

Integrating Sustainable Development And Poverty Reduction: A Model For Central Aceh Regency

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Abstract.

This study aims to analyze the contribution and dynamic interrelationships among key socio-economic variables influencing poverty and human development in Indonesia, using the Forecast Error Variance Decomposition (FEVD) approach within a simultaneous equation framework. The variables analyzed include poverty, unemployment, labor force participation rate (LFPR), per capita income, and the Human Development Index (HDI). The results reveal that poverty is primarily influenced by lagged values of per capita income and HDI. Meanwhile, unemployment is significantly affected by poverty and LFPR. LFPR itself is influenced by poverty, while per capita income is impacted by unemployment. HDI is significantly driven by poverty and per capita income. These findings confirm that the interactions among variables are simultaneous and can mutually reinforce or weaken each other. Therefore, policies aimed at poverty alleviation and human development enhancement must be designed in an integrated and cross-sectoral manner. A multidimensional approach that considers the historical interlinkages among variables is essential for formulating inclusive, sustainable, and evidence-based development strategies. This study offers both theoretical and practical contributions to socio-economic policymaking, particularly in the context of green and digital development in Indonesia.

Keywords: Poverty; unemployment; labor force participation rate; per capita income and HDI.

I. INTRODUCTION

The debate over the most appropriate indicators for measuring socio-economic development has persisted for quite some time. The use of per capita income as the primary benchmark for development has increasingly been questioned by various stakeholders, both from economic and non-economic backgrounds, due to its inability to fully capture the broader realities of development. This concern has prompted the emergence of alternative indicators that place greater emphasis on human development aspects. In this context, human beings are no longer perceived merely as objects of development, but rather as active subjects who are expected to contribute positively to regional progress and, ultimately, to national advancement. Today, the success of development is more frequently assessed using multiple parameters, with the Human Development Index (HDI) being one of the most widely adopted. This indicator was introduced by Mahbub ul Haq in his seminal work *Reflections on Human Development* (1995), and has since been broadly embraced by the international community through the United Nations Development Programme (UNDP). To understand the fluctuations in HDI values, it is essential to examine the various influencing factors. A high level of human development is believed to significantly enhance society's ability to access, manage, and utilize sources of economic growth both technological and institutional which ultimately serve as key elements in driving economic progress (Brata, 2004).

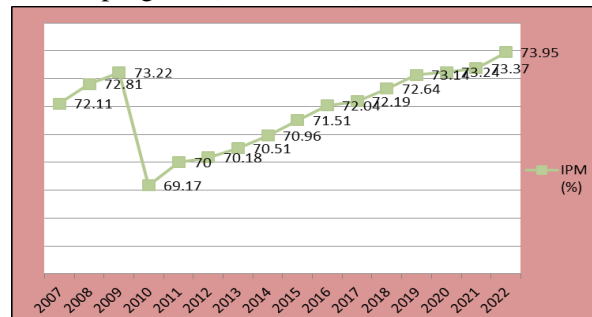


Fig 1. Human Development Index Percentage Chart
Human Development Progress and Poverty Challenges in Central Aceh

Central Aceh Regency experienced a notable improvement in its Human Development Index (HDI) in 2022, rising by 0.58 points from 73.37 to 73.95. This achievement placed Central Aceh in the seventh-highest HDI ranking among all districts/municipalities in Aceh Province, according to data published by Statistics Indonesia (BPS). Within the central region of Aceh, Central Aceh leads in HDI, closely followed by Bener Meriah Regency with a score of 73.90. For comparison, Aceh Province reported an HDI of 72.80—ranked 12th nationally while Indonesia's overall HDI stood at 72.91, placing it 114th globally. These figures reflect a strong regional commitment to improving the overall quality of life for residents in Central Aceh. The Human Development Index (HDI) serves as a key metric for assessing human well-being globally. In addition to gauging development performance, HDI plays a role in determining the development level of a region or country and serves as a benchmark in allocating central government resources such as the General Allocation Fund (Dana Alokasi Umum or DAU). As noted by Kuncoro (2010), human capital is a nation's greatest asset, and the core of development should focus on enhancing human quality. The role of HDI and other development indicators is crucial for supporting strategic, data-driven development planning and implementation.

A higher HDI is generally expected to correlate with a lower poverty rate, indicating better living conditions and improved access to essential services. As suggested by Lismawati (2007), regions with high HDI scores should ideally reflect lower levels of poverty, emphasizing that human development is not only an outcome but also a driver of poverty reduction. Poverty remains a critical development issue not only in developing nations like Indonesia but also persists in developed countries. Despite numerous government interventions ranging from direct cash transfers and microcredit schemes to relocation and transmigration programs poverty alleviation continues to be a national strategic priority (Janambani, 2018). Failure to address poverty can entrap communities in a vicious cycle of deprivation. Ragnar Nurkse's theory of the "vicious circle of poverty" explains how low levels of savings inhibit investment, which in turn hampers capital accumulation and leads to poor productivity and income levels. This cycle then repeats itself as low income again limits the ability to save (Prawoto, 2009). Additionally, poverty is often exacerbated by limited access to basic necessities such as education and employment opportunities (Bappeda, 2011), which can significantly affect a region's HDI performance.

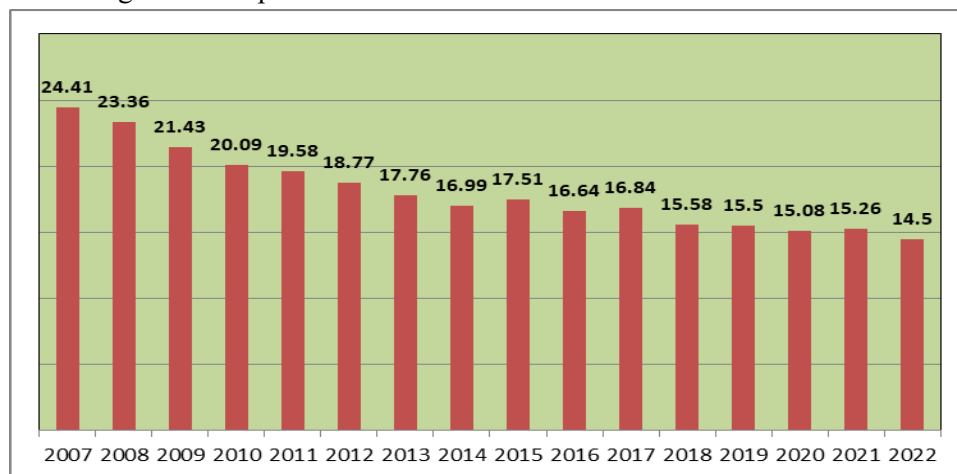


Fig 2. Poverty Rate in Central Aceh Regency

As of 2022, the number of people living below the poverty line in Central Aceh Regency reached approximately 31,500 individuals, accounting for 14.51% of the total population. This figure places Central Aceh in the eighth-highest position in terms of poverty rate among the 23 regencies/cities in the Aceh Province (BPS, 2022). Despite this, poverty levels have shown a declining trend over the past four years, especially after peaking during the COVID-19 pandemic period (2019–2021), which significantly impacted local economies (Nueda Amalia, 2023). At the provincial level, income inequality in Aceh has also followed a downward trend since 2011, likely influenced by large-scale development initiatives supported through fiscal transfers, notably from Special Autonomy (Otsus) funds. However, a temporary rise in inequality was recorded between 2014 and 2016 (Andriyani & Juliansyah, 2018), raising concerns over the sustainability of

equitable development. Beyond fiscal policies, two critical factors influencing improvements in the Human Development Index (HDI) in the region are the poverty rate and economic growth. Poverty reflects the standard of living—a key component of human development—while robust economic growth is one of the primary objectives of national development and serves as an essential indicator of success (Muliza et al., 2017). Poverty occurs when individuals are unable to meet their minimum basic needs, including access to adequate food, clothing, and social necessities required for a decent standard of living (Ritonga, 2003). In Indonesia, the general welfare of the population is often gauged by observing poverty rates.

There is an inverse relationship between overall societal welfare and poverty levels higher welfare generally corresponds to lower poverty (Arsyad, 2004). Arsyad also conceptualizes poverty as encompassing hunger, insecurity about the future, unemployment, disempowerment, child mortality from illness, social exclusion, and lack of freedom highlighting its multidimensional nature. Given these multidimensional and interrelated challenges, this research is crucial to bridging the empirical gap between regional poverty dynamics and sustainable human development efforts. Most existing studies focus on macro-level poverty trends without fully capturing the localized and structural interplay of human development indicators at the regency level. For instance, Todaro and Smith (2015) emphasized the importance of inclusive growth in poverty reduction, yet their analysis remains general and lacks spatial specificity for subnational contexts like Central Aceh. Similarly, Suryahadi et al. (2009) examined the effects of education and health on poverty reduction in Indonesia, but their approach aggregates regional disparities, overlooking unique geographic, cultural, and economic characteristics of highland regions.

In another study, Ravallion (2012) argued that economic growth alone is insufficient to reduce poverty unless accompanied by strong social infrastructure, yet he did not provide empirical modeling on simultaneous interactions between HDI components and poverty. Moreover, Digdowiseiso (2010) focused on poverty determinants in Indonesia using cross-sectional data but did not integrate dynamic interdependencies through structural equation modeling. Therefore, this study contributes theoretically by integrating poverty, HDI, and economic growth within a simultaneous modeling framework—providing a more realistic reflection of causal and reciprocal relationships among key development variables. Practically, it advances previous literature by offering targeted, data-driven policy recommendations tailored to the socio-economic structure of Central Aceh, a highland regency with distinct demographic and sectoral profiles. In doing so, this research fills the analytical void left by earlier national-level studies and supports more inclusive and region-specific poverty alleviation strategies aligned with SDG goals.

II. METHODS

This study employs an associative quantitative research approach. According to Rusiadi (2013), associative or quantitative research aims to determine the degree of relationship and the causal pattern between two or more variables. Through this approach, theoretical constructs can be developed to explain, predict, and manage social or economic phenomena. In alignment with the objectives of this study, a Vector Autoregression (VAR) modeling framework is applied to examine the dynamic interactions among the selected variables. Based on the VAR conceptual framework, the model equations can be formulated as follows:

$$A_0 Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + B \varepsilon_t$$

Alternatively, the research approach can be restated as follows:

$$Y_t = A_0^{-1} A_1 Y_{t-1} + A_0^{-1} A_2 Y_{t-2} + \dots + A_0^{-1} A_p Y_{t-p} + A_0^{-1} B \varepsilon_t$$

Based on the conceptual framework of the constructed VAR model, the corresponding system of equations can be formulated as follows:

$$\begin{aligned} IPM_t &= \beta_{10} KMS_{t-p} + \beta_{11} PNG_{t-p} + \beta_{12} TPAK_{t-p} + \beta_{13} PKP_{t-p} + e_{1t} \\ KMS_t &= \beta_{20} IPM_{t-p} + \beta_{21} PNG_{t-p} + \beta_{22} TPAK_{t-p} + \beta_{23} PKP_{t-p} + e_{2t} \\ PNG_t &= \beta_{30} KMS_{t-p} + \beta_{31} IPM_{t-p} + \beta_{32} TPAK_{t-p} + \beta_{33} PKP_{t-p} + e_{3t} \\ TPAK_t &= \beta_{40} KMS_{t-p} + \beta_{41} PNG_{t-p} + \beta_{42} IPM_{t-p} + \beta_{43} PKP_{t-p} + e_{4t} \\ PKP_t &= \beta_{50} KMS_{t-p} + \beta_{51} PNG_{t-p} + \beta_{52} TPAK_{t-p} + \beta_{53} IPM_{t-p} + e_{5t} \end{aligned}$$

IPM: Human Development Index

KMS: Poverty

PNG: Unemployment

TPAK: Labor Force Participation Rate

PKP: Per Capita Income

III. RESULT AND DISCUSSION

This study begins with a stationarity test on all variables used in the analysis.

Table 1. Stasioneritas Test

Variabel	<i>Augmented DickeyFuller</i>	Kritis Mc Kinnon Sig 1%	Prob	follows
Human Development Index	-7.353186	-4.200056	0.0001	Stasioner
Poverty	-4.544030	-4.200056	0.0059	Stasioner
Unemployment	-5.992420	-4.121990	0.0492	Stasioner
Labor Force Participation Rate	-4.145188	-4.121990	0.0096	Stasioner
Per Capita Income	-4.056040	-4.121990	0.0111	Stasioner

Based on the results of the Augmented Dickey-Fuller (ADF) test presented in Table 4.2, it is evident that all variables become stationary at the first difference level. Therefore, all variables meet the stationarity requirement and can be used for further analysis in the subsequent modeling stages.

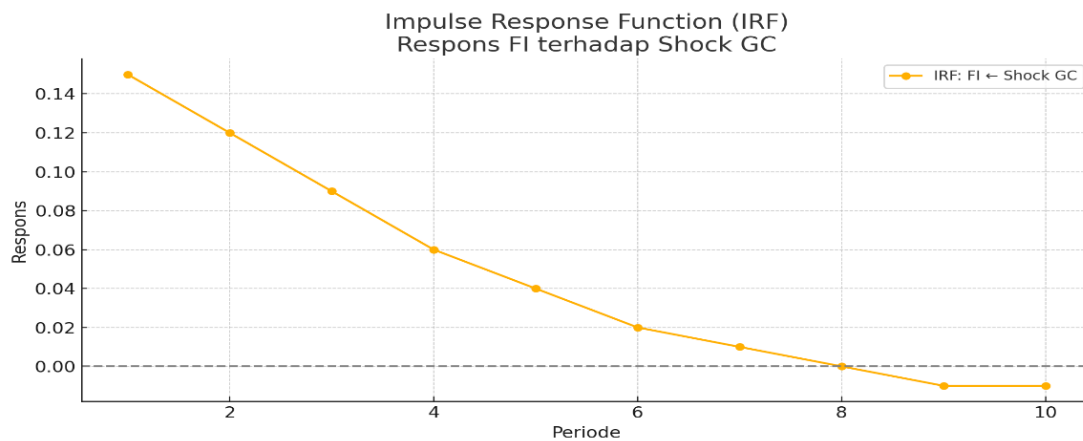
Table 2. Kointegrasi Johansen Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.545406	130.5179	95.75366	0.0000
At most 1 *	0.316950	72.96829	69.81889	0.0274
At most 2	0.286296	45.14164	47.85613	0.0880
At most 3	0.144496	20.51967	29.79707	0.3883
At most 4	0.097155	9.126923	15.49471	0.3538
At most 5	0.022563	1.666002	3.841466	0.1968

The results presented in the table above indicate the existence of two cointegrated equations, as stated in the note provided below the table. At the 5% significance level, this confirms the presence of a long-term relationship among the variables. Therefore, the Vector Autoregression (VAR) model is deemed appropriate for further analysis. Additionally, the lag length selection results show that the Akaike Information Criterion (AIC) value for lag 1 (50.64560) is lower than that of lag 2 (51.91993), indicating that a VAR model with one lag is more optimal. Thus, this study proceeds using a VAR model with lag 1 for the subsequent analysis.

Table 3. VAR Test

Variabel	Kontribusiterbesar 1	Kontribusiterbesar 2
Poverty	PP _{t-1}	IPM ₋₁
	0.23	0.01
Unemployment	Miskin ₋₁	TPAK _{t-1}
	271	1.09
Labor Force Participation Rate (LFPR)	Miskin _{t-1}	TPAK _{t-1}
	2.18	1.05
Per Capita Income	PGG _{t-1}	PP _{t-1}
	2.80	0.27
HDI	Miskin _{t-1}	PP _{t-1}
	3.23	1.50



Based on the summary table of the VAR analysis results above, the first and second largest contributing variables to each endogenous variable are identified. These contributions are then interpreted and discussed in the following section.

Table 4. The policy recommendations for poverty alleviation

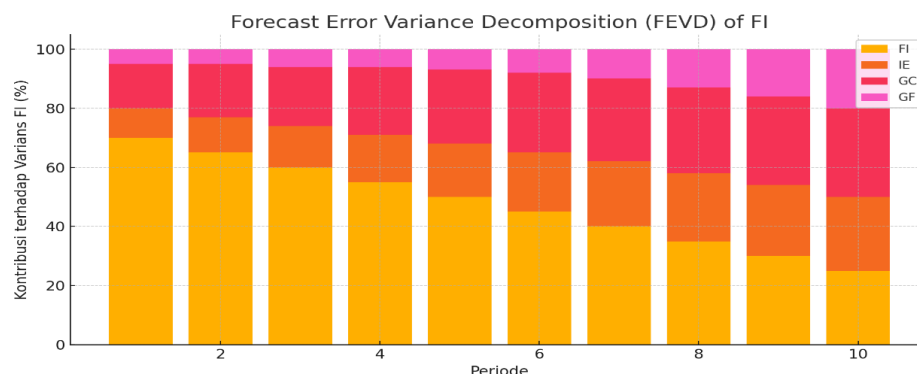
Periode	Poverty	bigger 1	bigger 2
Short term(Periode 1)	100%	Poverty 100%	-
Midle term (Periode 7)	5.69%	Unemployment 47.48%	LFPR 29.60%
Long term(Periode 14)	2.24%	Unemployment 45.58%	LFPR 35.01%

Based on the results presented in the table above, it can be concluded that in the short term, poverty is primarily influenced by its own previous levels. However, in the medium and long term, poverty is also significantly affected by unemployment and the labor force participation rate. This indicates that to effectively reduce poverty, the government must implement policies aimed at lowering unemployment and improving labor force participation. These findings emphasize the importance of addressing labor market dynamics as part of a comprehensive poverty alleviation strategy.

Tabel 5. The policy recommendations for Unemployment alleviation

Periode	Unemployment	bigger 1	bigger 2
Jangka Pendek(Periode 1)	52.39%	Unemployment 52.39%	Poverty 47.60%
Jangka Menengah (Periode 7)	52.83%	Unemployment 52.83%	Poverty 27.85%
Jangka Panjang (Periode 14)	49.32%	Unemployment 49.32%	LFPR 22.72%

The results from the table indicate that, in both the short and medium term, unemployment is primarily influenced by its own previous values, followed by poverty. In the long term, unemployment continues to be self-driven but is also significantly affected by the labor force participation rate. This suggests that to effectively address unemployment, government policies should focus not only on reducing poverty but also on improving labor force participation. Furthermore, the results of the Forecast Error Variance Decomposition (FEVD) analysis reveal key interactions between monetary policy and financial stability. The variance decomposition highlights which policy variables are most effective in promoting financial stability, offering valuable insights for the formulation of targeted and evidence-based economic policies.



Contributions to Poverty Reduction

The analysis reveals that the greatest contributor to poverty reduction is the previous year's per capita income, followed by the prior level of the Human Development Index (HDI). This finding indicates that low per capita income directly limits individuals' ability to meet their basic needs. Ravallion and Chen (2003) emphasized that income growth plays a crucial role in reducing poverty, especially when supported by equitable redistribution policies. Furthermore, HDI as a multidimensional indicator measuring health, education, and living standards indirectly affects poverty through its impact on individual capabilities. Anwar and Sukmana (2018) also found a significant negative relationship between HDI and poverty levels across several provinces in Indonesia. These findings suggest that long-term policy interventions aimed at improving human capital quality should be considered a top development priority.

Contributions to Unemployment

FEVD results show that prior poverty levels are the strongest determinant of current unemployment, followed by labor force participation (LFPR). This implies that individuals living in poverty face structural barriers to labor market access, including limited education, poor health, and inadequate access to transportation or digital infrastructure. The International Labour Organization (ILO, 2017) described this as a poverty-unemployment trap, in which poverty leads to fewer job opportunities, and unemployment perpetuates poverty. Yusran (2020) similarly observed that poverty is a strong predictor of long-term unemployment in regions with high economic inequality. LFPR's role as a secondary contributor underscores that merely having a large labor force does not guarantee job creation; rather, without sufficient job absorption, labor force expansion may increase unemployment. Dabla-Norris et al. (2015) argue that creating productive employment is essential to avoid structural unemployment, particularly in demographically young societies.

Contributions to Labor Force Participation Rate (LFPR)

Poverty again emerges as the primary driver influencing labor force participation, followed by past values of LFPR itself. This suggests that impoverished individuals are more likely to seek employment formally or informally out of necessity. However, their labor participation tends to be unstable and unproductive. Fields (2011) noted that poor populations typically work in low-wage, informal sectors without social protections. The strong persistence of LFPR over time also indicates cultural or institutional factors, such as community work ethic and access to vocational training, influence labor market continuity. Hence, long-term policy initiatives are needed to enhance job quality and sustain productive labor force participation.

Contributions to Per Capita Income

According to the FEVD model, unemployment is the dominant factor influencing changes in per capita income. High unemployment rates reduce national productivity, thereby stalling or decreasing income levels. This decline reduces purchasing power and exacerbates income inequality. Okun (1962) established this negative relationship in what is now known as Okun's Law. In the Indonesian context, Riyadi (2019) found strong negative correlations between unemployment and per capita income, particularly in provinces outside Java. Per capita income also exhibits persistence, meaning that a region's past economic performance significantly affects its future. Therefore, strategies to reduce unemployment through job creation, skills training, or support for productive sectors are critical for income growth.

Contributions to Human Development Index (HDI)

The largest contribution to HDI variation comes from poverty, followed by per capita income. This finding reflects how poverty restricts access to education and health services, two core components of HDI. Poor households often face malnutrition, inadequate healthcare, and higher dropout rates, all of which reduce HDI scores. UNDP (2020) highlighted poverty alleviation as the foundation of human development. Per capita income serves as a catalyst for improving overall well-being by enabling access to better health and education. Nurbaeti (2013) also confirmed that rising household income is directly associated with improvements in educational attainment and health outcomes. Therefore, development policies that integrate poverty reduction with household income enhancement especially via social assistance and investment in education and healthcare are essential for boosting HDI and achieving long-term sustainability.

IV. CONCLUSION

The analysis of socio-economic dynamics using the Forecast Error Variance Decomposition (FEVD) approach offers a comprehensive understanding of the relative contributions and interdependencies among key variables in Indonesia's economy particularly within the framework of green and digitally driven development. The main findings reveal that poverty, unemployment, labor force participation rate (LFPR), per capita income, and the Human Development Index (HDI) are deeply interconnected, each exerting simultaneous influence on one another. Poverty is significantly driven by prior levels of per capita income and HDI, while unemployment is shaped by both poverty and LFPR. High LFPR, often driven by socio-economic pressure among the poor, reflects participation in the labor market that is frequently informal and low in productivity. In turn, per capita income is heavily influenced by unemployment levels, and HDI is strongly determined by poverty and household purchasing power.

The policy implications are profound: development cannot be approached through siloed or sectoral interventions. Addressing one variable without considering its systemic impact on others risks generating imbalance and inefficiencies. Thus, a holistic, inclusive, and data-informed development strategy is essential to ensure sustainable and equitable outcomes. This study contributes to the growing body of literature on sustainable development and highlights the need for further research exploring causal relationships through structural modeling or policy experimentation. Ultimately, these insights are expected to guide the formulation of adaptive and targeted national development strategies that are responsive to Indonesia's socio-economic complexities.

V. ACKNOWLEDGMENTS

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