Sharia Economic and Management Business Journal (SEMBJ)

| Volume 7, Issue 3, 2026 | Page 554-569 |
https://doi.org/10.62159/sembj.v7i3.2623
ISSN-Online: 2774-2679
This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License © 2026 by author/s.
https://siducat.org/index.php/sembj

Causal Relationship Between Islamic Human Development Index, ZIS and Social Fiscal Policy on Poverty Reduction in Indonesia: Empirical Evidence

Armin Rahmansyah Nasution[1], Muhammad Ramadhan[2], Fitrawaty[3]

[13]State University of Medan, Indonesia.
[2]State Islamic University of North Sumatra, Indonesia.

armin@unimed.ac.id *✉

ARTICLE INFO

Keywords:
Islamic Human Development Index; Zakat; Fiscal Policy; Poverty Reduction; Vector Error Correction Model;

ABSTRACT

Background: Poverty remains a persistent structural challenge in Indonesia despite improvements in human development, fiscal interventions, and Islamic social finance. Understanding the dynamic relationships among these instruments is essential for sustainable poverty alleviation.
Research Gap: Previous studies have predominantly examined human development, zakat, and fiscal policies separately, providing limited evidence of their simultaneous short- and long-term relationships with poverty reduction.
Novelty: This study integrates the Islamic Human Development Index (IHDI), zakat, and sector-specific fiscal expenditures within a unified dynamic econometric framework to identify their distinct contributions to poverty reduction.
Method: Employing a quantitative explanatory approach, this study analyzes Indonesian annual data from 1995 to 2024 using the Vector Error Correction Model (VECM), Johansen cointegration, Granger causality, impulse response functions, and forecast error variance decomposition.
Results: The Johansen test identifies three cointegrating relationships. Long-run estimates indicate significant negative associations between poverty and both IHDI and zakat, while health expenditure exhibits a significant positive coefficient. Education expenditure and social assistance are statistically insignificant. Short-run VECM estimates reveal no significant immediate effects on poverty, although Granger tests identify predictive relationships from zakat and health expenditure to poverty. Variance decomposition indicates that poverty's own shocks explain over 95% of its forecast error variance.
Conclusion: Sustainable poverty alleviation requires continuous human development, strengthened zakat governance, and better-targeted fiscal interventions. Integrating Islamic social finance with public welfare policies offers a strategic foundation for inclusive development.

Received: 6/10/2026 **Revised:** 9/23/2026 **Accepted:** 9/25/2026 **Published:** 10/23/2026

How to cite this article:
Nasution, A.R., Ramadhan, M., & Fitrawaty. (2026). Causal Relationship Between Islamic Human Development Index, ZIS and Social Fiscal Policy on Poverty Reduction in Indonesia: Empirical Evidence. *Sharia Economic and Management Business Journal (SEMBJ)*, 7(3), 554-569. https://doi.org/10.62159/sembj.v7i3.2623

INTRODUCTION

Although long-term economic growth in Indonesia has shown improvement, poverty remains one of the most persistent structural problems. The government has deployed various fiscal instruments including expenditure on education and health, as well as the expansion of social protection systems while there has also emerged the growing relevance of Islamic social finance, especially zakat, as an alternative redistribution mechanism. Zakat, one of the obligatory forms of charity in Islam, plays a crucial role in poverty alleviation by redistributing wealth to marginalized individuals. Effective development, implementation, transparency, and accountability of zakat can strengthen poverty alleviation efforts (Beik & Arsyianti, 2021). To optimize the role of zakat in poverty alleviation, Indonesia can improve coordination mechanisms, strengthen regulatory frameworks, and increase public awareness (Mukhlishin et al., 2024). On the other hand, human development performance measured through the Islamic Human Development Index (IHDI) shows a steady trend towards improvement, but it is debatable to what extent these capacity-building policies actually result in sustainable poverty reduction, rather than just short-term consumption effects. Empirical studies show that the increase in HDI is negatively correlated with the poverty rate, namely the increase in the IHDI leads to a decrease in poverty at the Indonesian provincial level. However, another analysis warns that although zakat and HDI funds have a significant negative influence on poverty, the management and effectiveness of zakat distribution are still not optimal so the long-term impact is still limited (Mutmainah et al., 2024).

Indonesia is a very relevant case to study because the country hosts the largest Muslim population in the world, has a formally structured national zakat governance system, and allocates significant public resources to the human development sector. However, empirical evidence on the simultaneous effectiveness of fiscal policies, Islamic social finance, and human development in reducing poverty remains fragmented. Some studies, such as those conducted by (Nugroho et al., 2021). in his research shows that various fiscal instruments such as subsidies, social assistance, and health insurance have contributed to poverty reduction in Indonesia, although their effectiveness varies between regions (Nugroho et al., 2021). On the other hand, M.E. Siburian found that fiscal decentralization has a significant relationship with poverty reduction, but its effects are highly dependent on institutional capacity and the quality of regional governance (Siburian, 2022).

The study responded to this gap by examining the short-term and long-term causal relationships between the Islamic Human Development Index (IHDI), zakat (ZIS), and social fiscal policy instruments on poverty reduction in Indonesia using the Vector Error Correction Model (VECM). The model captures equilibrium adjustments, temporal causality, and the effects of policy delays, providing a more realistic assessment of how welfare interventions work in the context of a growing economy (Chen et al., 2006). The results aim to offer empirical evidence for policymakers, Islamic economic institutions, and development planners on which instruments result in structural change rather than temporary aid.

Poverty alleviation in Indonesia faces persistent structural challenges despite improving macroeconomic performance and human development indicators. The complex relationship between the Islamic Human Development Index (IHDI), Zakat, and fiscal social policies, especially government spending on education, health, and social assistance, are still not adequately understood from a dynamic causal perspective. Although previous research has established the role of IHDI in enhancing welfare and zakat potential as an Islamic social finance instrument to complement state fiscal measures, there is limited empirical evidence exploring long-term and short-term interactions together. In addition, policy outcomes often appear inconsistent due to delayed contagion effects and fragmented coordination between fiscal and philanthropic mechanisms. This gap in understanding raises an important question: how do human development, Islamic philanthropy, and fiscal social policy interact causally to affect poverty reduction within the framework of sustainable development? Answering this question is crucial to designing a coherent strategy that integrates social finance and fiscal planning to achieve inclusive economic growth and long-term poverty alleviation in Indonesia.

The main objective of this study is to analyze the causal relationship between the Human Development Index (IHDI), zakat, and fiscal social policies on poverty alleviation in Indonesia in a dynamic econometric framework. Specifically, this study aims to identify short-term and long-term interactions between these variables using the Vector Error Correction Model (VECM). Thus, this study seeks to reveal whether improvements in human development and optimal management of Islamic social

finance can effectively complement fiscal policy instruments in achieving sustainable poverty alleviation. Furthermore, this study intends to determine the direction of causality—whether zakat and fiscal intervention encourage poverty reduction directly or through the improvement of human resources represented by IHDI. Ultimately, these findings are expected to provide evidence-based insights for policymakers to formulate integrated strategies that align human development initiatives, fiscal expenditures, and sharia philanthropic mechanisms to accelerate poverty eradication in Indonesia.

This research is based on a key research question that aims to uncover how the Human Development Index (HDI), zakat, and social fiscal policies interact in influencing poverty reduction in Indonesia. Specifically, this study explores whether there is a long-term equilibrium relationship between these variables and how short-term adjustments contribute to achieving sustainable poverty reduction. This study also analyzes the direction of causality whether increasing human development and effective zakat distribution leads to poverty reduction, or whether fiscal policies in the fields of education, health, and social assistance play a role as the main driver of improving welfare. Basically, this research aims to answer how the integration of human development efforts, Islamic social finance, and fiscal interventions can create synergistic impacts in reducing poverty within the framework of sustainable and inclusive economic growth?

This study has theoretical and practical significance in the context of sustainable economic development and poverty alleviation in Indonesia. Theoretically, it enriches the literature on the linkages between human development, Islamic social finance, and fiscal policy by using dynamic econometric approaches specifically the Vector Error Correction Model (VECM) to capture short-term and long-term causal relationships. This methodological contribution helped bridge gaps in previous research that largely relied on static models and isolated variable analysis. From a practical perspective, the findings of this study provide valuable insights for policymakers, development planners, and Islamic financial institutions to design integrated strategies that align human resource development, zakat management, and fiscal social spending. By demonstrating empirically how human development and Islamic philanthropy interact with fiscal interventions to alleviate poverty, the study supports evidence-based policy formulation aimed at achieving inclusive growth and advancing the United Nations Sustainable Development Goals (SDGs), in particular the first goal of No Poverty.

LITERATURE REVIEW

Islamic Human Development and Poverty Reduction

Human development is widely recognized as the main determinant of poverty alleviation. According to Amartya Sen's Ability Approach, viewing poverty is not only a lack of income but also as a loss of the fundamental ability that allows individuals to live a dignified life (Garcés, 2023). The Human Development Index (HDI) that integrates the dimensions of education, health, and income captures this multidimensional view (Azubuike et al., 2024; Daghagh Yazd et al., 2025). Empirical studies show that the human development component from an Islamic perspective, which includes religious and social dimensions, is highly relevant to poverty alleviation (Shirazi et al., 2023). Areas with higher HDI are usually in line with direct initiatives aimed at improving access to health services, education (Djulius et al., 2022). Based on these findings, this study hypothesizes that IHDI has a significant long-run effect on poverty reduction in Indonesia (H1a). Furthermore, in the short run, it is expected that poverty itself exerts feedback effects on IHDI performance, as resource limitations and low income can hinder education and health outcomes (H2b).

Zakat and Islamic Social Finance

Zakat, as one of the pillars of Islam, serves as an important mechanism in the redistribution of wealth by covering spiritual and socio-economic functions in the Islamic economy. Zakat is a form of alms that must be done to clean one's wealth and help people in need, thereby encouraging social equality and economic justice (Rodzi Embong et al., 2013; Sarea, 2021) . Zakat is one of the most important redistribution mechanisms in Islamic economics, serving spiritual and socio-economic functionsi (Rusydiana et al., 2025). Through its mandatory nature, zakat functions as a social safety net for the poor and an instrument of wealth circulation (Mongkito & Samdin, 2025). Studi oleh [16]. found that zakat has a statistically significant impact on poverty alleviation if managed efficiently and transparently. In the Indonesian context, BAZNAS and other Islamic institutions play an important role in reducing

economic inequality through the distribution of productive zakat. Empirical studies show that zakat significantly reduces poverty rates. For example, in Indonesia, an increase in IKB BAZNAS (an impactful measure of zakat) has been associated with a decrease in the poverty ratio (Choiriyah et al., 2020). The long-term impact of zakat on poverty is in line with the Islamic principle of social justice, showing a direct inverse relationship between zakat mobilization and poverty level (H1b). In addition, zakat is hypothesized to affect human development indirectly by increasing access to education, health, and livelihood (H3c). However, due to delays in distribution and limited institutional integration, the short-term impact of zakat on poverty may not be statistically significant (H2a).

Fiscal Policy and Social Spending

Fiscal policy, particularly in the form of government spending on education, health, and social assistance, is another important determinant of poverty alleviation. The Keynesian framework shows that fiscal expansion through public spending stimulates aggregate demand, employment, and income, thereby reducing poverty. However, spending on preschool and primary education is generally on the side of the poor, while spending on secondary and tertiary education tends not to favor the poor (Lustig, 2017). More recent studies (Nugroho et al., 2021). affirmed that targeted fiscal spending improves welfare outcomes and reduces inequality. Nonetheless, empirical evidence shows varying degrees of effectiveness across sectors. Investment in education and health has consistently been associated with long-term benefits in human resource development. Studies show that government spending on education and health contributes significantly to poverty alleviation and economic growth (Muhammad et al., 2019; O. Ojike et al., 2021). In line with this, this study hypothesizes that fiscal policy on education (PD) may not show a significant long-term effect on poverty reduction (H1c), whereas fiscal policy on health (KS) is expected to have a significant and sustainable long-term impact (H1d). Social assistance (BS), on the other hand, is hypothesized to have limited long-term influence but may exhibit short-term self-causality due to reacting to previous conditions (H1e, H2f).

Short Run and Long-Run Dynamics in Poverty Determinants

Empirical evidence shows that the relationship between IHDI, zakat, and fiscal policy is dynamic and operates through short-term and long-term mechanisms. Short-term fluctuations often reflect direct policy shocks or changes in funding, while long-term effects capture structural improvements in human development and institutional performance. Studies using the Vector Error Correction Model (VECM) have confirmed this dual dynamic (Mohd Tamam et al., 2023; Yusuf et al., 2024). In line with this reason, this study hypothesizes that there is a long-term equilibrium relationship between IHDI, zakat, and fiscal social policies that collectively contribute to poverty alleviation (H3a–H3f). Meanwhile, the short-term effects are expected to be weaker due to delays in the transmission of fiscal and philanthropic interventions, administrative inefficiencies, and inherent time lags in human resource formation (H2a–H2e).

METHOD

Research Design

This study adopts a quantitative explanatory design supported by a time-series econometric framework to investigate the dynamic causal relationship both in the short and long term between the Human Development Index (IHDI), zakat (ZIS), fiscal education expenditure (PD), fiscal health expenditure (KS), social assistance expenditure (BS), and poverty level in Indonesia. The analytical approach uses the Vector Error Correction Model (VECM) to capture the adjustment mechanism and the long-term equilibrium relationship between variables under cointegration conditions. The model's estimation and validation process is further strengthened through a series of complementary econometric procedures, including the Johansen Cointegration Test to confirm the existence of a long-term relationship, the Granger Causality Test to identify short-term directional causality, and post-estimation diagnostics through Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD) analysis to examine the magnitude, persistence, and contribution of each variable to systemic fluctuations from time to time. This integrated econometric approach provides a rigorous and comprehensive assessment of the transmission mechanisms linking human development, sharia social finance, fiscal policy, and poverty outcomes in Indonesia.

Data Collection

This study utilizes secondary annual time series data covering the period 1995 to 2024, obtained from several authoritative and credible national and international institutions. The Islamic Human Development Index (IHDI) and poverty rate data are sourced from the Central Statistics Agency (BPS), as they provide official and nationally recognized socio-economic indicators. Zakat data is collected from the National Zakat Agency (BAZNAS) and the Ministry of Religious Affairs, which reflects the formal figures of Islamic social finance distribution in Indonesia. Fiscal spending data related to education, health, and social assistance is taken from the Ministry of Finance (MoF), because this is a government budget allocation in the social sector. In addition, several macroeconomic indicators are referenced from the World Bank database to ensure international comparability and standardized analytical robustness. This comprehensive data source approach ensures reliability, validity, and accuracy for empirical econometric analysis.

Variabel Description

Table 1 Variable Description

Variable	Code	Description	Type
Poverty Rate	KM	Percentage of population below poverty line	Dependent
Islamic Human Development Index	IHDI	Composite index (education, income, health)	Independent
Zakat	ZIS	National zakat distribution value	Independent
Education Fiscal Expenditure	SP	Government spending on education	Independent
Health Fiscal Expenditure	SK	Government spending on health	Independent
Social Assistance	BS	Government expenditure for social protection	Independent

Econometric Considerations

The data analysis in this study followed the standard econometric procedure of the Vector Error Correction Model (VECM), starting with a stationary test using the Augmented Dickey-Fuller (ADF) method to identify the presence of the unit root and ensure that all variables are integrated in the same order, preferably I(1). Once stationarity is confirmed, the optimal lag length is selected based on the Akaike Information Criteria (AIC) and the Schwarz Information Criteria (SIC) to guarantee stable and efficient model specifications. The Johansen Cointegration test was then used to examine whether there was a long-term equilibrium relationship between the observed variables, using the Trace and Maximum Eigenvalue statistics as decision indicators. If cointegration is detected, the VECM approach is applied to estimate the model, allowing for long-term and short-term dynamic analysis, where Term Error Correction (ECT) serves as an indicator of the speed of adjustment towards long-term equilibrium. To further explore the influence of direction between variables, the Granger Causality Test is used to determine causal interactions in the short term. In addition, model diagnostics include Impulse Response Function (IRF) analysis to observe the effects of structural shocks over time and Forecast Error Variance Decomposition (FEVD) to evaluate how much each variable contributes to future variations in poverty levels. Together, these analytical measures provide a comprehensive and robust understanding of the long-term and short-term relationships in the model.

Model Specification

$$VAR\ (k), Zt = A1Zt\text{-}1 + A2ZT\text{-}2 + \ldots\ldots AkZt\text{-}k + Et \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

a. $IIHDI_t = \alpha_{12}\cdot IIHDI_{t-1} + \alpha_{13}\cdot ZIS_{t-1} + \alpha_{14}\cdot SK_{t-1} + \alpha_{15}\cdot SP_{t-1} + \alpha_{16}\cdot BS_{t-1} + \alpha_{17}\cdot KM_{t-1} + \alpha_{18}\cdot IIHDI_{t-2} + \alpha_{19}\cdot ZIS_{t-2} + \alpha_{20}\cdot SK_{t-2} + \alpha_{21}\cdot SP_{t-2} + \alpha_{22}\cdot BS_{t-2} + \alpha_{23}\cdot KM_{t-2} + \varepsilon 1_t$

b. $ZIS_t = \beta_{12}\cdot IIHDI_{t-1} + \beta_{13}\cdot ZIS_{t-1} + \beta_{14}\cdot SK_{t-1} + \beta_{15}\cdot SP_{t-1} + \beta_{16}\cdot BS_{t-1} + \beta_{17}\cdot KM_{t-1} + \beta_{18}\cdot IIHDI_{t-2} + \beta_{19}\cdot ZIS_{t-2} + \beta_{20}\cdot SK_{t-2} + \beta_{21}\cdot SP_{t-2} + \beta_{22}\cdot BS_{t-2} + \beta_{23}\cdot KM_{t-2} + \varepsilon 2_t$

c. $SK_t = \gamma_{12}\cdot IIHDI_{t-1} + \gamma_{13}\cdot ZIS_{t-1} + \gamma_{14}\cdot SK_{t-1} + \gamma_{15}\cdot SP_{t-1} + \gamma_{16}\cdot BS_{t-1} + \gamma_{17}\cdot KM_{t-1} + \gamma_{18}\cdot IIHDI_{t-2} + \gamma_{19}\cdot ZIS_{t-2} + \gamma_{20}\cdot SK_{t-2} + \gamma_{21}\cdot SP_{t-2} + \gamma_{22}\cdot BS_{t-2} + \gamma_{23}\cdot KM_{t-2} + \varepsilon 3_t$

d. $SP_t = \delta_{12}\cdot IIHDI_{t-1} + \delta_{13}\cdot ZIS_{t-1} + \delta_{14}\cdot SK_{t-1} + \delta_{15}\cdot SP_{t-1} + \delta_{16}\cdot BS_{t-1} + \delta_{17}\cdot KM_{t-1} + \delta_{18}\cdot IIHDI_{t-2} + \delta_{19}\cdot ZIS_{t-2} + \delta_{20}\cdot SK_{t-2} + \delta_{21}\cdot SP_{t-2} + \delta_{22}\cdot BS_{t-2} + \delta_{23}\cdot KM_{t-2} + \varepsilon 4_t$

e. $BS_t = \theta_{12} \cdot IIHDI_{t-1} + \theta_{13} \cdot ZIS_{t-1} + \theta_{14} \cdot SK_{t-1} + \theta_{15} \cdot SP_{t-1} + \theta_{16} \cdot BS_{t-1} + \theta_{17} \cdot KM_{t-1} + \theta_{18} \cdot IIHDI_{t-2} + \theta_{19} \cdot ZIS_{t-2} + \theta_{20} \cdot SK_{t-2} + \theta_{21} \cdot SP_{t-2} + \theta_{22} \cdot BS_{t-2} + \theta_{23} \cdot KM_{t-2} + \varepsilon_{5t}$

f. $KM_t = \lambda_{12} \cdot IIHDI_{t-1} + \lambda_{13} \cdot ZIS_{t-1} + \lambda_{14} \cdot SK_{t-1} + \lambda_{15} \cdot SP_{t-1} + \lambda_{16} \cdot BS_{t-1} + \lambda_{17} \cdot KM_{t-1} + \lambda_{18} \cdot IIHDI_{t-2} + \lambda_{19} \cdot ZIS_{t-2} + \lambda_{20} \cdot SK_{t-2} + \lambda_{21} \cdot SP_{t-2} + \lambda_{22} \cdot BS_{t-2} + \lambda_{23} \cdot KM_{t-2} + \varepsilon_{6t}$

Hypothesis Testing Criteria

a. Long-Run Hypotheses (H1a–H1e)

- H1a: The Human Development Index (IHDI) has a significant long-run effect on poverty reduction in Indonesia.
- H1b: Zakat (ZIS) has a significant long-run effect on poverty reduction in Indonesia.
- H1c: Education fiscal policy (PD) does not have a significant long-run effect on poverty reduction in Indonesia.
- H1d: Health fiscal policy (KS) has a significant long-run effect on poverty reduction in Indonesia.
- H1e: Social assistance (BS) does not have a significant long-run effect on poverty reduction in Indonesia

b. Long-Run Hypotheses (H1a–H1e)

- H2a: In the short run, there is no causal effect of IHDI, zakat, education fiscal policy, health fiscal policy, and social assistance on poverty reduction.
- H2b: In the short run, poverty (KM) has a significant effect on IHDI.
- H2c: Education fiscal policy (PD) has a significant short-run effect on IHDI.
- H2d: Health fiscal policy (KS) has a significant short-run effect on IHDI.
- H2e: Health fiscal policy (KS) has a significant short-run effect on social assistance (BS).
- H2f: Social assistance (BS) exhibits self-causality in the short run, meaning past social assistance affects current levels.

c. Long-Run Hypotheses (H1a–H1e)

- H3a: IHDI, zakat, education, health, and social fiscal policies jointly have no significant effect on poverty reduction.
- H3b: Poverty (KM), zakat, education, health, and social fiscal policies jointly have a significant effect on IHDI.
- H3c: Poverty (KM), IHDI, education, health, and social assistance jointly affect zakat (ZIS).
- H3d: Poverty (KM), IHDI, zakat (ZIS), health, and social assistance jointly affect education fiscal policy (PD).
- H3e: Poverty (KM), IHDI, zakat (ZIS), education (PD), and social assistance (BS) jointly do not affect health fiscal policy (KS).
- H3f: Poverty (KM), IHDI, zakat (ZIS), education (PD), and health fiscal policy (KS) jointly affect social assistance (BS).

Ethical Considerations

This study uses publicly accessible secondary data without human subject involvement; therefore, no ethical clearance is required.

RESULTS

Survey Findings

Table 2. Result of Root Test (Augmented Dickey Fuller)

Variable	Critical Value (α)	First Difference	
		ADF-statistic	P value
Poverty (KM)	0,05	-10.0213	0
IIHDI	0,05	-5.80401	0.0003
ZIS (ZIS)	0,05	-3.934269	0.0238
Fiscal of Education (PD)	0,05	-7.398727	0
Fiscal of health (KS)	0,05	-4.978583	0.0023
Social Assistance (BS)	0,05	-5.651723	0.0004

The stationarity assessment was conducted using the Augmented Dickey–Fuller (ADF) unit root test at the 5% significance level. The empirical findings confirm that all variables become stationary after first differencing. The poverty rate (KM) exhibits a highly significant ADF statistic of –10.0213 (p = 0.0000), indicating strong stationarity at the first difference level. Similarly, the Human Development Index (IIHDI) demonstrates a significant ADF statistic of –5.80401 (p = 0.0003), confirming the absence of a unit root after transformation.

In addition, Zakat (ZIS) achieves stationarity at the first difference with an ADF statistic of –3.934269 (p = 0.0238), which meets the 5% critical threshold. Fiscal education expenditure (PD) also shows robust stationarity, reflected by an ADF statistic of –7.398727 (p = 0.0000). Fiscal health expenditure (KS) yields a statistically significant ADF statistic of –4.978583 (p = 0.0023), while social assistance expenditure (BS) exhibits an ADF statistic of –5.651723 (p = 0.0004). These results confirm that all research variables are integrated of order one, I(1), and therefore eligible for subsequent cointegration and Vector Error Correction Model (VECM) analysis.

Table 3. Result of Optimal Lag

Lag	LogL	LR	FPE	AIC	SC	HQ
1	-611.1142	NA	2.77e+13*	47.93438*	49.66216*	48.44814*
2	-580.7009	33.79255	5.97e+13	48.34821	51.80378	49.37573

The optimal lag length was determined using the Log-Likelihood (LogL), Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan–Quinn (HQ). The results show that lag 1 outperforms other lag options, indicated by the smallest FPE, AIC, SC, and HQ values. Although the LR statistic reports an improvement at lag 2, the dominant and parsimonious criteria consistently select lag 1 as the most efficient specification. Therefore, the model proceeds using lag 1 as the optimal lag structure.

After confirming the optimal lag, the next step is to examine whether the model variables exhibit long-run cointegration dynamics. Accordingly, the Johansen Cointegration Test is applied to validate the existence of long-term equilibrium relationships among poverty, human development, zakat, education fiscal policy, health fiscal policy, and social assistance, which then justifies the use of the Vector Error Correction Model (VECM) framework.

Table 4. Cointegration Test Johansen

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.784465	121.6481	95.75366	0.0003
At most 1 *	0.663611	78.67841	69.81889	0.0083
At most 2 *	0.564033	48.17277	47.85613	0.0467
At most 3	0.412287	24.92748	29.79707	0.1641
At most 4	0.283832	10.04502	15.49471	0.2773
At most 5	0.024602	0.697476	3.841466	0.4036

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level

Based on Table 4, the value of cointegration Johansen cointegration test was employed to determine whether a stable long-run equilibrium relationship exists among the analyzed macro–socioeconomic variables. The trace statistic results reveal that three cointegrating vectors are significant at the 5% level. Specifically, the null hypotheses of no cointegration, at most one cointegration vector,

and at most two cointegration vectors are rejected, as indicated by trace statistics (121.6481; 78.67841; 48.17277) that exceed their respective 5% critical values and are supported by p-values below 0.05. Meanwhile, hypotheses from the third to the fifth rank are not rejected, suggesting that no additional cointegration relationships are statistically supported. These results confirm the presence of long-run interdependence among poverty, human development, zakat, fiscal education expenditure, fiscal health expenditure, and social assistance expenditure, thereby validating the implementation of a Vector Error Correction Model (VECM) for further empirical estimation and dynamic analysis.

Table 5. Resul Of Granger Causality Test

Null Hypothesis	Obs	F-Statistic	Prob.
IIHDI does not Granger Cause KM	29	1.23474	0.2767
KM does not Granger Cause IIHDI	29	0.40848	0.5283
ZIS does not Granger Cause KM	29	10.4789	0.0033
KM does not Granger Cause ZIS	29	0.31328	0.5805
PD does not Granger Cause KM	29	2.92811	0.099
KM does not Granger Cause PD	29	2.232	0.1472
KS does not Granger Cause KM	29	10.3386	0.0035
KM does not Granger Cause KS	29	1.61083	0.2156
BS does not Granger Cause KM	29	0.03744	0.8481
KM does not Granger Cause BS	29	3.23287	0.0838
ZIS does not Granger Cause IIHDI	29	0.42334	0.521
IIHDI does not Granger Cause ZIS	29	0.50749	0.4826
PD does not Granger Cause IIHDI	29	0.00402	0.9499
IIHDI does not Granger Cause PD	29	0.17464	0.6795
KS does not Granger Cause IIHDI	29	0.42754	0.5189
IIHDI does not Granger Cause KS	29	0.42078	0.5222
BS does not Granger Cause IIHDI	29	0.39664	0.5343
IIHDI does not Granger Cause BS	29	0.26294	0.6124
PD does not Granger Cause ZIS	29	5.73939	0.0241
ZIS does not Granger Cause PD	29	10.4547	0.0033
KS does not Granger Cause ZIS	29	9.02418	0.0058
ZIS does not Granger Cause KS	29	1.55537	0.2235
BS does not Granger Cause ZIS	29	0.02851	0.8672
ZIS does not Granger Cause BS	29	3.13062	0.0886
KS does not Granger Cause PD	29	2.92073	0.0994
PD does not Granger Cause KS	29	1.6929	0.2046
BS does not Granger Cause PD	29	0.04837	0.8276
PD does not Granger Cause BS	29	6.81863	0.0148
BS does not Granger Cause KS	29	0.0000051	0.9982
KS does not Granger Cause BS	29	1.30449	0.2638

Tabel 5, The Granger causality test was conducted to examine short-run directional causality among the studied variables. The results show that zakat (ZIS) and health fiscal expenditure (KS) significantly influence poverty (KM) in the short run, indicated by p-values of 0.0033 and 0.0035, respectively, confirming that both variables act as short-run predictors of poverty dynamics. Meanwhile, there is no short-run feedback causality from poverty toward ZIS or KS, nor from or toward IHDI, education fiscal expenditure (PD), or social assistance (BS), as all associated probability values exceed the 5% level.

In addition to poverty-related causality, the test reveals bidirectional causality between ZIS and PD, where PD influences ZIS ($p = 0.0241$) and ZIS influences PD ($p = 0.0033$), suggesting mutual policy interdependence. A unidirectional causality is also found from KS to ZIS ($p = 0.0058$), as well as from PD to BS ($p = 0.0148$). No causal relationship is detected among the remaining variable pairs, as their probability values fail to meet the significance threshold. Overall, these results confirm the existence of selective short-run causal interactions rather than a fully interconnected causal system across variables.

Table 6. Result of VECM Estimation in Short Term

Variabel	Koefisien	Std. Error	t-Stat
CointEq1 (ECT)	-0.296676	0.26291	-1.12844
D(KM(-1),2)	-0.250287	0.15570	-1.60750
D(IIHDI(-1),2)	-0.005456	0.00554	-0.98503
D(ZIS(-1),2)	0.003453	0.10918	0.03163
D(PD(-1),2)	-3.44E-07	1.1E-06	-0.31916
D(KS(-1),2)	0.056436	0.07098	0.79513
D(BS(-1),2)	-3.38E-07	5.6E-07	-0.60946
C (konstanta)	0.000608	0.01520	0.04001

Source: Processed Data

Tabel 6, The short-run estimation results presented in Table 6 show that none of the differenced independent variables significantly affect poverty (KM) in the short term, as indicated by all t-statistics being below the critical value of |2.0639|. This means that changes occurring in IIHDI, ZIS, fiscal education (PD), fiscal health (KS), and social assistance (BS) do not produce an immediate short-run adjustment effect on poverty dynamics within the observed period.

The error correction term (ECT) coefficient is negative (–0.296676) in accordance with theoretical expectations, reflecting the correct adjustment direction, although it is not statistically significant (t-stat = –1.12844). This implies that deviations from the long-run equilibrium path are corrected slowly, and the system does not exhibit rapid short-run convergence.

Furthermore, all lagged differenced explanatory variables also display non-significant effects on poverty, such as D(IIHDI(-1)), D(ZIS(-1)), D(PD(-1)), and D(BS(-1)), confirming the absence of short-run causality. In summary, the short-run VECM estimation indicates that poverty adjustment is not influenced by short-term fluctuations in human development, zakat-based transfers, education and health fiscal policies, or social assistance, but rather driven by long-term equilibrium forces.

Table 7, Result of VECM Estimation in Long Term

Variable	Coefficient	Std. Error	t-Stat
D(IIHDI(-1))	-0.029537	0.00523	-5.64905
D(ZIS(-1))	-0.461953	0.09898	-4.66717
D(PD(-1))	-1.60E-06	1.3E-06	-1.21103
D(KS(-1))	0.118637	0.05057	2.34583
D(BS(-1))	-6.22E-07	4.9E-07	-1.27594
C (konstanta)	0.169084	–	–

The long-run estimation results in Table 6 confirm that several structural variables significantly influence poverty levels (KM) in Indonesia within a long-term dynamic framework. The coefficient of IIHDI is negative and statistically significant (–0.029537; t-stat = –5.64905), indicating that long-term improvements in human development directly contribute to poverty reduction. Likewise, ZIS demonstrates a negative and significant long-run coefficient (–0.461953; t-stat = –4.66717), implying that zakat-based redistribution mechanisms play a meaningful role in alleviating long-term poverty through wealth transfer and social support channels.

Conversely, fiscal education expenditure (PD) does not exhibit a significant long-run effect on poverty reduction (t-stat = –1.21103), suggesting ineffective allocation, long implementation lag, or policy misalignment relative to poverty-targeted impact mechanisms. Meanwhile, fiscal health expenditure (KS) has a positive and statistically significant coefficient (0.118637; t-stat = 2.34583), reflecting that increasing public health spending is associated with long-run poverty reduction, potentially through productivity protection and healthcare cost mitigation. Social assistance (BS), although negative, does not yield significant long-run influence (t-stat = –1.27594), indicating that current assistance schemes may not be sufficiently targeted or empowering to generate sustained poverty reduction.

Overall, the results highlight that human capital enhancement and Islamic social finance redistribution are the most reliable long-term drivers of poverty alleviation, while fiscal policy

effectiveness varies depending on program design, timing, and structural alignment with socioeconomic vulnerability

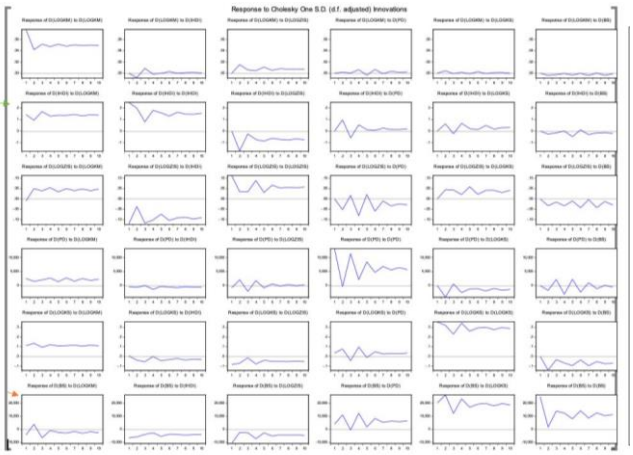


Figure 1. Impulse Response Function (IRF)

In figure 1. Impulse Response Function (IRF) results show that short-run shocks across variables do not create large or persistent dynamic effects, reinforcing the VECM and Granger findings that the system is predominantly long-run driven. Poverty (LOGKM) only responds briefly to its own shock before stabilizing, signaling the absence of self-reinforcing poverty cycles and indicating that poverty reduction does not react quickly to socioeconomic or fiscal disturbances. Human Development Index (IIHDI) displays a stronger reaction pattern, especially to poverty, education, and health expenditure shocks, confirming that human capital is more sensitive to socio-economic conditions and policy changes than poverty itself. Zakat (LOGZIS) reacts to initial shocks from poverty and development but quickly converges, implying that zakat allocation is responsive in the short run but does not escalate or persist over time. Fiscal education expenditure (PD) shows relatively volatile impulses, particularly when responding to shocks from social assistance and health expenditure, which suggests unstable short-term allocation behavior rather than a fixed strategic policy anchor. Meanwhile, fiscal health expenditure (LOGKS) demonstrates mild, gradual, and stable responses, implying that health spending tends to operate under longer-term planning rather than reacting abruptly to economic shocks. Social assistance expenditure (BS) presents the most persistent adjustment pattern, marked by strong self-response dynamics, emphasizing its path-dependency characteristics and inertia within social protection policies. Overall, the IRF confirms that the macro-socioeconomic and fiscal system under study adjusts slowly, reacts weakly to short-term disturbances, and stabilizes without generating long-term volatility, underscoring that equilibrium adjustments are predominantly long-run rather than shock-driven in the short run.

Table 8. Result of Variance Decomposition of GDP

Period	S.E.	D(KM)	D(IIHDI)	D(ZIS)	D(PD)	D(KS)	D(BS)
1	0.077381	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.089804	95.7913	0.7722	2.9659	0.0430	0.2432	0.1844
3	0.104149	95.7716	1.3041	2.5170	0.0338	0.1874	0.1861
4	0.114622	96.0	1.0927	2.2416	0.3344	0.1754	0.1573
5	0.126154	95.8057	0.9022	2.6110	0.3442	0.1513	0.1857
6	0.135271	95.8681	0.8318	2.4187	0.5432	0.1756	0.1626
7	0.144517	95.9750	0.7288	2.4498	0.4799	0.1563	0.2102
8	0.152764	96.1064	0.6565	2.4209	0.4835	0.1444	0.1883
9	0.160888	96.1995	0.6010	2.4007	0.4442	0.1358	0.2188
10	0.168312	96.3172	0.5508	2.3802	0.4256	0.1241	0.2021

Source: Processed Data

According to table 8, Variance Decomposition (VD) for poverty (D(KM)) confirms that the forecast error variance is dominantly explained by its own historical shocks across all horizons, exceeding 95% from period 1 to period 10. This implies that poverty in Indonesia exhibits high autoregressive

persistence and is minimally driven by short-run fluctuations in human development, zakat, education spending, health spending, or social assistance. Among the exogenous variables, zakat (D(ZIS)) consistently emerges as the largest external contributor to poverty variance, reaching approximately 2.38% in period 10, suggesting a modest yet non-negligible role of Islamic social finance in influencing poverty dynamics, although the impact remains weak in the short term. Contributions from IIHDI gradually increase but remain below 1.5%, indicating that human capital improvements produce gradual rather than immediate shocks to poverty levels. Meanwhile, fiscal policy variables—education, health, and social assistance display marginal explanatory power below 1%, implying that government spending programs have limited short-run shock effects despite potentially stronger long-run impacts. Overall, the VD results reinforce that short-run poverty movements in Indonesia are largely self-determined, with external socioeconomic and fiscal interventions showing limited immediate influence, thereby confirming a long-run adjustment structure rather than short-run responsiveness.

DISCUSSION

Interpretation of Long-Run Relationship Between Human Development, Islamic Social Finance, Fiscal Policy, and Poverty Reduction

The empirical findings from the Vector Error Correction Model (VECM), Granger causality analysis, Impulse Response Function (IRF), and Forecast Error Variance Decomposition (FEVD) collectively demonstrate that poverty dynamics in Indonesia are predominantly characterized by long-term structural relationships rather than immediate policy responses. The presence of three cointegration vectors confirms that poverty, human development, Islamic social finance, and fiscal policy instruments are interconnected within a stable long-run equilibrium framework.

The long-run estimation results indicate that Islamic Human Development Index (IHDI), zakat (ZIS), and health fiscal expenditure significantly influence poverty reduction, while education expenditure and social assistance do not demonstrate statistically significant long-run effects. These findings highlight that poverty alleviation is not solely determined by the magnitude of government spending or financial transfers but by the effectiveness through which resources are converted into improved human capabilities, economic opportunities, and social resilience.

The negative and significant coefficient of IHDI (−0.029537) confirms that improvements in human development contribute to reducing poverty in Indonesia. This result supports the capability approach, which conceptualizes poverty as a deprivation of fundamental capabilities rather than merely insufficient income. Improvements in education, health, and living standards increase individuals' ability to participate productively in economic activities, thereby improving employment opportunities and household income capacity.

However, the relatively moderate coefficient magnitude indicates that human development improvements generate poverty reduction through gradual structural transformation rather than immediate effects. Human capital formation requires time because improvements in education quality, health conditions, and productivity accumulate over years before producing measurable changes in household welfare. Therefore, the significant long-run effect of IHDI should be interpreted as evidence that sustainable poverty reduction depends on continuous investment in human capability rather than short-term intervention.

The findings regarding zakat (ZIS) provide additional evidence regarding the role of Islamic social finance as a redistributive mechanism in poverty alleviation. The negative and significant coefficient of ZIS (−0.461953) indicates that increasing zakat distribution is associated with lower poverty levels in the long run. Compared with IHDI, the larger coefficient suggests that zakat has a relatively stronger direct transmission mechanism because redistribution can immediately improve access to basic needs, productive resources, and economic support among vulnerable groups.

Nevertheless, the economic interpretation of this result requires careful consideration. Although ZIS demonstrates a significant long-run relationship, its contribution to short-run poverty fluctuations remains limited. The FEVD results show that the contribution of ZIS to poverty variance reaches only approximately 2.38% in the tenth period. This indicates that zakat has structural importance but has not yet achieved sufficient scale to become a dominant macroeconomic poverty reduction instrument.

This finding suggests that the effectiveness of zakat depends not only on the amount collected but also on institutional quality, distribution efficiency, and program orientation. A transition from consumptive assistance toward productive zakat programs, including entrepreneurship development, skills improvement, and income-generating activities, is necessary to maximize its long-term poverty reduction impact.

Health fiscal expenditure also shows a significant relationship with poverty reduction. The coefficient of health expenditure (0.118637) requires careful interpretation because the positive sign does not necessarily indicate that increased health spending causes higher poverty. Instead, this relationship may reflect a reactive fiscal mechanism, where government increases health expenditure in response to worsening socioeconomic conditions or greater poverty vulnerability. From an economic perspective, health expenditure remains a critical poverty reduction instrument because poor health conditions can reduce labour productivity, increase household financial burdens, and create vulnerability through catastrophic healthcare costs. Therefore, the long-run significance of health expenditure suggests that improving healthcare accessibility, preventive programs, and service quality may strengthen household resilience and reduce poverty risks.

Understanding the Insignificant Effects of Education Expenditure and Social Assistance

Although education expenditure and social assistance are theoretically expected to reduce poverty, the empirical results show insignificant long-run effects. These findings require deeper interpretation because statistical insignificance does not necessarily imply policy ineffectiveness. The insignificant effect of education expenditure may be explained by the existence of a long transmission mechanism between educational investment and poverty reduction. Unlike direct income transfers, education generates benefits through gradual improvements in skills, productivity, and labour market competitiveness. Therefore, education expenditure implemented during the observation period may require a longer period before producing measurable impacts on poverty indicators.

Another possible explanation relates to spending quality rather than spending quantity. Higher education budgets do not automatically translate into improved human capital if allocation efficiency remains limited. Education spending may have weaker poverty impacts when resources are concentrated on administrative expenditure, infrastructure development without quality improvement, or programs that are disconnected from labour market requirements. Therefore, the insignificant coefficient should not be interpreted as evidence that education investment is unnecessary. Instead, it indicates that education policy effectiveness depends on how resources are allocated, targeted, and transformed into meaningful capability improvements, particularly among vulnerable populations.

A similar interpretation applies to social assistance expenditure. Social assistance programs are generally designed as protective mechanisms to prevent households from experiencing severe welfare deterioration. However, their long-term poverty reduction impact depends on whether programs create pathways toward economic independence. The insignificant effect of social assistance suggests that existing assistance mechanisms may still have limited transformative capacity. If assistance remains focused primarily on short-term consumption support without integration with employment opportunities, skills development, or productive asset accumulation, its ability to permanently reduce poverty will remain constrained. Therefore, improving targeting accuracy, strengthening beneficiary identification systems, and integrating social assistance with empowerment programs are necessary steps to transform social protection from a temporary safety mechanism into a pathway toward sustainable poverty reduction.

Short-Run Dynamics and the Importance of Policy Consistency

The short-run VECM estimation demonstrates that changes in IHDI, ZIS, education expenditure, health expenditure, and social assistance do not immediately influence poverty reduction. This finding indicates that poverty dynamics in Indonesia are characterized by delayed policy transmission mechanisms. The absence of immediate effects does not necessarily indicate that poverty policies are ineffective. Instead, it reflects the structural nature of poverty, where accumulated disadvantages require persistent interventions before significant improvements become observable.

The error correction coefficient (ECT) of −0.296676 indicates that approximately 29.67% of deviations from long-run equilibrium are corrected annually, although the adjustment speed is statistically insignificant. This suggests that the poverty system adjusts gradually and requires sustained policy implementation to achieve equilibrium improvement. From a policy perspective, these results emphasize that poverty reduction strategies should not be evaluated solely through short-term changes in poverty rates. Governments need to maintain consistency, continuity, and coordination because human development programs, fiscal interventions, and social finance mechanisms require sufficient time horizons to generate measurable welfare improvements.

Theoretical and Policy Implications of Granger Causality Findings

The Granger causality results reveal selective causal relationships rather than a fully integrated causal system. One of the most important findings is the bidirectional causality between ZIS and education expenditure. The relationship between ZIS and education expenditure indicates that Islamic social finance and government fiscal policy may operate as complementary mechanisms in improving welfare outcomes. The influence of ZIS on education expenditure suggests that zakat institutions contribute to expanding educational access among disadvantaged groups. Conversely, the influence of education expenditure on ZIS implies that improvements in education may strengthen institutional participation and awareness regarding Islamic social finance.

This finding provides empirical support for a collaborative welfare framework where government institutions and Islamic financial organizations should not operate separately. Greater coordination between fiscal authorities, educational institutions, and zakat organizations may improve resource allocation efficiency and expand poverty reduction coverage. The causality from ZIS and health expenditure toward poverty also indicates that redistributive and basic service interventions remain important components of poverty reduction strategies. However, their effectiveness depends on governance capacity, targeting precision, and long-term institutional commitment.

Poverty Persistence and Structural Transformation: Evidence from Fevd and Irf

The FEVD results provide an important insight into the persistence of poverty in Indonesia. The variance decomposition shows that poverty itself explains more than 95% of its forecast variance throughout the ten forecasting periods. This indicates that poverty exhibits strong autoregressive characteristics, meaning that historical poverty conditions significantly influence future poverty dynamics. This finding has important policy implications. The dominance of internal poverty shocks suggests that poverty is not easily changed through isolated policy interventions or short-term budget increases. Instead, poverty reflects accumulated structural constraints, including limited human capital, restricted economic opportunities, and persistent vulnerability among disadvantaged households.

The limited contribution of external variables also indicates that policy instruments require stronger integration and effectiveness. Although ZIS provides the largest external contribution among explanatory variables, its influence remains relatively small, highlighting the need for broader institutional strengthening. The IRF results reinforce these findings by demonstrating that shocks from socioeconomic and fiscal variables generate gradual rather than immediate responses in poverty levels. The slow adjustment pattern confirms that poverty reduction follows a long-term development process rather than short-term policy reaction. Therefore, poverty alleviation strategies should prioritize structural transformation through sustained human development investment, productive economic inclusion, institutional strengthening, and integrated welfare governance.

CONCLUSION

The empirical results confirm a stable long-run equilibrium relationship among poverty, human development, zakat, education spending, health spending, and social assistance in Indonesia. Long-run estimates reveal that improvements in IHDI, the expansion of zakat distribution, and government health expenditure significantly reduce poverty, indicating that human capital enhancement, Islamic social finance, and public health investment are structural drivers of welfare improvement. In contrast, education spending and social assistance do not show a significant long-run impact, suggesting inefficiencies, leakage, or delayed benefit transmission. Short-run dynamics show no direct causal effect of IHDI, zakat, education, health, or social assistance on poverty, reflecting that poverty reduction policies operate with lagged effects rather than immediate responses. Meanwhile, short-run interactions

highlight that poverty significantly influences IHDI, while both education and health fiscal spending influence human development. FEVD and IRF results reinforce that innovations in poverty are primarily self-driven, with minimal explanatory contribution from other variables in the short term, confirming slow policy responsiveness. Overall, the evidence underscores that structural, capability-building, and empowerment-based interventions are more influential than short-term distributive spending for sustainable poverty reduction in Indonesia.

ACKNOWLEDGMENT

This study expands the empirical understanding of poverty reduction mechanisms in emerging Muslim-majority economies by integrating human development indicators, Islamic social finance, and sector-specific fiscal policies into a unified macro-dynamic framework using VECM. Unlike previous studies that examined IHDI, zakat, or government spending in isolation, this research provides a simultaneous causality assessment and identifies which policy instruments produce long-term structural effects versus those that yield limited short-run outcomes. The findings demonstrate that zakat and public health spending operate as long-run anti-poverty drivers, positioning Islamic social finance and health-oriented fiscal interventions as strategic pillars for welfare policy design. This research also contributes methodologically by confirming stable cointegration among multidimensional welfare determinants and revealing weak short-term policy responsiveness, offering a more realistic view of policy lag effects in developing countries. These insights refine theoretical debates on capability development, fiscal efficiency, and social protection design, providing evidence-based direction for hybrid welfare models that combine state fiscal policy with Islamic redistributive mechanisms.

AUTHOR CONTRIBUTION STATEMENT

Armin Rahmansyan Nasution, Muhammad Ramadhan, and Fitrawaty contributed to the development of this research, which examines the relationships among the Islamic Human Development Index, zakat, fiscal social policy, and poverty reduction in Indonesia. The study involved conceptualization, literature review, secondary data collection, econometric analysis using the Vector Error Correction Model (VECM), interpretation of empirical findings, and manuscript preparation. The specific distribution of these responsibilities among the authors should be confirmed before publication. All authors are expected to review and approve the final manuscript and accept accountability for their respective contributions.

AI DISCLOSURE STATEMENT

The manuscript does not explicitly disclose whether artificial intelligence (AI) tools were used during the research or manuscript preparation process. The authors should confirm whether generative AI or AI-assisted technologies contributed to language editing, manuscript organization, data processing, statistical analysis, or other research-related activities. Any such use should be transparently disclosed, including the name of the tool and its specific purpose, in accordance with applicable publication ethics and editorial requirements. The authors retain full responsibility for the accuracy, originality, integrity, and scientific validity of the published work.

FUNDING STATEMENT

This study was conducted using secondary data obtained from publicly accessible national and international institutional databases, including Statistics Indonesia (BPS), the National Zakat Agency (BAZNAS), relevant government ministries, and the World Bank. The manuscript does not identify any specific research grant, financial sponsor, or institutional funding arrangement supporting the study. Accordingly, the authors should confirm whether the research received external financial assistance. If no external funding was received, the statement may be finalized as follows: "This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors."

CONFLICTS OF INTEREST

The manuscript does not report any financial, professional, institutional, or personal relationships that could constitute potential conflicts of interest. The authors should confirm whether any circumstances could have influenced the research design, data analysis, interpretation of findings, or

presentation of conclusions. Subject to confirmation by all authors, the declaration may be finalized as follows: "The authors declare that they have no known financial or non-financial competing interests that could have influenced the research, analysis, interpretation, or publication of this manuscript."

REFERENCES

Azubuike, H., Jiburum, U., Nwachukwu, M. U., Mba, H. C., Okosun, A. E., & Nwanmuoh, E. E. (2024). Inclusive factor inputs for determination of human development index for informal settlements: A case study of Enugu city, Nigeria. Sage Open, 14(4). https://doi.org/10.1177/21582440241294144

Beik, I. S., & Arsyianti, L. D. (2021). Digital Technology and Its Impact on Islamic Social Finance Literacy. In Islamic FinTech (pp. 429–445). Springer International Publishing. https://doi.org/10.1007/978-3-030-45827-0_23

Chen, C., McCarl, B. A., & Chang, C. (2006). Estimating the Impacts of Government Interventions in the International Rice Market. Canadian Journal of Agricultural Economics/Revue Canadienne d'agroeconomie, 54(1), 81–100. https://doi.org/10.1111/j.1744-7976.2006.00039.x

Choiriyah, E. A. N., Kafi, A., Hikmah, I. F., & Indrawan, I. W. (2020). ZAKAT AND POVERTY ALLEVIATION IN INDONESIA: A PANEL ANALYSIS AT PROVINCIAL LEVEL. Journal of Islamic Monetary Economics and Finance, 6(4), 811–832. https://doi.org/10.21098/jimf.v6i4.1122

Daghagh Yazd, S., Pekin Alakoç, N., & Oroszlányová, M. (2025). Exploring the influence of high-technology and environmental factors on human development index: a longitudinal investigation. Cogent Social Sciences, 11(1). https://doi.org/10.1080/23311886.2025.2473642

Djulius, H., Lixian, X., & Lestari, A. N. (2022). The Impact of a Poor Family Assistance Program on Human Development in Indonesia.

Erni, E., Artis, A., & Rahman, R. (2024). Zakat Management Practices and Sustainable Development in Indonesia. Sinergi International Journal of Islamic Studies, 2(1), 24–37. https://doi.org/10.61194/ijis.v2i1.129

Garcés, P. (2023). The reasoning agent: agency in the capability approach and some implications for development research and practice. Revista Iberoamericana de Estudios de Desarrollo = Iberoamerican Journal of Development Studies, 9(2), 268–292. https://doi.org/10.26754/ojs_ried/ijds.491

Lustig, N. (2017). El impacto del sistema tributario y el gasto social en la distribución del ingreso y la pobreza en América Latina: Argentina, Bolivia, Brasil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, México, Nicaragua, Perú, República Dominicana, Uruguay y Venezuela Una aplicación del marco metodológico del proyecto Compromiso con la Equidad (CEQ). El Trimestre Económico, 84(335), 493–568. https://doi.org/10.20430/ete.v84i335.277

Mohd Tamam, M. Q., Yahya, W. J., Ithnin, A. M., Abdullah, N. R., Kadir, H. A., Rahman, M. M., Rahman, H. A., Abu Mansor, M. R., & Noge, H. (2023). Performance and emission studies of a common rail turbocharged diesel electric generator fueled with emulsifier free water/diesel emulsion. Energy, 268, 126704. https://doi.org/10.1016/j.energy.2023.126704

Mongkito, A. W., & Samdin, S. (2025). The Role of Zakat in Poverty Alleviation and Farmer Welfare; the Theoretical Review. Journal of Global Innovations in Agricultural Sciences, 285–296. https://doi.org/10.22194/JGIAS/25.1427

Muhammad, S., Zulham, T., Sapha, D., & Saputra, J. (2019). Investigating the Public Spending and Economical Growth on the Poverty Reduction in Indonesia. Industrial Engineering & Management Systems, 18(3), 495–500. https://doi.org/10.7232/iems.2019.18.3.495

Mukhlishin, M., Wahab, A., Setiaji, B., & Tazhdinov, M. (2024). Zakat Maal Management and Regulation Practices: Evidence from Malaysia, Turki and Indonesia. Journal of Human Rights, Culture and Legal System, 4(2), 569–592. https://doi.org/10.53955/jhcls.v4i2.204

Mutmainah, S., Rahayu, N. W. I., Fauzan, F., & Sholichin, A. A. (2024). The influence of zakat, Human Development Index, open unemployment rate, and income on poverty in Indonesia. Journal of Islamic Economics Lariba, 10(1), 363–382. https://doi.org/10.20885/jielariba.vol10.iss1.art20

Nugroho, A., Amir, H., Maududy, I., & Marlina, I. (2021). Poverty eradication programs in Indonesia: Progress, challenges and reforms. Journal of Policy Modeling, 43(6), 1204–1224. https://doi.org/10.1016/j.jpolmod.2021.05.002

O. Ojike, R., Ikpe, M., R. Uwajumogu, N., N. Yuni, D., A. Okwor, S., & O. Enyoghasim, M. (2021). Education, Health Spending, and Sustainable Development in Nigeria : Empirical Analysis using an ARDL Bounds Test Approach. African Journal of Business and Economic Research, 16(2), 29–50. https://doi.org/10.31920/1750-4562/2021/v16n2a2

Rodzi Embong, M., Taha, R., & Mohd Nor, M. N. (2013). Role of Zakat to Eradicate Poverty in Malaysia. Jurnal Pengurusan, 39, 141–150. https://doi.org/10.17576/pengurusan-2013-39-13

Rusydiana, A. S., Prakoso, M. F. D., Aslan, H., & Riani, R. (2025). Unveiling the effects of zakat toward socioeconomic empowerment in OIC countries. International Journal of Ethics and Systems. https://doi.org/10.1108/IJOES-10-2024-0331

Sarea, A. (Ed.). (2021). Impact of Zakat on Sustainable Economic Development. IGI Global. https://doi.org/10.4018/978-1-7998-3452-6

Shirazi, N., Md Isa, M., Abdul Kareem, M. A., & Eskandar Shah, M. E. S. (2023). Islamic Human Development Index (i-HDI) and Poverty Reduction in OIC Countries. Journal of King Abdulaziz University: Islamic Economics, 36(1), 71–90. https://doi.org/10.4197/Islec.36-1.4

Siburian, M. E. (2022). The link between fiscal decentralization and poverty – Evidence from Indonesia. Journal of Asian Economics, 81, 101493. https://doi.org/10.1016/j.asieco.2022.101493

Yusuf, A., Pervin, N., Román-González, M., & Noor, N. M. (2024). Generative <scp>AI</scp> in education and research: A systematic mapping review. Review of Education, 12(2). https://doi.org/10.1002/rev3.3489