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The Effect of Village Funds on Economic Growth in Aceh Province

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Abstract

Village Funds are a fiscal policy instrument designed to promote local development and stimulate economic growth through various categories of village expenditure. However, their effectiveness in fostering economic growth and the mediating role of the Human Development Index (HDI) remain insufficiently explored in Aceh Province, Indonesia. This study examines the effects of Village Fund expenditures on village governance, village development, community development, community empowerment, and disaster management on the HDI and economic growth. It also investigates the mediating role of the HDI in the relationship between Village Fund expenditures and economic growth. Using panel data from 23 regencies and municipalities in Aceh Province over the period 2015–2024, this study employs panel data regression using the Random Effects Model (REM), followed by the Sobel test to assess the mediation effect. The empirical findings indicate that expenditures on village governance, community development, community empowerment, and disaster management have significant positive effects on the HDI. However, the HDI does not have a significant effect on economic growth and does not mediate the relationship between Village Fund expenditures and economic growth. These findings suggest that Village Funds may contribute to economic growth primarily through direct channels, particularly expenditures on community development and community empowerment. Therefore, Village Fund management should prioritize productive investment programs that enhance community capacity, strengthen local economic resilience, and support sustainable local development.

Introduction

Economic growth is widely recognized as one of the most important indicators for assessing the overall development performance of a region [1]. It serves as a key measure of regional development success by reflecting the expansion of an area's productive capacity to generate goods and services over a given period. In the context of regional development, economic growth is commonly measured by the increase in Gross Regional Domestic Product (GRDP) at constant prices, which reflects a region's ability to generate sustainable economic value added [2,3]. Sustained economic growth is expected to improve public welfare by creating employment opportunities, increasing household income, and reducing poverty. Beyond serving as an indicator of development performance, economic growth also provides an important benchmark for evaluating the effectiveness of regional fiscal policies [4,5]. From the perspective of development economics, sustainable economic growth reflects a region's capacity to allocate and utilize its resources efficiently, thereby enhancing regional output, improving living standards, and promoting social welfare [2]. Consequently, governments continue to implement fiscal decentralization policies aimed at accelerating regional economic development and reducing interregional disparities.

From a theoretical perspective, economic growth is influenced by several key determinants, including capital accumulation, investment, human capital, infrastructure, and government fiscal

policy [6]. Endogenous Growth Theory emphasizes that human capital, technological innovation, and effective public policies play fundamental roles in sustaining long-term economic growth [7]. In the case of Aceh Province, economic growth continues to face a number of structural challenges. Despite its abundant natural resources and substantial fiscal transfers from the central government, Aceh's economic growth has remained below the national average during several periods. According to data published by Statistics of Aceh Province (BPS Aceh) [8], Aceh's economic growth fluctuated considerably during the 2015–2024 period. As shown in Figure 1, the provincial economy contracted by 0.73% in 2015 before recovering to approximately 4.16% in 2018. However, economic growth declined again to -0.37% in 2020 due to the COVID-19 pandemic. Following the pandemic, the provincial economy gradually recovered, reaching approximately 4.66% in 2024.

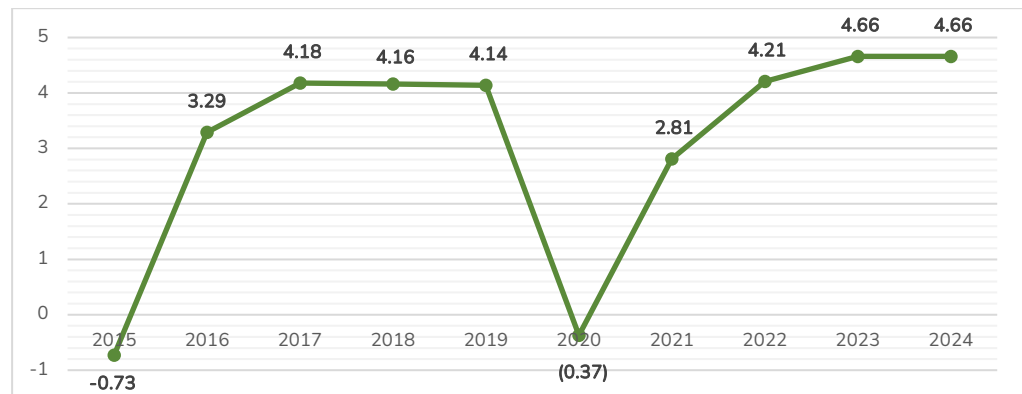


Figure 1. Economic growth of Aceh Province, 2015–2024.

Source: Statistics of Aceh Province (BPS Aceh) [8].

Endogenous Growth Theory posits that long-term economic growth is primarily driven by internal factors, particularly the accumulation of human capital, technological progress, and innovation [9]. Rather than relying solely on external inputs, the theory argues that sustainable economic growth results from continuous improvements in productivity generated through investments in education, research, and technological development. The principal endogenous determinants of economic growth include human capital, technological innovation, knowledge accumulation, and positive externalities, all of which enhance production efficiency and stimulate long-term economic expansion [10,11]. Building upon this framework, Lucas [7] incorporated human capital into the production function, emphasizing that investments in education and training increase workers' productivity and generate sustained economic growth. According to Lucas's endogenous growth model, the knowledge, skills, education, and experience possessed by individuals not only improve production efficiency but also foster technological innovation by facilitating the creation and diffusion of new ideas throughout the economy.

The Human Development Index (HDI) is a composite indicator that measures the quality of life through three fundamental dimensions: health, education, and a decent standard of living. Human Capital Theory argues that investments in education and health improve workers' productivity, thereby contributing to long-term economic growth [12]. Statistics of Aceh Province (BPS Aceh) [8] indicate that Aceh experienced a consistent increase in its HDI throughout the 2015–2024 period. This steady improvement reflects substantial progress in the quality of life of the population, particularly in terms of educational attainment, health outcomes, and living standards. As human development is closely associated with labor productivity and economic performance, the continuous improvement in HDI represents an important indicator of the province's development progress.

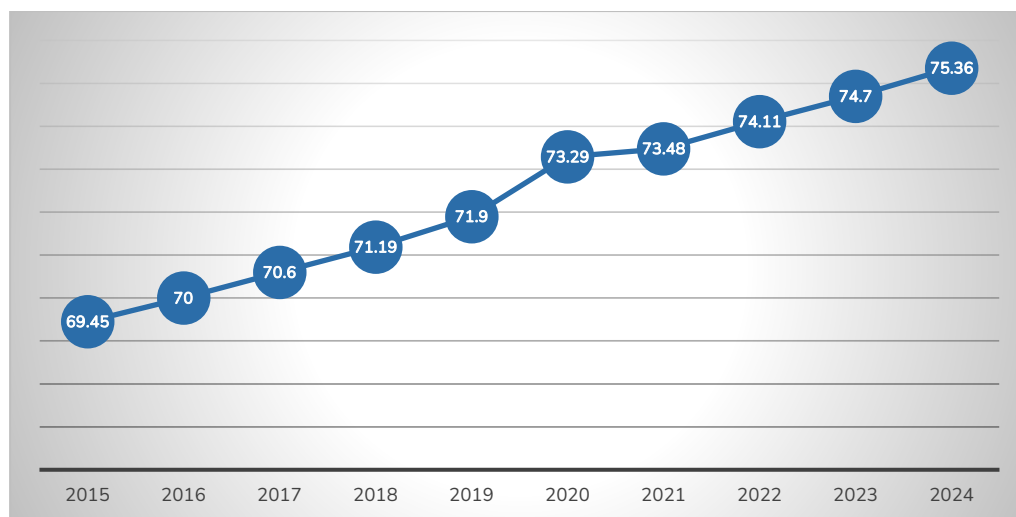


Figure 2. Human Development Index of Aceh Province, 2015–2024.

Source: Statistics of Aceh Province (BPS Aceh) [8].

The HDI of Aceh Province exhibited a stable and sustained upward trend throughout the 2015–2024 period. This improvement indicates continuous progress in the quality of human development across the three core dimensions of health, education, and living standards. From the perspective of endogenous growth theory, improvements in human capital are expected to enhance labor productivity, expand employment opportunities, increase household income, and strengthen the region's long-term economic growth potential. Consequently, sustained improvements in human development constitute a strategic foundation for achieving inclusive and sustainable regional economic development.

In response to regional development challenges, the Government of Indonesia enacted Law No. 6 of 2014 on Villages, introducing Village Funds as a key component of the country's fiscal decentralization policy. This policy was designed to reduce regional disparities, strengthen rural development, and stimulate local economic growth. Through the implementation of this legislation, every village receives fiscal transfers financed by the State Budget (APBN), Regional Government Budgets (APBD), and other legitimate funding sources to support village development initiatives.

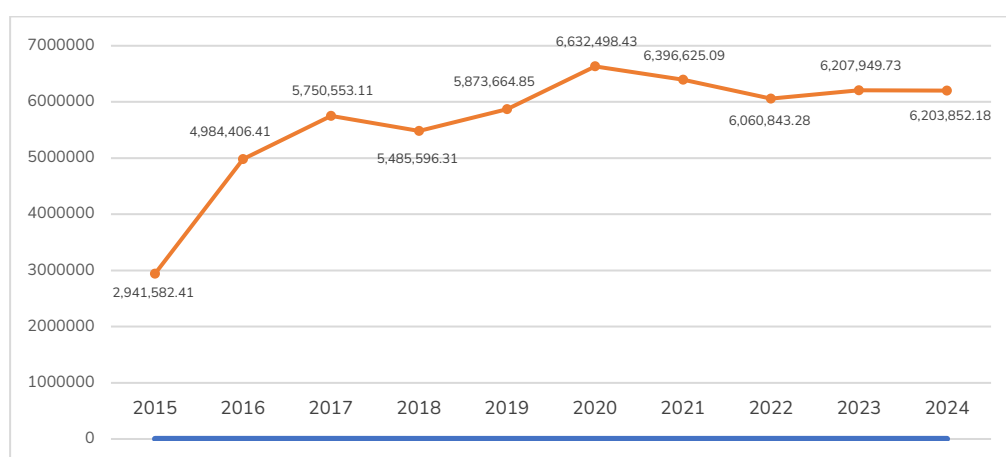


Figure 3. Distribution of village funds in Aceh Province, 2015–2024.

Source: Statistics Indonesia (BPS) [13].

Figure 3 illustrates the trend in Village Fund allocations received by Aceh Province during the 2015–2024 period. Overall, Village Fund allocations exhibited an upward trend, although several years experienced fluctuations due to adjustments in central government fiscal policies.

and revisions to the Village Fund allocation formula. Since the introduction of the Village Fund policy, total allocations have increased substantially, rising from approximately IDR 2.94 trillion in 2015 to IDR 6.20 trillion in 2024, more than doubling over the past decade. This substantial increase reflects the Indonesian government's strong commitment to strengthening rural development through fiscal decentralization. Nevertheless, larger budget allocations do not necessarily translate into better economic development outcomes. Therefore, the effectiveness of Village Funds should be evaluated not only in terms of their nominal value but also in terms of how efficiently expenditures are allocated across different spending categories to improve human development and promote sustainable economic growth.

Previous studies have identified Village Funds as an important fiscal policy instrument for accelerating rural development and reducing poverty in Aceh through their potential effects on regional economic performance and human development [14]. However, empirical evidence on their effectiveness remains mixed. A panel study of 23 regencies and municipalities in Aceh during 2016–2022 found that Village Funds significantly contributed to poverty reduction but had no direct effect on regional economic growth or Gross Regional Domestic Product (GRDP) [15]. Similarly, evidence from East Java indicates that Village Funds had no significant direct effect on either the Human Development Index (HDI) or GRDP [16]. In contrast, Prasetyo & Dinarjito [17] reported a positive effect of Village Funds on economic growth across Indonesian regencies and municipalities, while Monalisa et al. [18] found a positive and significant effect of Village Fund allocations on economic growth in Aceh, although HDI did not significantly affect economic growth. These mixed findings suggest that the effectiveness of Village Funds may depend not only on the magnitude of fiscal allocations but also on how these resources are allocated and managed.

The composition and implementation of Village Fund expenditures may therefore be critical determinants of their development outcomes. Yusniati et al. [19], for example, demonstrated that the effectiveness of Village Funds in reducing poverty varied across expenditure components, particularly village development, community development, and community empowerment. Meanwhile, a systematic literature review by Digdowiseiso & Afriyanto [20] showed that Village Fund utilization remains heavily concentrated on physical infrastructure, with comparatively limited attention to community empowerment, human capital development, stakeholder coordination, and public participation. The implementation of Village Fund programs also faces institutional challenges, including inadequate monitoring and evaluation. These findings indicate that treating Village Funds as a single aggregate fiscal variable may obscure substantial differences in the effectiveness of individual expenditure categories.

Despite the growing literature on Village Funds, relatively few empirical studies have disaggregated expenditures into their legally mandated categories, namely village governance, village development, community development, community empowerment, and disaster, emergency, and urgent-response management, and examined their respective effects on human development and regional economic growth. This represents an important gap because each expenditure category serves a distinct development function and may generate different economic and social outcomes. Moreover, relatively limited attention has been given to the potential role of human development as a transmission mechanism linking Village Fund expenditures to regional economic performance. Human capital, reflected in education, health, and workforce capacity, can enhance productivity and improve the capacity of local economies to attract and utilize investment effectively. Accordingly, Village Fund expenditures that strengthen community development and empowerment may improve HDI and, in turn, contribute to economic growth.

This perspective is consistent with the broader literature on fiscal decentralization, which emphasizes that the effectiveness of fiscal transfers depends on expenditure composition, governance quality, and institutional capacity. Thanh & Canh [21], using panel data from 62

provinces in Vietnam, found that fiscal decentralization positively affected regional economic growth, with stronger effects in regions characterized by higher-quality local governance. Similarly, Hanif et al. [4] reported a positive relationship between fiscal decentralization and economic growth in developing countries operating under federal systems, while emphasizing the importance of institutional capacity in allocating and implementing productive public expenditures. Collectively, these findings suggest that the economic effects of fiscal transfers depend not only on the amount of resources transferred but also on how effectively they are transformed into productive public and human capital investments.

Against this background, this study examines the effects of five Village Fund expenditure categories, namely village governance, village development, community development, community empowerment, and disaster, emergency, and urgent-response management, on the HDI and regional economic growth in Aceh Province. Using panel data from 23 regencies and municipalities over 2015–2024, the study further investigates whether HDI mediates the relationship between Village Fund expenditures and economic growth. By adopting a disaggregated expenditure approach and incorporating HDI as a potential transmission mechanism, this study extends the existing literature beyond aggregate measures of Village Fund allocations and provides more precise evidence on how different expenditure categories contribute to human development and regional economic performance. The findings are expected to provide evidence-based guidance for improving Village Fund allocation and management and for strengthening its contribution to inclusive and sustainable regional development.

Materials and Methods

Data and Variables

This study employs a quantitative research design to examine the relationships among Village Fund expenditures, the Human Development Index (HDI), and regional economic growth in Aceh Province, Indonesia. The unit of analysis comprises the 23 regencies and municipalities in Aceh Province that received Village Fund allocations throughout the study period. In the analytical framework, Village Fund expenditures are treated as the independent variables, the HDI serves as the mediating variable, and regional economic growth is specified as the dependent variable. Details of the variables are presented in Table 1.

The study utilizes panel data that combine cross-sectional and time-series observations. The cross-sectional dimension consists of the 23 regencies and municipalities in Aceh Province, while the time-series dimension covers the period from 2015 to 2024, resulting in a balanced panel of 230 observations. The study period was selected because the implementation of Law No. 6 of 2014 on Villages, which introduced the Village Fund policy, officially commenced in 2015. Moreover, 2024 represents the most recent year for which complete and consistent panel data covering all regencies and municipalities in Aceh are available.

The data used in this study were obtained from official government sources. Data on Village Fund expenditures by expenditure category were collected from Statistics Indonesia (BPS) [13], while data on regional economic growth, measured by the growth rate of Gross Regional Domestic Product (GRDP), and the HDI were obtained from the Statistics of Aceh Province (BPS Aceh) [8]. The use of official secondary data ensures the reliability, consistency, and comparability of observations across regions and over time.

Table 1. Details of variables.

Variable Name	Variable Role	Indicator and Unit of Measurement	Data Source
Village Fund expenditure on village governance	Independent variable	Actual Village Fund expenditure (IDR)	Statistics Indonesia (BPS)
Village Fund expenditure on village development	Independent variable	Actual Village Fund expenditure (IDR)	Statistics Indonesia (BPS)
Village Fund expenditure on community development	Independent variable	Actual Village Fund expenditure (IDR)	Statistics Indonesia (BPS)
Village Fund expenditure on community empowerment	Independent variable	Actual Village Fund expenditure (IDR)	Statistics Indonesia (BPS)
Village Fund expenditure on disaster, emergency, and urgent-response management	Independent variable	Actual Village Fund expenditure (IDR)	Statistics Indonesia (BPS)
Human Development Index (HDI)	Mediating variable	HDI score (Index: 0–100)	BPS Aceh
Economic Growth	Dependent variable	Annual growth rate (%)	BPS Aceh

Model and Method

Unlike most previous studies, which have treated Village Funds as a single aggregate variable when examining their effects on rural economic development [22,23], this study disaggregates Village Fund expenditures into five categories: village governance, village development, community development, community empowerment, and disaster, emergency, and urgent-response management. This approach is adopted because each expenditure category serves distinct policy objectives, encompasses different program characteristics, and follows different implementation mechanisms, which may generate heterogeneous effects on regional economic growth and the Human Development Index (HDI). Treating Village Funds as a single aggregate variable may obscure these heterogeneous effects, making it difficult to identify which expenditure categories contribute most effectively to development outcomes [24,25]. Moreover, this disaggregated approach is consistent with recent empirical evidence suggesting that the composition of Village Fund expenditures has differential impacts on development outcomes, implying that expenditure-specific analyses can provide more informative and policy-relevant insights than analyses based solely on aggregate fiscal transfers [26].

Furthermore, all variables measured in monetary values were transformed into their natural logarithms prior to the panel data regression analysis. The logarithmic transformation was applied to reduce data skewness, mitigate potential heteroskedasticity, minimize differences in scale across variables, and improve the stability of the estimated coefficients. In addition, the log transformation allows the estimated regression coefficients to be interpreted as elasticities, thereby facilitating a more intuitive interpretation of the percentage change in the dependent variable associated with a one-percent change in the corresponding independent variable [27–29].

Based on the proposed analytical framework, the empirical analysis is specified using two panel data regression models. Model I examines the direct effects of Village Fund expenditures across the five expenditure categories on the HDI, while Model II evaluates the effects of Village Fund expenditures and the HDI on regional economic growth. The specification of Model I is presented in Equation 1.

$$HDI_{it} = \gamma_0 + \gamma_1 LOG_DDBID1_{it} + \gamma_2 LOG_DDBID2_{it} + \gamma_3 LOG_DDBID3_{it} + \gamma_4 LOG_DDBID4_{it} + \gamma_5 LOG_DDBID5_{it} + \varepsilon_{it} \quad (1)$$

To examine the direct effects of Village Fund expenditures and the HDI on economic growth, while simultaneously testing whether the HDI mediates the relationship between Village Fund expenditures and economic growth, Model II is specified in Equation 2.

$$PE_{it} = \delta_0 + \delta_1 LOG_DDBID1_{it} + \delta_2 LOG_DDBID2_{it} + \delta_3 LOG_DDBID3_{it} + \delta_4 LOG_DDBID4_{it} + \delta_5 LOG_DDBID5_{it} + \delta_6 IPM_{it} + \varepsilon_{it} \quad (2)$$

Where LOG_DDBID1_{it} denotes the logarithm of Village Fund expenditure on village governance in regency/municipality i during period t ; LOG_DDBID2_{it} denotes the logarithm of Village Fund expenditure on village development in regency/municipality i during period t ; LOG_DDBID3_{it} denotes the logarithm of Village Fund expenditure on community development in regency/municipality i during period t ; LOG_DDBID4_{it} denotes the logarithm of Village Fund expenditure on community empowerment in regency/municipality i during period t ; LOG_DDBID5_{it} denotes the logarithm of Village Fund expenditure on disaster, emergency, and urgent-response management in regency/municipality i during period t ; HDI_{it} represents the Human Development Index of regency/municipality i during period t ; and PE_{it} represents the economic growth rate of regency/municipality i during period t . The parameters γ_1 - γ_5 denote the regression coefficients estimated in Model I (HDI equation), whereas δ_1 - δ_6 represent the regression coefficients estimated in Model II (economic growth equation). The term ε_{it} denotes the random error component, which captures the influence of unobserved factors affecting the dependent variables.

Results and Discussion

Descriptive Statistics

As presented in Table 2, Village Fund expenditure allocated to village governance recorded a mean value of IDR 67,694.45 million, a median of IDR 52,011.06 million, a maximum of IDR 227,286.58 million, and a minimum of IDR 2,142.71 million. The standard deviation was IDR 47,051.53 million, indicating substantial variation in village governance expenditure across regencies and municipalities in Aceh Province.

The relatively high degree of variation suggests considerable differences in village governance budget allocations across local governments. These disparities may reflect differences in administrative expenditures, including remuneration for village officials, as well as the number of villages administered by each regency or municipality. Consequently, the financial resources allocated to support village governance functions vary substantially across regions.

Table 2. Descriptive statistics.

Variable	Mean	Median	Max.	Min.	Std. Dev.	Obs.
DDBID1*	67,694.45	52,011.06	227,286.58	2,142.71	47,051.53	230
DDBID2*	105,432.78	70,449.03	530,837.90	5,034.37	97,088.72	230
DDBID3*	21,857.69	15,852.43	136,086.99	38.22	20,795.25	230
DDBID4*	23,443.10	16,385.14	100,775.61	55.00	20,409.15	230
DDBID5**	27,387.51	7,944.52	238,619.29	0.01	43,951.68	230
HDI**	70.99	70.27	87.17	61.32	4.8	230
PE***	3.39	4.04	13.23	-20.34	2.71	230

Note: * indicates that values are expressed in million Indonesian Rupiah (IDR); ** indicates that values are expressed as index points; *** indicates that values are expressed as percentages.

Panel Data Model Selection

To determine the most appropriate panel data regression model, a series of model selection tests was conducted. Three alternative panel data models were considered: the Common Effects Model (CEM), the Fixed Effects Model (FEM), and the Random Effects Model (REM). Model selection was performed using the Chow test, Hausman test, and Lagrange Multiplier

(LM) test. The Chow test was first employed to determine whether the FEM was more appropriate than the CEM. The results of the tests are presented in Table 3.

For Model I, which examines the direct effects of Village Fund expenditures on the Human Development Index (HDI), the Chow test produced a cross-section Chi-square p-value of 0.000, which is below the 5% significance level ($p < 0.05$). This result indicates that the null hypothesis is rejected, suggesting that the FEM is preferred over the CEM. Subsequently, the Hausman test was conducted to determine the most appropriate model between the FEM and REM. The test yielded a cross-section random p-value of 0.3168, which exceeds the 5% significance level ($p > 0.05$). Accordingly, the null hypothesis cannot be rejected, indicating that the REM is more appropriate than the FEM.

Because the Chow and Hausman tests suggested different model specifications, the Lagrange Multiplier (LM) test was subsequently performed to determine the most appropriate model. The Breusch–Pagan LM test produced a cross-section p-value of 0.000, which is statistically significant at the 5% level ($p < 0.05$). This finding indicates that the REM is preferred over the CEM. Based on the overall model selection procedure, the REM was selected as the most appropriate estimation model for Model I.

For Model II, which examines the direct effects of Village Fund expenditures and the HDI on economic growth, the Chow test generated a cross-section Chi-square p-value of 0.0005, indicating statistical significance at the 5% level ($p < 0.05$). Accordingly, the null hypothesis was rejected, suggesting that the FEM is preferred over the CEM. The Hausman test, however, yielded a cross-section random p-value of 0.2834, which exceeds the 5% significance threshold ($p > 0.05$). Consequently, the null hypothesis cannot be rejected, indicating that the REM is more appropriate than the FEM. To resolve the discrepancy between the Chow and Hausman test results, the LM test was subsequently employed. The Breusch–Pagan LM test produced a cross-section p-value of 0.0104, which is statistically significant at the 5% level ($p < 0.05$). This result indicates that the REM is preferred over the CEM. Therefore, based on the combined results of the Chow, Hausman, and LM tests, the REM was selected as the most appropriate estimation model for both Model I and Model II.

Table 3. Results of the Chow test, Hausman test, and Lagrange multiplier (LM) test for models I and II.

Model	Test	Effects Test	Stat.	d.f.	Prob.	Conclusion
Model I	Chow Test	Cross-section F	265.69	(22,202)	0.0000	FEM
		Cross-section Chi-square	781.79	22	0.0000	
	Hausman Test	Cross-section random	5.89	5	0.3168	REM
	Lagrange Multiplier Test	Cross-section Breusch-Pagan	890.52		0.0000	REM
Model II	Chow Test	Cross-section F	2.25	(22,201)	0.0018	FEM
		Cross-section Chi-square	50.61	22	0.0005	
	Hausman Test	Cross-section random	7.42	6	0.2834	REM
	Lagrange Multiplier Test	Cross-section Breusch-Pagan	6.57		0.0104	REM

Panel Data Regression Results

Results of the Direct Effects Analysis

The results of the partial significance tests (t-tests) for Model I, as shown in Table 4, indicate that LOG_DDBID1 (Village Fund expenditure on village governance), LOG_DDBID3 (community development), LOG_DDBID4 (community empowerment), and LOG_DDBID5 (disaster, emergency, and urgent-response management) have positive and statistically significant effects on the Human Development Index (HDI). This is evidenced by p-values below the 5%

significance level ($p < 0.05$), with estimated regression coefficients of 2.0458, 0.4758, 0.7384, and 0.4549, respectively. In contrast, LOG_DDBID2 (Village Fund expenditure on village development) does not have a statistically significant effect on the HDI, as indicated by a p-value exceeding the 5% significance threshold.

The results of the joint significance test (F-test) further demonstrate that the explanatory variables included in Model I are jointly significant in explaining variations in the HDI. This is confirmed by the model's Prob. (F-statistic) of 0.000, which is below the 5% significance level. Furthermore, the coefficient of determination (Adjusted $R^2 = 0.665$) indicates that approximately 66.5% of the variation in the HDI is explained by the independent variables included in the model, while the remaining 33.5% is attributable to factors not incorporated into the regression model.

The results of the partial significance tests (t-tests) for Model II reveal that LOG_DDBID3 (community development expenditure) and LOG_DDBID4 (community empowerment expenditure) have positive and statistically significant effects on economic growth, with regression coefficients of 1.1122 and 1.4719, respectively. Conversely, LOG_DDBID5 (disaster, emergency, and urgent-response management expenditure) has a negative and statistically significant effect on economic growth, as reflected by a regression coefficient of -0.5248 . Meanwhile, LOG_DDBID1 and LOG_DDBID2 do not exhibit statistically significant effects on economic growth, as their p-values exceed the 5% significance level.

The F-test results indicate that the independent variables included in Model II are jointly significant in explaining economic growth, as evidenced by a Prob. (F-statistic) of 0.000025, which is below the 5% significance level. However, the explanatory power of the model remains relatively limited. The coefficient of determination (Adjusted $R^2 = 0.105$) indicates that the independent variables explain approximately 10.5% of the variation in economic growth, while the remaining 89.5% is explained by other factors not included in the model.

Table 4. Results of panel data regression for Model I and Model II.

Model	Variable	Coeff.	Std. Er.	t-Stat.	Prob.
Model I	LOG_DDBID1	2.0458***	0.5203	3.9324	0.0001
	LOG_DDBID2	-0.5860	0.4138	-1.4162	0.1581
	LOG_DDBID3	0.4758***	0.1491	3.1913	0.0016
	LOG_DDBID4	0.7384***	0.1607	4.5950	0.0000
	LOG_DDBID5	0.4549***	0.0629	7.2317	0.0000
	R-squared	0.6719			
	Adj. R-squared	0.6645			
	F-stat.	91.7274			
	Prob. (F-stat.)	0.0000***			
Model II	LOG_DDBID1	-1.3170	1.1210	-1.1749	0.2413
	LOG_DDBID2	-0.6652	0.7345	-0.9057	0.3661
	LOG_DDBID3	1.1122***	0.3749	2.9670	0.0033
	LOG_DDBID4	1.4719***	0.4024	3.6574	0.0003
	LOG_DDBID5	-0.5248***	0.1598	-3.2843	0.0012
	IPM	0.0372	0.0530	0.7018	0.4835
	R-squared	0.1287			
	Adj. R-squared	0.1053			
	F-stat.	5.4902			
	Prob. (F-stat.)	0.0000***			

Note: *** indicates statistical significance at the 1% level.

Results of the Indirect Effects Analysis

To examine the mediating role of the Human Development Index (HDI) in the relationship between Village Fund expenditures and economic growth, a mediation analysis was conducted using the Sobel test. Specifically, the analysis assessed whether the HDI mediates the effects of Village Fund expenditures on village governance (LOG_DDBID1), village development

(LOG_DDBID2), community development (LOG_DDBID3), community empowerment (LOG_DDBID4), and disaster, emergency, and urgent-response management (LOG_DDBID5) on economic growth (EG). The Sobel test results, presented in Table 5, indicate that the HDI does not significantly mediate the relationship between any category of Village Fund expenditure and economic growth. For all five expenditure categories, the Sobel test produced p-values greater than the 5% significance level ($p > 0.05$), indicating that the indirect effects are statistically insignificant. A p-value exceeding 0.05 in the Sobel test indicates that the indirect effect through the HDI is not statistically significant. These findings are further supported by the panel regression results, which show that although several categories of Village Fund expenditure significantly affect the HDI, the HDI itself does not have a statistically significant effect on economic growth. Consequently, the conditions required to establish a statistically significant mediation effect are not satisfied.

Overall, these findings provide no empirical evidence of a significant mediating role of the HDI in the relationship between Village Fund expenditures and economic growth. Furthermore, the path analysis indicates that the estimated indirect effects through the HDI are consistently smaller than the corresponding direct effects of Village Fund expenditures on economic growth. This finding suggests that the influence of Village Funds on economic growth operates primarily through direct mechanisms rather than indirectly through improvements in human development.

Table 5. Results of the Sobel test for the mediating effect of HDI.

Variable	Direct Effect	Indirect Effect	Sobel Test Value		
			Test Stat.	Std. Er.	Prob.
LOG_DDBID1	-1.3170	-0.0820	0.6909	0.1101	0.4896
LOG_DDBID2	-0.6650	0.0463	-0.6288	0.0347	0.5294
LOG_DDBID3	1.1120	0.0030	0.6855	0.0258	0.4931
LOG_DDBID4	1.4720	-0.0050	0.6938	0.0396	0.4878
LOG_DDBID5	-0.5250	-0.0130	0.6986	0.0242	0.4848

Discussion

The empirical findings of this study provide important insights into the relationships among Village Fund expenditures, the Human Development Index (HDI), and economic growth in Aceh Province. Specifically, this study examines the effects of Village Fund expenditures allocated to village governance, village development, community development, community empowerment, and disaster, emergency, and urgent-response management on human development and regional economic growth. A summary of the estimated relationships among the variables is presented in Table 6.

Table 6. Summary of the effects of village fund expenditure categories on the Human Development Index and economic growth.

Variable	Model I (HDI)	Model II (Economic Growth)
Village Fund expenditure on village governance	Positive and significant	Negative and insignificant
Village Fund expenditure on village development	Negative and insignificant	Negative and insignificant
Village Fund expenditure on community development	Positive and significant	Positive and significant
Village Fund expenditure on community empowerment	Positive and significant	Positive and significant
Village Fund expenditure on disaster, emergency, and urgent-response management	Positive and significant	Negative and significant
Human Development Index	–	Positive and insignificant

The empirical results indicate that Village Fund expenditures allocated to village governance, community development, community empowerment, and disaster, emergency, and urgent-response management have positive and statistically significant effects on the HDI. In contrast, expenditures on village development do not have a statistically significant effect on the HDI. The positive relationship between village governance expenditure and the HDI suggests that effective village governance contributes to improved public service delivery and administrative capacity, thereby creating a more supportive environment for human development. Well-managed village administrations are better positioned to implement programs that improve education, health services, and other dimensions of human well-being.

Likewise, the positive effects of expenditures on community development and community empowerment indicate that investments in social development and human capacity building play an essential role in improving living standards. Community empowerment programs can enhance skills, expand access to non-formal education, and increase household income, all of which may contribute to improved human development outcomes. These findings are consistent with the Human Development approach proposed by the United Nations Development Programme [30], which emphasizes that human development is determined not only by economic growth but also by improvements in education, health, and overall quality of life.

Furthermore, the positive effect of disaster, emergency, and urgent-response expenditure on the HDI suggests that social protection measures implemented during periods of crisis can help preserve community welfare, particularly by safeguarding health conditions and maintaining minimum living standards. Such interventions can reduce household vulnerability and mitigate the adverse social consequences of economic and natural shocks.

By contrast, the insignificant effect of Village Fund expenditure on village development indicates that investments in physical infrastructure may require a longer period before their benefits are reflected in improvements in human development. This finding also suggests that Village Fund utilization remains predominantly oriented toward infrastructure development, while relatively less emphasis has been placed on investments in human capital. Previous studies have similarly reported that the implementation of Village Fund programs continues to face several constraints, including an excessive focus on physical infrastructure, limited community empowerment initiatives, and inadequate monitoring and supervision mechanisms [20]. Consequently, improvements in village infrastructure alone may not immediately translate into better educational outcomes, health services, or household purchasing power in the short run.

Moreover, the Adjusted R^2 value of 66.5% indicates that the model explains a substantial proportion of the variation in the HDI across regencies and municipalities in Aceh Province. This finding underscores the potential importance of Village Fund expenditures for rural human development, particularly when funds are directed toward programs that strengthen institutional capacity and empower local communities.

The regression results further demonstrate that expenditures on community development and community empowerment have positive and statistically significant effects on economic growth. These findings imply that investments aimed at strengthening social capital, enhancing community participation, and improving productive capacity may generate positive economic spillover effects that contribute to regional economic performance. In contrast, expenditures allocated to disaster, emergency, and urgent-response management exhibit a negative and statistically significant relationship with economic growth. This finding is understandable because such expenditures are primarily intended to address immediate social and humanitarian needs rather than stimulate productive economic activities. Consequently, although disaster-related expenditures are essential for maintaining social stability, they may reduce the fiscal resources available for productive investment and economic expansion in the short term.

The results also reveal that the HDI does not have a statistically significant effect on economic growth. This finding suggests that improvements in human development have not yet translated into higher economic growth in Aceh Province during the study period. One possible explanation is that the province continues to face structural constraints, including limited productive employment opportunities, a relatively low level of industrialization, and a mismatch between workforce skills and labor market demands. Under such conditions, improvements in education and health may not immediately translate into higher labor productivity or increased regional output.

These findings are broadly consistent with those reported by Salpina et al. [31], who argue that improvements in education, health, and living standards enhance the quality of human resources and ultimately contribute to regional economic growth. However, the present study indicates that these effects may not materialize in the short run. This interpretation is further supported by Ranis et al. [32], who emphasize that the relationship between human development and economic growth is bidirectional but depends on an economy's capacity to absorb improvements in human capital. Without sufficient productive sectors and employment opportunities, gains in human development are unlikely to generate immediate economic returns.

The mediation analysis using the Sobel test further demonstrates that the HDI does not mediate the relationship between Village Fund expenditures and economic growth in Aceh Province. All Sobel test p-values exceed the 5% significance level, indicating that the indirect effects are statistically insignificant. These findings imply that improvements in human development have not yet translated into higher economic productivity. In other words, investments in human development alone may be insufficient to stimulate economic growth unless they are accompanied by the expansion of productive economic sectors capable of effectively utilizing improved human capital.

Overall, the findings suggest that the contribution of Village Funds to economic growth in Aceh Province occurs primarily through direct channels, particularly through expenditures on community development and community empowerment. These expenditure categories can strengthen community capacity, promote local economic activities, and encourage greater community participation in development processes. The results therefore support Romer's Endogenous Growth Theory, which argues that long-term economic growth is driven not only by physical capital accumulation but also by human capital development, community capacity, institutional quality, and local innovation [33]. Accordingly, Village Fund management in Aceh Province should place greater emphasis on productive and community-based development programs that strengthen local economic capacity, encourage entrepreneurship, and generate sustainable sources of income for rural communities.

Conclusions

This study examined the effects of Village Fund expenditures across five expenditure categories, namely village governance, village development, community development, community empowerment, and disaster, emergency, and urgent-response management, on the Human Development Index (HDI) and economic growth in Aceh Province, with the HDI serving as a mediating variable. The results indicate that expenditures on village governance, community development, community empowerment, and disaster management significantly improve the HDI, whereas village development expenditure does not. Regarding economic growth, only community development and community empowerment expenditures have positive and significant effects, while disaster-related expenditure has a significant negative effect. In contrast, village governance expenditure, village development expenditure, and the HDI do not significantly affect economic growth. Furthermore, the Sobel test confirms that the HDI does not mediate the relationship between Village Fund expenditures and economic growth,

indicating that the contribution of Village Funds to economic growth occurs primarily through direct channels rather than through improvements in human development.

These findings suggest that improving the effectiveness of Village Funds requires greater emphasis on productive expenditures that strengthen community capacity and local economic activities. Therefore, local governments should prioritize community empowerment and community development programs while improving the efficiency of disaster-related expenditures by integrating them with post-disaster economic recovery initiatives. Strengthening monitoring and evaluation systems is also essential to ensure that Village Fund allocations are transparent, well-targeted, and capable of generating sustainable economic benefits. Future studies are encouraged to incorporate additional determinants of regional economic growth, such as poverty, unemployment, infrastructure quality, and regional capital expenditure, as well as longer observation periods and more comprehensive analytical approaches to further explain the relationship between Village Funds and regional economic development.

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