + a2mZ2 + \cdots + apmZp) + \varepsilon \quad (3)$$

So that the estimated principal component linear regression equation is obtained as follows:

$$Y = b0 + bK \quad (4)$$

Explanation:
Y: dependent variable (Poverty)
K: independent variable (Natural factors)

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4. Result

West Halmahera Regency is one of the regencies in North Maluku Province. This regency changed its name from North Maluku Regency to West Halmahera Regency after the expansion based on Law No. 1 of 2003 dated February 5, 2003 concerning the Establishment of North Halmahera Regency, South Halmahera Regency, Sula Islands Regency, East Halmahera Regency, and Tidore Islands City in North Maluku Province. The area of West Halmahera Regency originated from the area of North Maluku Regency which was expanded into 3 new regencies. The capital of West Halmahera Regency is Jailolo. Geographically, West Halmahera Regency has an area of 14,689.16 km² with a land area of 2,227.56 km² and a sea area of 12,461.60 km². Astronomically, West Halmahera Regency is located between 0048' North Latitude to 1048' North Latitude and between 127016' 00" East Longitude to 127016'01" East Longitude. The following are the results of data analysis in this research.

4.1. Validity Test Results

Based on the analysis results for the Research Instrument Test, it can be seen that all question items in the Research Instrument have a Correlation Coefficient value > Critical Point (0.098). This shows that all indicators X1 - X6 are valid. So, it is considered quite good in measuring the construction or variables measured by the instrument as a whole.

4.2. Reliability Test Results

Based on the analysis results, the reliability coefficient for all variables is greater than the critical value (0.600), so that all research variables are declared reliable, thus the instrument can be continued for the next analysis process.

4.3. Confirmatory Factor Analysis (CFA) Estimation Results

The following are the results of Confirmatory Factor Analysis Estimation, which is a way to condense data in many variables into only a few variables or is a data collection technique used to reduce a large number of variables into fewer factors

Table 1.
Results of CFA analysis of natural capital variable (X1).

Component matrix [a]	
$X_{1.1}$	0.145
$X_{1.2}$	0.274
$X_{1.3}$	0.809
$X_{1.4}$	0.894*
$X_{1.5}$	0.884
$X_{1.6}$	-0.249
$X_{1.7}$	0.155

Note: * Most influential.

Then it is described with the aim of explaining the entire data that has been collected by presenting, grouping, and classifying into a table which is then explained based on the most dominant and weakest indicators. Based on the results of the analysis Where the Variable used is the Natural Capital Variable (X). The following are the results of the analysis of the Natural Capital variable (X). Where it is measured using 7 indicators, namely the area of land managed (X_1.1), Soil fertility level (X_1.2), Accessibility to clean water Then analyzed using Factor Analysis. Based on the results obtained, factor analysis on the Natural Capital variable (X) was carried out to reduce the indicators contained in the Natural Capital variable (X) so that a new factor was obtained that represented all of these indicators.

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Table 2.
Total variance explained.

Component	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% Of variance	Cumulative %	Total	% Of variance	Cumulative %
1	2.419	34.553	34.553	2.419	34.553	34.553
2	1.164	16.628	51.181			
3	1.035	14.792	65.973			
4	.949	13.558	79.531			
5	.767	10.951	90.482			
6	.474	6.770	97.252			
7	.192	2.748	100.000			
Extraction method: Principal component analysis.						

Based on the results of the CFA analysis, it was obtained that the most influential indicator on the Natural Capital variable (X1) is the indicator of the distance of the house from the clean water source (X1.4), namely, with a coefficient of 0.894, the indicator of the condition of the water source near the residence (X1.5) with a coefficient of 0.884 and the indicator of accessibility to clean water sources (X1.3) with a coefficient of 0.89. The factor equation formed from the results of the factor analysis is in the following table.

$$F1 = 0{,}145\ X_{1.1} + 0{,}809\ X_{1.3} + 0{,}894\ X_{1.4} + 0{,}884\ X_{1.5} + (-0{,}249\ X_{1.6}) + 0{,}155\ X_{1.7}$$

4.4. Principal Component Regression Analysis (PCRA) Results

Multiple linear regression analysis is a test to see the effect of two or more independent variables on the dependent variable. This linear equation has an interval scale measurement.

Table 3.
Linear regression parameter estimation results coefficients[a].

Model	Unstandardized coefficients		Standardized coefficients
	B	Std. error	Beta
(Constant)	1.554	0.023	
Natural capital (X)	-0.051	0.024	-0.078

The linear regression model in this study is as follows:

$Y = 1{,}554 - (-0{,}051\ X)$

Based on the results of the significance value of the influence of the natural capital variable (X) on poverty of $0.036 < \alpha = 0.05$. then the conclusion is that the natural capital variable (X) has a significant effect on poverty in West Halmahera Regency.

5. Discussion

In general, poverty is a condition where a person or group is unable to meet their basic needs such as food, clothing, shelter, education and decent health. (Wolff 2020); (Lusted 2010) While the causes of poverty include external factors that come from outside the system being analyzed, including natural capital factors. Natural capital is an exogenous/independent variable.(Andersen 2012) This variable is related to the condition of natural resources that support or threaten poverty in the community in the research area. The indicators that build the natural capital variable (X1) are indicators of land area owned (X1.1), soil fertility level (X1.2), accessibility to clean water sources (X1.3), distance from residence to clean water sources (X1.4), condition of water sources near residence (X1.5), need to access forests (X1.6), influence of mining on water quality (X1.7). Of the 7 (seven) indicators, there are 3 (three) indicators that most significantly affect the poverty rate, namely the distance from residence to clean water sources (X1.4), condition of water sources near residence (X1.5), and accessibility to clean water sources (X1.3).

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West Halmahera Regency is an archipelago. Its population lives in coastal areas and mountainous areas. Essential infrastructure facilities are not evenly distributed throughout West Halmahera, especially areas far from the district capital.(Yoon 2020) Until now, there are still areas that have not been served by clean water. In some mountainous areas, there is already clean water infrastructure in the form of piping, but the influence of geography means that this infrastructure does not function properly. Water cannot reach higher areas. So the poor have to go down to get clean water. To get clean water, the poor in Dere Village and Todahe Village located in the mountainous area in Sahu District, still rely on rainwater to meet their daily needs. The community utilizes rainwater by building reservoirs in each house. The average size of these reservoirs is 3 x 3 m wide and 1.5 m high. During the dry season, people are forced to buy water from PDAM with details of 3,000 liters for Rp. 400,000-Rp. 450,000. However, on average, people can only afford to buy around 1000 liters for Rp. 150,000-Rp. 175,000. In addition to rainwater, people in the mountainous area also use well water. There are 3 wells as a water source located on the beach. So to get water, you have to go down the mountain to the beach which is about 1-2 km away. The well water can only be used for bathing, washing clothes, and kitchen utensils. Well water cannot be consumed because it tastes brackish because it is only a few meters from the coastline (Griggs 2020); (Plappally 2012). Such infrastructure conditions can continue to be an obstacle to the socio-economic activities of the community.

Furthermore, based on the research results of (Soamole and Runtunuwu 2020), it shows that clean water is a very important basic need for the people of Kedi Village, Jailolo District, West Halmahera Regency.(Harimisa, Kerebungu, and Umaternate 2022) However, there is a difference in access between the Kedi Atas and Kedi Bawa communities, where the Kedi Atas community has to face great difficulties in getting clean water such as:

- Unfavorable geographical conditions, where Kedi Village is located in a mountainous area, while the water source is in a lower area (Medo Valley RT 1).
- The long distance of water collection, about 1 km to Medo Valley RT 1, makes water collection a very tiring and time-consuming task.
- Limited infrastructure. There is no adequate infrastructure, such as distribution pipes or water pumps, that can facilitate the distribution of water from Medo Valley to Kedi Atas. The Kedi Atas community must use vehicles or carry water manually to bring it back to their homes.
- High costs. For those who are unable to carry water themselves, they must rent vehicles such as motorcycle taxis to transport water. The costs incurred are quite significant, which is around IDR 5,000 per gallon (25 liters), which can be an additional economic burden for families in Kedi Atas.

Difficulty accessing clean water causes the people of Kedi Atas to have to pay additional costs to buy or rent vehicles to get water, which adds to their economic burden. According to research from (Ompusunggu 2018) that the importance of infrastructure development, especially in mountainous areas, is because there is an impact of road infrastructure development on growth. community economy, opening up new job opportunities and speeding up distribution channels for both goods and services in Spirit Mountain Village, Karo Regency. According to Syaiful and Koswara (2021) that the importance of coastal area development will be the integrity of infrastructure and clean water in meeting needs Where the area is still partly economically disadvantaged, therefore the importance of the community in overcoming poverty by using natural resources such as water wisely and efficiently in addition to the importance of sustainable development programs (Ishatono and Raharjo 2016);(Iskandar 2020) which is a perspective on an activity that is carried out systematically and in a planned manner to improve the welfare, quality of life, and environment of humanity without reducing access and opportunities for future generations to enjoy and utilize it so that poverty in the West Halmahera area can be overcome properly and community welfare can be realized.

6. Conclusion

Based on the results and discussions, several things can be concluded below.

1. Poverty remains a serious problem in West Halmahera Regency, with macro indicators such as

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the poverty line increasing until 2023, and the Human Development Index (HDI) which is still in the moderate category. Although the distribution of income is relatively even (indicated by the low gini ratio).

2. Based on the results of the statistical analysis, the factors causing poverty were obtained. namely the results of the Confirmatory Factor Analysis (CFA) analysis and the results of the Principal Regression Analysis (PCRA) test, indicators were obtained from the research variables that had the most influence on poverty. In the natural capital variable (X), namely the accessibility indicator to clean water and the quality of clean water. In West Halmahera, poor people who have not received clean water facilities from PDAM, who live in mountainous areas to get clean water, have to travel a distance of approximately 2 km to the water source, while those living in coastal areas get clean water from artificial wells located on the coast. However, the water condition is not suitable for consumption, so to get clean water, you have to buy it from PDAM, or neighbors who have water sources, or wait for rainwater to be collected in reservoirs.
3. Based on the results of the study, it is hoped that this research can provide contributions, input and suggestions for the government, community and other stakeholders to increase accessibility to clean water through collaboration with local governments, the private sector, and universities. It is necessary to utilize the PAMSIMAS program in the development of sustainable and environmentally friendly water management infrastructure to overcome the problem of accessibility to clean water sources.

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