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Unveiling The Nexus Between Zakat Distribution and Islamic Human Development Index: Implications for Poverty Reduction

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ABSTRACT

This study analyzes the interaction between zakat distribution and the Islamic Human Development Index (I-HDI) on the poverty rate in North Sumatra. The problem addressed in this research is the limited empirical evidence explaining how zakat and human development jointly influence poverty reduction in Muslim-majority regions. Fourteen districts/cities with complete annual data for the four-year period 2019–2022 were selected, producing panel data observations. This study employs the Panel Vector Error Correction Model (PVECM), which is suitable for analyzing causality, interdependence, and adjustment processes within non-stationary panel data. The results show that zakat distribution contributes to reducing poverty, although its effect becomes meaningful only after several periods when the adjustment process converges toward a consistent long-term pattern. Meanwhile, the I-HDI demonstrates a stronger and more persistent influence on poverty reduction, with its impact increasing until it reaches a stable long-run trajectory. The findings also indicate that zakat positively supports improvements in I-HDI, especially in later periods of the analysis. This study highlights the need to improve the efficiency and targeting of zakat distribution and to strengthen collaboration between zakat institutions and government development programs. The novelty of this research lies in the use of the I-HDI, an index based on *maqāṣid al-sharīʿah* that integrates spiritual, educational, health, and socioeconomic dimensions, offering a more contextual and holistic measure of human development compared to the conventional HDI.

1. Introduction

Poverty remains one of the most pressing development challenges in Indonesia, hindering efforts to achieve sustainable and inclusive economic growth (Leiwakabessy & Payapo, 2022; Sabri et al., 2024; Sijabat, 2024). Despite various poverty alleviation programs initiated by the government, such as the Family Hope Program (PKH), Public Health Insurance (Jamkesmas), Education Assistance Program, and Direct Cash Assistance (BLT), the impact has not been sufficiently effective. According to (Tamimi et al., 2023), these initiatives have yet to produce significant long-term results, leaving poverty as a persistent social issue (R. S. Abdullah & Nasirin, 2022; Wurarah et al., 2025). In North Sumatra Province, poverty

reduction has been a priority of local development policies. However, inequality across regions persists. Data from the Statistics Bureau of North Sumatra (Badan Pusat Statistik Provinsi Sumatera, 2024) reveals a fluctuating poverty rate, declining from 11.36% in 2010 to 8.42% in 2022, but previously spiking dramatically in 2015 to 20.53%. The World Bank's international poverty line of $2.15 (PPP, 2017) continues to highlight the severity of poverty in various regions (Baah et al., 2022), including North Sumatra.

North Sumatra is home to a predominantly Muslim population, accounting for approximately 66.79% of more than 15 million residents (Kusnandar, 2022). Given this demographic, Islamic institutions such as the National Amil Zakat Agency (BAZNAS) hold a strategic position in supporting poverty reduction efforts through Islamic philanthropic instruments, particularly zakat. BAZNAS, as a non-structural government institution, contributes to public welfare by managing and distributing zakat in accordance with Article 34 of the 1945 Constitution, which mandates state responsibility in caring for the poor and neglected children. In addition to zakat distribution, BAZNAS also engages in public education to raise awareness about the social and spiritual importance of zakat in developing responsible and compassionate individuals (Aziz & Sholikah, 2015).

Zakat serves not only as a religious obligation but also as an economic mechanism for redistributing income and wealth in an Islamic society. Unlike capitalist or socialist economic systems that often engage in ideological debates about wealth redistribution, Islam provides a comprehensive and time-tested framework through zakat. The Qur'an, for instance, emphasizes the significance of helping the poor in verses such as Al-Haqqah:34 and Al-Fajr:18. Zakat also supports socio-economic empowerment by functioning as a source of productive capital for *mustahik* (zakat beneficiaries), thereby creating employment opportunities. This concept has become part of Islamic economic theory that has contributed to the economic paradigm shift since the 1980s and 1990s (Almas, 2016). According to BAZNAS (2024), zakat distribution in North Sumatra has increased significantly from IDR 2.1 billion in 2016 to IDR 20.6 billion in 2024. Despite this progress, the effectiveness of zakat in substantially reducing poverty remains uncertain and requires further evaluation.

From the perspective of Islamic economics, human development is closely tied to the concepts of *maslahah* and *maqashid shariah*, which prioritize the protection of religion, life, intellect, lineage, and wealth. These principles are operationalized in the Islamic Human Development Index (I-HDI), a more contextualized alternative to the conventional Human Development Index (HDI), particularly in Muslim-majority societies (Viollani et al., 2022). Data from Statistics Indonesia (Badan Pusat Statistik Provinsi Sumatera, 2024) indicates that North Sumatra has two cities classified as having very high HDI levels (Medan and Pematangsiantar), 25 cities/regencies with high HDI, and six with moderate HDI. However, the absolute number of people living in poverty remains high, reaching 1.477 million in 2022. This discrepancy suggests that improvements in HDI or I-HDI do not automatically translate to effective poverty alleviation. The fluctuating poverty trend further implies that zakat distribution by BAZNAS in North Sumatra has yet to deliver optimal results. A more integrative evaluation based on I-HDI and *maqashid shariah* is needed to ensure sustainable and impactful poverty alleviation strategies.

Previous studies have explored the relationship between zakat and poverty reduction from different angles. Research by Syafii et al. (2021) and Murniati & Beik (2014) found a significant positive effect of zakat on *mustahik* income and poverty alleviation. Fitrowati et al. (2022) introduced zakat as a moderating variable that strengthens the influence of HDI and economic growth on poverty. Furthermore, (Widiastuti et al., 2022) utilized the I-HDI framework and demonstrated its effectiveness in reducing poverty among member countries of the Organization of Islamic Cooperation (OIC). However, several research gaps remain unaddressed. First, there is a lack of empirical studies that specifically analyze the dynamic relationship between zakat distribution and I-HDI in the context of poverty in North Sumatra. Second, many existing studies use static analysis methods and do not account for long-term or reciprocal relationships among variables.

This study aims to address these gaps by introducing a novel analytical framework that combines zakat distribution and I-HDI to assess their joint effect on poverty reduction in North Sumatra. The novelty of this research lies in three main aspects. First, it integrates Zakat Distribution and I-HDI as the central variables in explaining poverty reduction within the Islamic economic paradigm. Second, it employs a dynamic econometric model Panel Vector Autoregression (PVAR), which allows all variables to be treated as endogenous and examines their interactions over time. Third, it provides a region-specific analysis focused on North Sumatra during the 2019–2022 period, offering localized insights that are often overlooked in national-level studies.

Conceptually, this study is grounded in the maqashid shariah approach, where zakat distribution is expected to enhance human development (I-HDI), which in turn contributes to sustainable poverty reduction. Thus, zakat distribution and I-HDI are treated as interconnected variables influencing poverty reduction simultaneously. This conceptual framework positions I-HDI as both an outcome of zakat distribution and a mediating factor in reducing poverty.

Zakat, as an Islamic social finance instrument, plays a strategic role in poverty alleviation and improving human welfare. Previous studies show that zakat distribution has a significant impact on reducing poverty (Martaliah et al., 2023; Tamimi et al., 2023) and enhancing human development (Suprayitno et al., 2017). Similarly, the Islamic Human Development Index (I-HDI), which measures education, health, and governance from an Islamic perspective, also contributes to poverty reduction (Shirazi et al., 2023; Widiastuti et al., 2022). Effective zakat distribution not only alleviates poverty but also strengthens I-HDI by improving access to education, health, and income levels, ultimately accelerating community welfare. Thus, zakat and I-HDI are interrelated and mutually reinforcing in reducing poverty and achieving sustainable development.

The findings from this research are expected to contribute meaningfully to the literature on Islamic economics and development studies by offering empirical evidence on the effectiveness of Islamic philanthropy in addressing poverty (Agussalim et al., 2024; Wurarah et al., 2025). Additionally, this study provides practical insights for policymakers, especially in enhancing zakat distribution strategies and aligning them with I-HDI principles. Ultimately, the study emphasizes the urgency of adopting a more holistic, faith-based approach to human development

that ensures poverty alleviation efforts are not only short-term solutions but also sustainable initiatives for long-term welfare in North Sumatra.

2. Literature Review
2.1. Poverty

Poverty can be defined as a multidimensional deprivation that is not only related to a lack of material resources, but also includes various non-material limitations that affect the welfare of individuals and households, as described in the World Bank report (D'Attoma & Matteucci, 2024). Each year, the United Nations Development Programme (UNDP) publishes the Human Development Report, providing a data driven global assessment of progress in poverty reduction and human development through updated indices, comparative analyses, and policy oriented insights (Alam, 2017). The concept of poverty cannot be separated from its historical and cultural contexts, as its meaning is continually shaped through the social constructions of specific societies (Jones & Tvedten, 2019). Poverty is a socially constructed phenomenon, and the way it is understood may vary across different groups within the same society. Although poverty is socially constructed, this does not negate its reality; rather, such construction reflects the collective engagement of society in defining its meaning (Baah et al., 2022) (Dean, 2016). Consequently, poverty is not merely a social phenomenon but also a political construct, closely linked to the distribution of resources both within and between societies. This complexity makes poverty a highly contested issue. As American historian Michael B. Katz argues, poverty remains a national disgrace partly because of how it is defined and conceptualized, which, in turn, shapes the energy and commitment directed toward its eradication (Katz & Katz, 2013). The conceptualization of poverty has direct implications for policy practices, as it carries implicit explanations that underpin public policy formulation. The emphasis in addressing poverty varies—ranging from socioeconomic structural conditions and power relations to cultural and individual behavioral factors. Thus, policies designed to combat poverty often reflect dominant conceptual frameworks. (Lister, 2021)

Poverty reduction serves as a critical strategy for fostering a global community with a shared future and for promoting sustainable development across countries and regions (Chansanam & Li, 2022). Several programs have been implemented to alleviate poverty, utilizing two main strategic approaches. The indirect strategy involves formulating macroeconomic policy frameworks aimed at ensuring sustainable economic growth, expanding employment opportunities, increasing per capita income, and ultimately reducing poverty levels. Conversely, the direct strategy focuses on providing assistance to underprivileged populations by enhancing access to credit, improving healthcare services, increasing literacy rates, and thereby working toward the overall eradication of poverty. Zakat is an instrument that serves to create equitable welfare within society, because its distribution mechanism allows for the reallocation of resources from groups with greater economic capacity to less fortunate groups, thereby promoting social justice and balanced development (Ahmed et al., 2017). Zakat contributes to the improvement of social welfare within society. This improvement can be achieved more effectively when the distribution process is carried out efficiently and zakat management institutions are able to maximize the

utilization of available funds (Maisyarah & Hamzah, 2024). The concept of zakat distribution, rooted in Islamic economic principles, has evolved from a mere religious obligation into a potential institutional mechanism for poverty alleviation and human development (H., 2004). In Bahrain, the distribution of zakat has been shown to effectively reduce poverty rates. A similar outcome is observed in Tunisia, where zakat plays a significant role in decreasing poverty levels across several regions (Arbi et al., 2024).

Zakat has a fundamental purpose in overcoming various social problems, such as unemployment, poverty, and underdevelopment. Distribution of zakat to those who are entitled to receive zakat or *mustahiq* zakat, which is carried out with the aim of distributing consumptive zakat and productive zakat. The distribution of zakat is carried out properly and fairly to all *mustahiq* (Nafi', 2020). The distribution of zakat through official institutions is seen as a strategic mechanism to answer social problems that occur in society. In addition, zakat plays a role in providing assistance to the poor without discrimination on the basis of race, tribe, ethnicity, skin color, or other worldly attributes. Therefore, zakat plays a very vital and urgent role to be fulfilled consistently as part of the instrument of social justice in the Islamic economy (Cahyani et al., 2019).

While zakat is mandated as a spiritual duty, its function in contemporary socio-economic systems is increasingly analyzed through the lens of redistribution, equity, and sustainable development (Shah Shirazi, 2014). Zakat distribution can be categorized into two main areas: distribution and utilization. Based on BAZNAS Regulation No. 3 of 2018 concerning Distribution and Utilization, distribution refers to the provision of zakat to beneficiaries in the form of consumptive assistance. In contrast, utilization involves the productive use of zakat in a manner that maintains its value and benefits, aiming to generate broader social welfare through sustainable economic activities (Nisa & Hasibuan, 2022). From the Islamic economic perspective, transparent and effective zakat distribution plays a crucial role in promoting income equality, enhancing social welfare, and supporting economic stability. It serves not only as a means of spiritual and financial purification but also as a fiscal instrument that mobilizes resources, empowers the poor, and fosters self-reliance (N. Abdullah & Saad, 2014).

Various studies have shown that the effectiveness of zakat distribution contributes to poverty reduction. (Martaliah et al., 2023) found that although simultaneously zakat has a significant effect on poverty rates, partially the impact is not always significant. (Rukiah, 2019) showed that fiscal policies related to education and health contribute significantly to poverty reduction through improving human development. (Suprayitno et al., 2017) identified a positive relationship between zakat and human development in Malaysia, while (Tamimi et al., 2023) confirmed that zakat plays a role in poverty alleviation in Indonesia.

The Islamic Human Development Index (I-HDI) reflects the quality of human resources from an Islamic perspective, covering aspects of education, health and governance. Widiastuti et al. (2022) found that an increase in I-HDI contributes to poverty reduction, because better education and health factors can improve the quality of life and encourage more pro-human development government policies. Shirazi et al. (2023) confirmed that maqashid shariah-based I-HDI can help alleviate poverty within the framework of sustainable development (SDG 2030).

As a social finance instrument in Islam, zakat has a strategic role in improving people's quality of life. Effective distribution of zakat funds can improve access to education, health services, as well as improve social welfare, which contributes to an increase in I-HDI. (Rukiah, 2019) found that fiscal policies related to education and health have an effect on I-HDI. (Syafii et al., 2021) showed that zakat can increase the income of asnaf in North Sumatra, thus having a positive impact on their quality of life. (Tamimi et al., 2023) concluded that zakat contributes to poverty reduction as well as a significant increase in I-HDI in Indonesia. These findings show that zakat is not only an economic aid, but also a social development instrument that can improve the overall welfare of the community.

2.2. Contribution and interaction between zakat fund distribution and the poverty rate.

Zakat distribution is theoretically grounded in Islamic economic principles that view zakat as a redistributive mechanism aimed at reducing economic inequality and supporting the poor. The logic behind this relationship suggests that when zakat funds are distributed effectively, whether through consumptive assistance or productive empowerment programs, they increase the income and economic capacity of *mustahik*, thereby reducing their vulnerability to poverty. Empirical evidence supports this view: studies consistently show that well-managed zakat distribution contributes to poverty alleviation. For instance, (Martaliah et al., 2023) found that zakat distribution significantly influences poverty reduction when considered simultaneously, while (Tamimi et al., 2023) demonstrated that zakat has a positive and significant effect on decreasing poverty in Indonesia. Similarly, (Suprayitno et al., 2017) highlighted zakat's positive role in improving human welfare in Malaysia. These findings collectively reinforce the theoretical expectation that effective zakat distribution contributes to lowering the poverty rate. Hence, first hypothesis proposes that zakat fund distribution contributes to and interacts with the poverty rate.

H_1: There is a contribution and interaction between zakat fund distribution and the poverty rate.

2.3. Contribution and interaction between the Islamic Human Development Index (I-HDI) and the poverty rate.

The Islamic Human Development Index (I-HDI) is rooted in human development theory and *maqāṣid al-sharī'ah*, emphasizing improvements in education, health, welfare, and governance as pathways to enhanced human well-being (Kadir et al., 2022). Conceptually, increased human development reduces poverty by improving individuals' capabilities, productivity, and access to essential services. Strong I-HDI performance typically enables better educational attainment, healthier populations, and more efficient public governance, all of which reduce household economic burdens and strengthen opportunities for upward mobility. Empirical findings support this theoretical linkage (Widiastuti et al., 2022). found that I-HDI has a negative and significant relationship with poverty, indicating that higher levels of human development correlate with lower poverty rates. (Shah Shirazi, 2014) further demonstrated that I-HDI, aligned with *maqāṣid al-sharī'ah* and the SDGs, contributes holistically to poverty reduction across Muslim-majority regions. These studies verify

that improvements in Islamic-oriented human development lower poverty rates. Based on this rationale, second hypothesis proposes that the Islamic Human Development Index contributes to and interacts with the poverty rate.

H₂: There is a contribution and interaction between the Islamic Human Development Index (I-HDI) and the poverty rate.

2.4. Contribution and interaction between zakat fund distribution and the Islamic Human Development Index (I-HDI).

Zakat distribution theory positions zakat as not only an economic relief mechanism but also a catalyst for human development by enhancing access to education, healthcare, and social welfare—core components of the Islamic Human Development Index. The logical connection suggests that when zakat funds are distributed effectively to targeted groups, they can improve beneficiaries' living conditions, support educational continuity, and enhance health outcomes, all of which directly contribute to higher I-HDI scores. Findings from prior research strengthen this theoretical linkage. (Rukiah, 2019) showed that fiscal policies related to health and education significantly influence I-HDI levels, while (Syafii et al., 2021) found that zakat improves household income and welfare among *asnaf* in North Sumatra. Additionally, (Tamimi et al., 2023) provided evidence that zakat contributes positively to both poverty reduction and improvements in human development indicators. These observations confirm that zakat distribution functions as a strategic instrument in enhancing the quality of human development. Therefore, third hypothesis proposes that zakat fund distribution contributes to and interacts with the Islamic Human Development Index.

H₃: There is a contribution and interaction between zakat fund distribution and the Islamic Human Development Index (I-HDI).
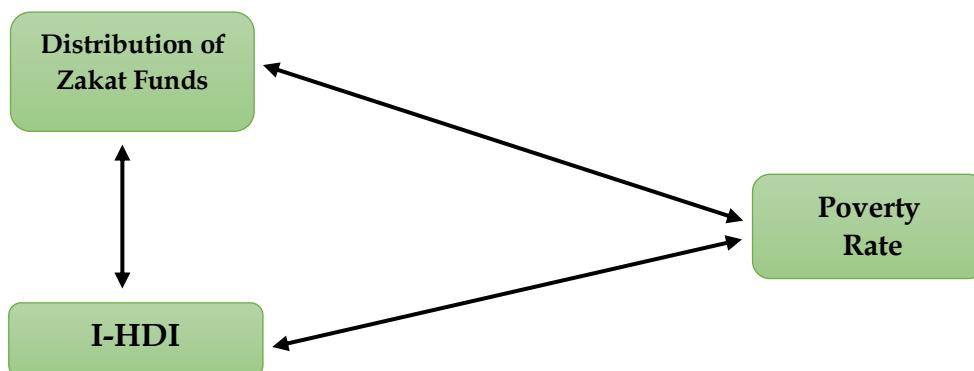

Figure 1. Conceptual Framework
Source: figure processed by authors

The conceptual framework of this study analyzes how the distribution of zakat and the Islamic Human Development Index (I-HDI) contribute to reducing poverty rates in North Sumatra. In the context of Islamic economic development, zakat functions as a redistribution instrument that promotes social welfare, while the I-HDI reflects human development achievements through education, health, and living standards. The interaction between zakat distribution and I-HDI improvement is key to reducing poverty and achieving sustainable welfare equality.

3. Research Method

The present study employs a quantitative research design using annual panel data to examine the dynamic relationships between zakat distribution, the Islamic Human Development Index (I-HDI), and poverty rates in North Sumatra. The population consists of 34 districts/cities over a 33-year period (1990–2023), but the final sample follows purposive sampling based on data completeness, variable consistency, and comparability across regions. As a result, 14 districts/cities with complete monthly data which is then accumulated into annual data for the four-year period 2019–2022 were selected. Although four years is not sufficiently long to represent a long-term horizon, the accumulated dataset across 14 cross-sectional units yields 56 observations, allowing reliable panel estimation. All variables are measured using ratio scales. Zakat is operationalized using the total annual zakat disbursement (rupiah value), I-HDI is measured using a composite index derived from five *maqashid sharia* dimensions, and poverty is represented by the annual poverty rate published by BPS. To ensure transparency and measurement clarity, the operational definitions of all variables are summarized in the table below.

Table 1. Operational Definitions of Variables

No	Variable	Operational Definition	Indicator	References
1	Zakat Distribution	The annual distribution of zakat funds allocated to eligible recipients (*mustahik*) through consumptive or productive programs to ensure fair and equitable welfare improvement.	Total Zakat Distribution (Rp)	(Rukiah, 2019)
2	Islamic Human Development Index (I-HDI)	A composite index measuring human development based on both material and non-material welfare using five *maqashid sharia* dimensions—preservation of life, wealth, intellect, faith, and lineage.	I-HDI = 2/5(ID) + 1/5(INF + IA + INS + IM) × 100%	(Rukiah, 2019)
3	Poverty Rate	The inability of households to meet minimum standards of basic needs, both food and non-food, as defined by BPS.	Annual Poverty Rate (%)	(Badan Pusat Statistik Indonesia, 2024)

The analysis applies the Panel Vector Autoregression (PVAR) method to evaluate the reciprocal interactions among zakat distribution, I-HDI, and poverty. PVAR integrates the strengths of VAR and panel data, enabling simultaneous assessment of temporal dynamics and cross-regional heterogeneity (Yang et al., 2023). Prior to estimation, the data are examined using the Augmented Dickey–Fuller (ADF) test to ensure stationarity, followed by lag-length selection using AIC, SC, and HQC criteria. The mathematical representation of the PVAR model takes the general form:

$$Y_{it} = A_1 Y_{i,t-1} + A_2 Y_{i,t-2} + \cdots + \mu_i + \varepsilon_{it},$$

$$PVR_{it} = c + A_1\, IHDI_{it1} + A_2\, ZKT_{it2} + \varepsilon_{it}$$

where Y_{it} is the vector of endogenous variables (zakat distribution, I-HDI, poverty rate), A_j represents the coefficient matrices, μ_i captures unit-specific effects, and ε_{it} is the error term. The model is estimated using EViews 12.

Following PVAR estimation, several advanced diagnostic and dynamic analyses are conducted. Granger causality tests are used to identify predictive causal directions among variables, while cointegration tests determine whether long-run equilibrium relationships exist when variables become stationary after differencing. If cointegration is detected, the Panel Vector Error Correction Model (PVECM) is used. The Impulse Response Function (IRF) is employed to trace the effect of one-time shocks on the future values of other variables, and Forecast Error Variance Decomposition (FEVD) quantifies the contribution of each variable to the variance in the forecasting errors of the system. Through this comprehensive methodological approach, the study provides a rigorous assessment of the interconnected dynamics between zakat distribution, human development, and poverty within the framework of Islamic economics.

4. Result

To provide an overview of the distribution and characteristics of the variables used in this study, descriptive statistical analysis was conducted for Poverty, Zakat distribution, and the Islamic Human Development Index (I-HDI). These statistics summarize the central tendency, dispersion, and distributional properties of the dataset before proceeding to dynamic panel analysis.

The descriptive results indicate substantial variation across the three variables. Poverty has a relatively moderate mean value with low skewness, suggesting a fairly symmetric distribution across districts. Zakat distribution shows a very high standard deviation and strong positive skewness, reflecting wide disparities in zakat disbursement among regions, with a few districts receiving exceptionally large allocations. Meanwhile, I-HDI ranges widely from very low to very high values, indicating significant differences in human development conditions across North Sumatra. The Jarque–Bera probabilities for Poverty and I-HDI exceed 0.05, suggesting that these variables follow an approximately normal distribution, while Zakat shows a significant deviation from normality due to extreme values in the upper tail. Overall, the descriptive results demonstrate adequate variability and distributional characteristics suitable for dynamic panel estimation.

Table 2: Descriptive Statistics

	POVERTY	ZAKAT	IHDI
Mean	8.233559	1.51E+09	56.95115
Median	8.560000	7.96E+08	57.84758
Maximum	12.67000	1.17E+10	102.0455
Minimum	2.090629	17.73379	3.691924
Std. Dev.	3.092347	1.96E+09	27.70291
Skewness	-0.671718	2.886812	-0.578737
Kurtosis	2.768756	14.36912	2.472358

Jarque-Bera	4.336017	379.3804	3.775689
Probability	0.114405	0.000000	0.151398
Sum	461.0793	8.48E+10	3189.264
Sum Sq. Dev.	525.9435	2.11E+20	42209.83
Observations	56	56	56

Source: data processeed by authors

This study successfully fulfills all methodological requirements for conducting a Panel Vector Autoregression (PVAR) analysis. The stationarity requirement was met through the Augmented Dickey-Fuller (ADF) unit root test, which confirmed that all variables (Poverty Rate, Zakat, and the Islamic Human Development Index (I-HDI)) become stationary at the first difference level. The unit root test results further indicate that these variables are stationary within the panel data structure, ensuring the absence of stochastic trends. The stability assessment also demonstrated that all characteristic roots have a modulus less than one and lie within the unit circle, confirming that the system is dynamically stable. Moreover, the optimal lag length was determined to be lag 1 based on consistent results across multiple selection criteria, including the Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hannan–Quinn Criterion (HQ). With stationarity achieved, dynamic stability confirmed, and lag structure optimized, the analysis appropriately proceeds to the Panel Vector Error Correction Model (PVECM) to examine the long-term equilibrium relationships among the variables.

The following are the results of the PVECM estimation in the long-term poverty equation model:

Table 3: Estimation of Long-Term and Short Term Poverty Model

Endogenous	Exogenous	Coefficient	S.E	T-Stat
		Long Term		
POVERTY	IHDI	0,155018	0,06920	2,24002
(-0.322680)	ZKT	-0,019948	0,03009	-0,66299
		Short Term		
POVERTY	IHDI	-0,026913	0,00738	-3,64809
(0.324553)	ZKT	0,006048	0,00459	1,31743

Source: data processeed by authors

Based on the PVECM estimation, the long-term poverty equation model formed is:

$$PVR_{it(LONG-TERM)} = -0,323 + 0,15\ IHDI_{it1} - 0,019\ ZKT_{it2} + \varepsilon_{it}$$

$$PVR_{it(SHORT-TERM)} = 0,325 - 0,027\ IHDI_{it1} + 0,006\ ZKT_{it2} + \varepsilon_{it}$$

The estimation results of the Panel Vector Error Correction Model (PVECM) show the relationship between poverty, the Islamic Human Development Index (IHDI), and zakat distribution in both the long and short term. In the long-term model, an increase in zakat distribution contributes to a reduction in poverty, while an increase in IHDI is associated with a rise in poverty, which may indicate that

improvements in human development do not immediately translate into poverty reduction due to structural or distributional issues. In the short-term model, the findings show that when IHDI improves, poverty tends to decrease, suggesting that short-term investments in human development can quickly benefit poverty alleviation. However, in the short term, an increase in zakat distribution is followed by a slight increase in poverty, possibly due to delays in the distribution process or temporary mismatches in targeting. These results reflect the complex and time-dependent nature of how development and social instruments like zakat influence poverty rates.

Table 4: Impulse Response Functions (IRFs) Poverty Model

	Response of D(POVERTY):		
Period	**D(POVERTY)**	**D(ZAKAT)**	**D(IHDI)**
1	0,01955	0	0
2	0,026273	-7,57E-07	0,009655
3	0,02843	-0,004948	0,021604
4	0,02907	-0,007747	0,030986
5	0,02869	-0,010419	0,037378
6	0,028671	-0,011983	0,041947
7	0,028202	-0,013061	0,044463
8	0,028235	-0,013736	0,046384
9	0,027926	-0,014112	0,047208
10	0,028016	-0,014385	0,048005
11	0,02782	-0,014498	0,048205
12	0,02792	-0,014611	0,048561
13	0,027788	-0,014635	0,048559
14	0,027877	-0,014686	0,048741
15	0,027784	-0,014682	0,048686

Source: data processeed by authors

The Impulse Response Function (IRF) analysis shows how poverty responds dynamically to changes in zakat and I-HDI over 15 periods. The response of poverty to I-HDI is significantly positive, beginning at 0.0097 in period 2 and increasing consistently to 0.0487 in period 15. This indicates that improvements in human development—through education, health, and living standards, have a strong, cumulative impact on reducing poverty over time. Meanwhile, the impact of zakat distribution on poverty starts to appear in period 3 with a negative value of -0.0049 and continues to decline to -0.0147 in period 15. This gradual effect suggests that zakat may require a longer implementation period to effectively influence poverty reduction, although the magnitude of its effect remains relatively small. These trends are consistent with the long-term PVECM results, where I-HDI significantly affects poverty (t-statistic = 2.24 > 1.98), while zakat does not (t-statistic = -0.66 < 1.98).

The Forecast Error Variance Decomposition (FEVD) further confirms the dominant long-term influence of I-HDI on poverty. In the first period, poverty is fully explained by its own shocks (100%). However, by the 15th period, this influence declines to 29.47%, while I-HDI accounts for 64.92% of the variance in poverty. Zakat begins to contribute from period 3 (0.99%) and gradually increases to 5.61% in period

15. These results reinforce the conclusion that human development efforts have a more substantial and growing impact on poverty alleviation compared to zakat. The short-term PVECM results also align with this, showing that I-HDI significantly affects poverty in the short run (t-statistic = -3.65 > 1.98), while zakat remains insignificant (t-statistic = 1.32 < 1.98). Thus, both the IRF and FEVD models highlight the consistent and increasing importance of I-HDI in poverty reduction across time horizons.

Table 5: Forecasting Error Variance Decomposition Poverty Model

		Variance Decomposition of D(POVERTY):		
Period	S.E.	D(POVERTY)	D(ZAKAT)	D(IHDI)
1	0,01955	100	0	0
2	0,034143	92,00342	4,91E-08	7,99658
3	0,049651	76,29255	0,99309	22,71436
4	0,065806	62,94623	1,951319	35,10245
5	0,081604	53,29424	2,898988	43,80678
6	0,096873	46,5772	3,587291	49,83551
7	0,111028	41,90979	4,114652	53,97556
8	0,124357	38,56263	4,499892	56,93748
9	0,136646	36,1148	4,79348	59,09172
10	0,148217	34,26876	5,016123	60,71511
11	0,158985	32,84596	5,191275	61,96277
12	0,169196	31,72394	5,329266	62,9468
13	0,178806	30,82071	5,441688	63,7376
14	0,18799	30,082	5,533282	64,38471
15	0,196718	29,46654	5,610224	64,92323

Source: data processeed by authors

Despite the theoretical role of zakat in supporting the poor, the empirical test results indicate that its effect is not statistically significant in either the short or long term. Additionally, the PVECM test shows that zakat does not significantly influence I-HDI (t-statistic = -0.11 < 1.98), suggesting that current zakat distribution mechanisms may lack the integration and scale needed to contribute meaningfully to human development. Therefore, to improve zakat's long-term effectiveness, it is necessary to restructure its distribution through targeted, sustainable programs aligned with education, health, and economic empowerment. This study concludes that enhancing human development via the I-HDI has a stronger, measurable, and statistically significant impact on poverty alleviation in North Sumatra than zakat distribution alone.

5. Discussion

5.1 Contribution and interaction between zakat fund distribution and the poverty rate.

The PVECM results indicate that zakat distribution has a negative long-term association with poverty, implying that increasing zakat disbursement tends to reduce poverty; however, the effect is statistically insignificant. This finding suggests that

although zakat theoretically functions as a direct poverty alleviation mechanism, its current implementation—whether in scope, targeting, or timeliness—may not yet be optimal in generating strong or sustained impacts. Theoretically, zakat is designed within Islamic economic principles as a redistributive instrument that channels wealth to the poor to improve welfare and reduce deprivation. Yet, the insignificant relationship found here aligns with earlier empirical studies showing that zakat's effectiveness depends heavily on institutional efficiency, accurate *mustahik* identification, and integration with development-oriented programs. Logically, if zakat distribution remains fragmented or limited in coverage, the expected reduction in poverty may not materialize. The implication is that zakat institutions must enhance governance, transparency, and strategic targeting—particularly by linking zakat allocation to productive sectors, skills development, and local economic empowerment to ensure measurable and long-term poverty reduction.

5.2 Contribution and interaction between the Islamic Human Development Index (I-HDI) and the poverty rate.

The study finds that the Islamic Human Development Index (I-HDI) exerts a significant and positive influence on poverty in the long term, while demonstrating a significant poverty-reducing effect in the short term. This duality suggests that improvements in human development do not automatically guarantee long-term poverty reduction unless accompanied by equitable access and inclusive distribution of social services. The result is consistent with human development theory and UNDP's framework, which emphasizes that education, health, and living standards contribute to poverty alleviation only when the gains are accessible to marginalized communities. Supporting empirical evidence from previous studies also indicates that human development contributes to reducing poverty by expanding opportunities and enhancing capabilities, although these effects may be uneven across regions. Logically, when improvements in I-HDI indicators are concentrated geographically or socioeconomically, poverty may persist in underserved communities, explaining the unexpected long-term positive effect. The implication is that policymakers must focus not only on raising I-HDI scores but also on ensuring inclusive, equitable distribution of human development benefits to achieve sustained poverty reduction.

5.3 Contribution and interaction between zakat fund distribution and the Islamic Human Development Index (I-HDI).

The PVECM analysis shows no significant interaction between zakat distribution and the Islamic Human Development Index (I-HDI), indicating that both variables operate independently rather than complementing each other in improving welfare outcomes. This finding highlights that zakat programs, in their current form, are not yet integrated with long-term human development initiatives such as education, healthcare enhancement, or capacity building. Theoretically, zakat has the potential to support human development by providing resources that can enhance capabilities, as proposed in Islamic welfare theory and capability approaches. However, the absence of significant linkage in this study mirrors earlier conclusions in the literature that zakat institutions often focus on consumptive aid rather than developmental or human-capital-oriented programs. Logically, if zakat disbursement is not aligned with strategies that improve education, health, or living standards, its

ability to enhance I-HDI outcomes becomes limited. The implication is clear: zakat management agencies need to redesign their programs to align with human development objectives by investing in scholarships, healthcare support, skill-enhancement programs, and community empowerment initiatives to create synergistic, measurable welfare improvements.

In conclusion, while both zakat and human development are important tools in poverty reduction, human development has a stronger and more consistent impact. The IRF and FEVD analyses further confirm this, showing that over time, I-HDI explains up to 64.92% of poverty variation, compared to only 5.61% from zakat. Therefore, policy implications from this study suggest that zakat management institutions should collaborate more closely with human development programs to design targeted, education- and health-focused zakat initiatives. This would allow zakat not only to meet short-term needs but also to contribute meaningfully to long-term poverty reduction through sustainable human capital development. Policymakers should also prioritize enhancing I-HDI indicators through inclusive, equitable programs that address the root causes of poverty.

6.   Conclusion

The findings of this study reveal that while zakat distribution is negatively associated with poverty in the long term, its effect is not statistically significant, suggesting that current zakat mechanisms may be limited in scale, targeting accuracy, or long-term sustainability. In contrast, the I-HDI demonstrates a significant relationship with poverty: in the short term, improvements in I-HDI effectively reduce poverty, while in the long term, the positive association suggests structural challenges that may prevent human development gains from directly translating into poverty alleviation. Additionally, the study finds no significant interaction between zakat distribution and I-HDI, indicating that zakat programs currently operate independently from broader human development strategies. These results partially align with theoretical expectations and previous empirical findings that emphasize the role of human development in reducing poverty, while also highlighting the gap between zakat's potential and its current implementation.

From a policy perspective, the results emphasize the need to strengthen the integration between zakat institutions and human development programs. To enhance zakat's contribution to poverty alleviation, zakat funds should be directed toward sustainable, long-term initiatives, such as access to education, healthcare, and economic empowerment, rather than short-term financial assistance alone. Policymakers should also focus on improving the inclusiveness and effectiveness of human development policies to ensure that improvements in I-HDI reach the most vulnerable populations. Furthermore, creating collaborative frameworks between government agencies, zakat institutions, and community organizations can help align zakat efforts with national development goals, ensuring that both zakat and I-HDI contribute meaningfully to long-term poverty reduction in North Sumatra.

Based on the findings of the study, it is recommended that the North Sumatra government and the Zakat Agency strengthen the management and distribution of zakat through training, monitoring, and the use of digital technology to ensure greater transparency, accountability, and accuracy. This effort needs to be supported by

increasing public awareness of the obligation to pay zakat, especially professional zakat, through education, socialization, and the involvement of religious leaders. In addition, local governments need to expand access to education and health care as the main pillars of improving the Islamic Human Development Index (I-HDI), given their dominant contribution to long-term poverty reduction. The integration between zakat programs and human development must also be strengthened through institutional collaboration, so that zakat funds can be directed to strategic sectors such as education and health. Thus, zakat will not only function as short-term assistance, but also as a sustainable instrument that supports improving quality of life and eradicating poverty as a whole.

7. References

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