

THE EFFECT OF NATURAL RESOURCE REVENUE-SHARING FUNDS, CAPITAL EXPENDITURE, AND LOCAL OWN-SOURCE REVENUE ON THE HUMAN DEVELOPMENT INDEX OF REGENCIES/MUNICIPALITIES IN NORTH SUMATRA PROVINCE, 2017–2024

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Abstract

This study aims to analyze the effects of Natural Resource Revenue-Sharing Funds (DBH-SDA), Capital Expenditure, and Local Own-Source Revenue (PAD) on the Human Development Index (HDI) across 33 regencies and municipalities in North Sumatra Province during the 2017–2024 period. Although the average HDI increased from 69.42 to 74.70, the interregional disparity remained substantial at 17.57 points. This study is grounded in Fiscal Decentralization Theory (Oates, 1972) and Human Development Theory (Sen, 1999). Secondary data were obtained from the Central Bureau of Statistics (BPS) and the Directorate General of Fiscal Balance (DJPK), resulting in a balanced panel dataset comprising 264 observations. The analysis employed panel data regression using EViews, with the Chow Test and Hausman Test indicating that the Fixed Effect Model (FEM) was the most appropriate model, yielding an Adjusted R² of 85.48%. The partial regression results reveal that Natural Resource Revenue-Sharing Funds have a negative and statistically significant effect on the HDI, Capital Expenditure has a positive and statistically positive effect, and Local Own-Source Revenue also has a negative and statistically significant effect on the HDI. Simultaneously, all three variables significantly influence the HDI (Prob. F = 0.000). The findings suggest that the effectiveness of regional fiscal allocation, rather than the magnitude of fiscal revenue alone, constitutes the primary determinant of human development quality.

Keywords: Human Development Index; Natural Resource Revenue-Sharing Funds; Capital Expenditure; Local Own-Source Revenue; Panel Data Regression

INTRODUCTION

Human development is one of the primary objectives of regional development, as its achievement reflects the level of societal well-being supported by improvements in health, education, and a decent standard of living. In Indonesia, the level of human development is measured using the Human Development Index (HDI) published by the Central Bureau of Statistics (BPS). The HDI serves as an important indicator because it comprehensively represents the quality of human resources and is widely used as a benchmark for assessing regional development performance (Central Bureau of Statistics, 2024).

Over the past several years, the HDI in North Sumatra Province has demonstrated a relatively consistent upward trend. According to data published by the Central Bureau of Statistics, the average HDI across regencies and municipalities in North Sumatra increased from 69.42 in 2017 to 74.70 in 2024. This improvement reflects enhanced social welfare, as indicated by better access to education, healthcare services,

and higher income levels. Nevertheless, despite the overall increase in the average HDI, these achievements have not fully reflected equitable human development across the province, as considerable disparities persist among regencies and municipalities (North Sumatra Provincial Central Bureau of Statistics, 2024).

The variation in HDI levels indicates differences in regional capacity to provide educational services, healthcare facilities, and economic opportunities for the population. Furthermore, disparities in regional fiscal capacity are also presumed to be one of the factors influencing the level of human development. Therefore, further investigation is required to examine the determinants of the HDI, particularly Natural Resource Revenue-Sharing Funds (DBH-SDA), Capital Expenditure, and Local Own-Source Revenue (PAD) as the principal instruments of regional public financial management.

The unequal distribution of HDI achievements across regions suggests that the success of human development is influenced by various factors that differ from one locality to another, one of which is the fiscal capacity of local governments. From the perspective of Fiscal Decentralization Theory (Oates, 1972), strengthening regional fiscal capacity through regional revenues and development expenditures is expected to improve the quality of public services, thereby contributing to higher levels of the Human Development Index (HDI). Fiscal capacity may be derived from central government transfers in the form of Natural Resource Revenue-Sharing Funds (DBH-SDA), the ability of local governments to generate Local Own-Source Revenue (PAD), and the allocation of Capital Expenditure for the development of infrastructure and public facilities.

Previous research examining the effect of fiscal decentralization on regional economic growth in Java Island found that regional fiscal capacity, reflected in local governments' ability to manage intergovernmental transfers and locally generated revenue, has a significant influence on regional economic development. These findings suggest that similar mechanisms may also affect the level of human development in other regions, including North Sumatra Province (Agastha & Rahman, 2022). Therefore, the three major components of regional public finance—Natural Resource Revenue-Sharing Funds (DBH-SDA), Capital Expenditure, and Local Own-Source Revenue (PAD)—constitute relevant variables for analyzing their influence on the variations in HDI achievements described above.

One of the sources of regional revenue transferred from the central government is the Natural Resource Revenue-Sharing Fund (DBH-SDA), which refers to funds allocated to regional governments based on a specified proportion of state revenues generated from the exploitation of natural resources. These funds are intended to compensate resource-producing regions while strengthening regional fiscal capacity to support development implementation (Simanjuntak & Mukhlis, 2015). Data indicate that the average DBH-SDA received by regencies and municipalities in North Sumatra Province fluctuated throughout the study period. The highest average natural logarithm of DBH-SDA ($\ln$ DBH-SDA) was recorded in 2017 at 26.315, whereas the lowest was observed in 2020 at 25.727. These fluctuations suggest that DBH-SDA revenues have not yet achieved full stability, potentially affecting local governments' capacity to finance

development programs and provide public services (Directorate General of Fiscal Balance, 2025).

Although several regencies and municipalities in North Sumatra Province receive relatively substantial DBH-SDA allocations from the mining, forestry, and other natural resource sectors, significant disparities in HDI performance persist across regions. This condition is consistent with the Resource Curse Theory, which argues that abundant natural resources do not necessarily lead to higher development outcomes when the resulting revenues are not managed effectively or directed toward productive sectors that promote human development (Sachs & Warner, 1995).

In addition to DBH-SDA, Capital Expenditure represents another strategic component of human development, as it is allocated to the acquisition and construction of fixed assets, including roads, bridges, schools, hospitals, community health centers, and other public infrastructure. Adequate infrastructure expands public access to education and healthcare services, thereby contributing to improvements in the quality of human resources (Todaro & Smith, 2021). Data show that the average capital expenditure of regencies and municipalities in North Sumatra Province remained relatively stable throughout the study period. However, a decline occurred in 2020, which was likely associated with budget reallocation in response to the COVID-19 pandemic, before gradually increasing again through 2024. This pattern indicates that capital expenditure allocations have continued to fluctuate over time, potentially affecting infrastructure quality and the effectiveness of local public service delivery (Directorate General of Fiscal Balance, 2025).

These fluctuations warrant particular attention because productive public infrastructure has been shown to contribute significantly to regional economic capacity and long-term social welfare. Consequently, disruptions in capital expenditure patterns, such as those experienced during the COVID-19 pandemic, may have subsequent implications for the achievement of the Human Development Index (HDI) in the following years (Aschauer, 1989).

Another factor contributing to the success of human development is Local Own-Source Revenue (PAD), which reflects the degree of a region's fiscal autonomy in financing development programs. The greater a region's PAD, the broader the fiscal space available for local governments to provide public services and implement development programs aimed at improving community welfare (Mardiasmo, 2018). Data indicate that the average PAD of regencies and municipalities in North Sumatra Province exhibited a fluctuating pattern during the 2017–2024 period. The highest average natural logarithm of PAD (Ln PAD) was recorded in 2019 at 25.496, whereas the lowest occurred in 2022 at 25.156. These findings indicate that regional capacity to generate own-source revenue remains heterogeneous, thereby potentially influencing local governments' ability to finance development initiatives and improve the quality of public services (Directorate General of Fiscal Balance, 2025).

The movement of PAD, which does not entirely correspond with the consistently increasing trend of the HDI, suggests that the relationship between regional fiscal autonomy and human development outcomes is neither direct nor straightforward. Therefore, further investigation is required to examine how PAD interacts with other

regional financing sources, particularly Natural Resource Revenue-Sharing Funds (DBH-SDA) and Capital Expenditure, in influencing the Human Development Index (HDI).

Differences in regional capacity to generate PAD indicate variations in fiscal autonomy across regencies and municipalities. According to Fiscal Autonomy Theory, regions with higher levels of fiscal independence tend to possess greater flexibility in financing development programs oriented toward improving public welfare. Therefore, PAD is presumed to be one of the determinants contributing to regional disparities in HDI achievement.

Numerous studies have examined the relationship between regional fiscal capacity and human development. Rahmayati and Pertiwi (2018) found that Local Own-Source Revenue (PAD) and intergovernmental fiscal transfers positively influence the Human Development Index (HDI). These findings are consistent with those of Sofilda, Hamzah, and Kusairi (2023), who reported that fiscal decentralization contributes to improvements in human development through the strengthening of local government expenditure capacity. Similarly, Hung and Thanh (2022) and Jin and Jakovljevic (2023) also identified a positive relationship between fiscal decentralization and human development.

Nevertheless, previous studies still exhibit several limitations. Most have employed broad indicators of fiscal decentralization, such as aggregate intergovernmental transfers or balancing funds, with relatively few specifically examining the role of Natural Resource Revenue-Sharing Funds (DBH-SDA) in human development. Furthermore, studies linking regional fiscal capacity to the HDI have generally focused on the revenue side of local government finance, whereas the expenditure dimension, represented by Capital Expenditure, has rarely been analyzed simultaneously within a single empirical framework.

Moreover, the majority of previous studies have been conducted at the national, provincial, or cross-country level, thereby limiting their ability to capture fiscal characteristics at the regency and municipal levels. In reality, each region possesses distinct fiscal capacities, natural resource endowments, and levels of human development. This issue is particularly relevant in the context of North Sumatra Province, where substantial disparities exist in both regional fiscal capacity and HDI achievement.

Based on the foregoing discussion, further research is required to examine the simultaneous effects of Natural Resource Revenue-Sharing Funds (DBH-SDA), Capital Expenditure, and Local Own-Source Revenue (PAD) on the Human Development Index (HDI) at the regency and municipal levels. Such an analysis is expected to provide a more comprehensive understanding of the role of regional fiscal instruments in promoting human development in North Sumatra Province.

The novelty of this study lies in its simultaneous examination of the effects of Natural Resource Revenue-Sharing Funds (DBH-SDA), Capital Expenditure, and Local Own-Source Revenue (PAD) on the Human Development Index (HDI) across regencies and municipalities in North Sumatra Province. Unlike previous studies, which generally employed aggregate indicators of fiscal decentralization or examined only selected aspects of regional fiscal capacity, this study integrates central government transfer revenues (DBH-SDA), internally generated fiscal capacity (PAD), and regional

development expenditure (Capital Expenditure) into a single analytical framework. Furthermore, the use of balanced panel data covering 33 regencies and municipalities over the 2017–2024 period enables this study to capture both cross-sectional differences and temporal dynamics more comprehensively, thereby providing more specific empirical evidence regarding the determinants of human development in North Sumatra Province.

RESEARCH METHOD

This study employed a quantitative approach using a causal-associative research design to analyze the effects of Natural Resource Revenue-Sharing Funds (DBH-SDA), Capital Expenditure, and Local Own-Source Revenue (PAD) on the Human Development Index (HDI) across 33 regencies and municipalities in North Sumatra Province. The study utilized secondary panel data, combining cross-sectional data from 33 regencies and municipalities with time-series data covering the 2017–2024 period, resulting in a balanced panel dataset comprising 264 observations. The use of panel data enhances estimation efficiency, accommodates heterogeneity across regions, and provides more comprehensive information than the separate use of cross-sectional or time-series data (Gujarati & Porter, 2012; Baltagi, 2021; Sugiyono, 2019).

The research was conducted between January 2025 and June 2026 across all regencies and municipalities in North Sumatra Province. The province was selected because of its diverse fiscal characteristics and natural resource potential, making it an appropriate setting for examining the relationship between fiscal decentralization and human development. The study population consisted of all 33 regencies and municipalities in the province, all of which were included as the research sample using a saturated sampling (census) technique (Sugiyono, 2019). The variables examined included Natural Resource Revenue-Sharing Funds (DBH-SDA), Capital Expenditure, Local Own-Source Revenue (PAD), and the Human Development Index (HDI) for the 2017–2024 period. The data were obtained from official publications of the Central Bureau of Statistics (BPS) of North Sumatra Province, the Directorate General of Fiscal Balance (DJPK) of the Ministry of Finance through the Regional Financial Information System (SIKD), and the Regional Budget Realization Reports (Laporan Realisasi APBD) of each regency and municipality as supporting data sources (North Sumatra Provincial Central Bureau of Statistics, 2024; DJPK, 2024).

Data were collected using the documentation method by compiling and organizing data based on the indicators of each research variable. The independent variables consisted of Natural Resource Revenue-Sharing Funds (DBH-SDA), Capital Expenditure, and Local Own-Source Revenue (PAD), while the dependent variable was the Human Development Index (HDI) (UNDP, 2023; BPS, 2023). Prior to analysis, the DBH-SDA, Capital Expenditure, and PAD variables were transformed into their natural logarithmic (Ln) forms to standardize the measurement scale and reduce the potential for heteroskedasticity. The data were analyzed using panel data regression based on the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM). The most appropriate estimation model was selected using the Chow Test, Hausman Test, and Lagrange Multiplier Test. All statistical analyses were performed

using EViews software following preliminary descriptive statistical analysis (Gujarati & Porter, 2012).

RESULTS AND DISCUSSION

Descriptive Statistical Analysis

Table 1. Descriptive Statistics of the Research Variables

Statistics	DBH_SDA	CAPITAL_EXPENDITURE	PAD	HDI
Mean	26.01641	27.60127	25.31943	71.53572
Median	25.95400	27.51000	25.20900	71.83500
Maximum	30.07500	32.98500	32.47900	83.23000
Minimum	23.04100	26.70200	23.21500	59.56000
Std. Dev.	0.724749	0.710438	1.210229	4.794328
Skewness	1.989793	5.001732	2.726478	-0.324308
Kurtosis	13.95104	38.06675	15.92432	2.989980
Jarque-Bera	1493.387	14627.21	2164.502	4.628832
Probability	0.000000	0.000000	0.000000	0.098824
Sum	6868.331	7286.735	6684.329	18885.43
Sum Sq. Dev.	138.1437	132.7418	385.2040	6045.207
Observations	264	264	264	264

Based on Table 1, all research variables comprise 264 observations derived from 33 regencies and municipalities in North Sumatra Province during the 2017–2024 period, indicating that the dataset is adequate for panel data regression analysis. The Natural Resource Revenue-Sharing Fund (DBH-SDA) and Capital Expenditure variables exhibit relatively low levels of variation, whereas Local Own-Source Revenue (PAD) displays the greatest variation among the independent variables, reflecting differences in fiscal capacity across regions. Meanwhile, the Human Development Index (HDI), as the dependent variable, demonstrates a relatively wider dispersion, indicating that disparities in human development remain evident among the regencies and municipalities of North Sumatra Province. Overall, the mean value of each variable exceeds its corresponding standard deviation, suggesting that the data are relatively well distributed, free from extreme variation, and appropriate for use in panel data regression analysis.

Panel Data Regression Model Estimation

Common Effect Model (CEM) Estimation

Table 2. Estimation Results of the Common Effect Model (CEM)

Variable	Coefficient	Std. Error	t-Statistic	Probability
C	114.1610	10.34612	11.03418	0.0000
DBH_SDA	-2.637683	0.588338	-4.483281	0.0000
CAPITAL_EXPENDITURE	-3.091265	0.676357	-4.570461	0.0000
PAD	4.396646	0.343307	12.80674	0.0000

Model Statistics			
Statistic	Value	Statistic	Value
R-squared	0.397572	Mean dependent variable	71.53572
Adjusted R-squared	0.390620	S.D. dependent variable	4.794328
S.E. of regression	3.742585	Akaike information criterion	5.492466
Sum squared residuals	3641.805	Schwarz criterion	5.546647
Log likelihood	-721.0055	Hannan–Quinn criterion	5.514237
F-statistic	57.19551	Durbin–Watson statistic	0.263373
Prob(F-statistic)	0.000000		

Source: EViews 12 output, processed data (2026).

Based on the estimation results of the Common Effect Model (CEM) presented in Table 2, the regression equation describing the relationship between Natural Resource Revenue-Sharing Funds (DBH-SDA), Capital Expenditure, and Local Own-Source Revenue (PAD) and the Human Development Index (HDI) was obtained. However, the regression coefficients are not interpreted at this stage because the most appropriate panel data model has not yet been determined. The estimation results indicate an Adjusted R-squared value of 0.390620, implying that the independent variables explain 39.06% of the variation in the HDI, while the remaining 60.94% is explained by factors outside the scope of this study. In addition, the Prob(F-statistic) value of 0.000000 (< 0.05) indicates that the regression model is statistically significant and appropriate as an initial estimation model. Nevertheless, because the Common Effect Model assumes homogeneous characteristics across all regencies and municipalities, further model selection through comparison with the Fixed Effect Model (FEM) and the Random Effect Model (REM) is required to determine the most appropriate panel data model.

Fixed Effect Model (FEM) Estimation

Table 3. Estimation Results of the Fixed Effect Model (FEM)

Variable	Coefficient	Std. Error	t-Statistic	Probability
C	68.06449	9.089724	7.488070	0.0000
DBH_SDA	-1.807849	0.366767	-4.929148	0.0000
CAPITAL_EXPENDITURE	2.796276	0.651179	4.294176	0.0000
PAD	-1.053571	0.476943	-2.209008	0.0282
Effects Specification				
Effect	Description			
Cross-section fixed	Dummy variables			
Model Statistics				
Statistic	Value	Statistic	Value	
R-squared	0.874102	Mean dependent variable	71.53572	

Statistic	Value	Statistic	Value
Adjusted R-squared	0.854776	S.D. dependent variable	4.794328
S.E. of regression	1.827036	Akaike information criterion	4.169391
Sum squared residuals	761.0778	Schwarz criterion	4.657020
Log likelihood	-514.3596	Hannan–Quinn criterion	4.365335
F-statistic	45.22840	Durbin–Watson statistic	0.578822
Prob(F-statistic)	0.000000		

Source: EViews 12 output, processed data (2026).

Based on the estimation results of the Fixed Effect Model (FEM) presented in Table 3, the regression equation describing the relationship between Natural Resource Revenue-Sharing Funds (DBH-SDA), Capital Expenditure, and Local Own-Source Revenue (PAD) and the Human Development Index (HDI) was obtained. However, the regression coefficients are not interpreted at this stage because the most appropriate panel data model has not yet been determined. The estimation results show an Adjusted R-squared value of 0.854776, indicating that 85.48% of the variation in the HDI is explained by the independent variables, while the remaining 14.52% is attributable to factors outside the proposed research model. The Prob(F-statistic) value of 0.000000 (< 0.05), together with the smaller Standard Error of Regression compared with that of the Common Effect Model, indicates that the Fixed Effect Model provides a better fit for explaining data variation and accommodates differences in characteristics among regencies and municipalities more effectively. Nevertheless, the Fixed Effect Model must still be compared with the Common Effect Model using the Chow Test and with the Random Effect Model (REM) using the Hausman Test to determine the most appropriate panel data estimation model.

Random Effect Model (REM) Estimation

Table 4. Estimation Results of the Random Effect Model (REM)

Variable	Coefficient	Std. Error	t-Statistic	Probability
C	81.30041	8.608373	9.444341	0.0000
DBH_SDA	-2.018515	0.360847	-5.593825	0.0000
CAPITAL_EXPENDITURE	1.190194	0.593587	2.005090	0.0460
PAD	0.390962	0.418454	0.934302	0.3510
Effects Specification				
Effect	S.D.		Rho	
Cross-section random	3.129044		0.7457	
Idiosyncratic random	1.827036		0.2543	
Weighted Statistics				

Statistic	Value	Statistic	Value
R-squared	0.097180	Mean dependent variable	14.46276
Adjusted R-squared	0.086763	S.D. dependent variable	2.044444
S.E. of regression	1.953740	Sum squared residuals	992.4465
F-statistic	9.328871	Durbin–Watson statistic	0.424324
Prob(F-statistic)	0.000000		

Source: EViews 12 output, processed data (2026).

Based on the estimation results of the Random Effect Model (REM) presented in Table 4, the regression equation describing the relationship between Natural Resource Revenue-Sharing Funds (DBH-SDA), Capital Expenditure, and Local Own-Source Revenue (PAD) and the Human Development Index (HDI) was obtained. However, the regression coefficients are not interpreted at this stage because the most appropriate panel data model has not yet been determined. The estimation results indicate an Adjusted R-squared value of 0.086763, implying that the independent variables explain only 8.68% of the variation in the HDI, while the remaining 91.32% is explained by factors outside the proposed research model. The Prob(F-statistic) value of 0.000000 (< 0.05) indicates that the model is jointly significant. Furthermore, the inclusion of cross-section random effects suggests that differences in characteristics across regencies and municipalities are treated as random effects within the model. Nevertheless, the Random Effect Model must still be compared with alternative models using the Hausman Test and the Lagrange Multiplier (LM) Test to determine the most appropriate panel data model for this study.

Panel Data Model Selection

Chow Test

Table 5. Chow Test Results

Effects Test	Statistic	d.f.	Probability
Cross-section F	26.968569	(32, 228)	0.0000
Cross-section Chi-square	413.291748	32	0.0000

Source: Processed using EViews 11 (2026).

Based on Table 5, the Cross-section F probability value is 0.0000, which is lower than the 5% significance level. This result indicates that H_0 is rejected and H_1 is accepted. Therefore, between the Common Effect Model (CEM) and the Fixed Effect Model (FEM), the Fixed Effect Model (FEM) is considered the more appropriate specification. These findings indicate that significant differences exist in the characteristics of regencies and municipalities in North Sumatra Province, and these differences should be taken into account in the regression model. Consequently, the Fixed Effect Model is considered more appropriate because it accommodates region-specific characteristics, unlike the Common Effect Model, which assumes homogeneous characteristics across all regions.

Based on the results of the Chow Test, the next step is to conduct the Hausman Test to determine the most appropriate model between the Fixed Effect Model (FEM) and the Random Effect Model (REM).

Hausman Test

Table 6. Hausman Test Results

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Probability
Cross-section random	40.312283	3	0.0000

Source: Processed using EViews 11 (2026).

Based on Table 6, the probability value is 0.0000, which is lower than the 5% significance level. This result indicates that H_0 is rejected and H_1 is accepted. Therefore, between the Random Effect Model (REM) and the Fixed Effect Model (FEM), the Fixed Effect Model (FEM) is identified as the more appropriate estimation model.

The Hausman test results indicate that the individual effects associated with each regency and municipality are correlated with the independent variables included in the research model. Consequently, the Fixed Effect Model is considered to provide more consistent and reliable parameter estimates than the Random Effect Model.

Selection of the Best Panel Data Model

Based on the results of the panel data model selection tests conducted using the Chow Test and the Hausman Test, both tests consistently identified the Fixed Effect Model (FEM) as the most appropriate model for this study. The Chow Test produced a probability value of 0.0000, indicating that the Fixed Effect Model is superior to the Common Effect Model (CEM). Furthermore, the Hausman Test also yielded a probability value of 0.0000, indicating that the Fixed Effect Model is more appropriate than the Random Effect Model (REM).

Accordingly, the Fixed Effect Model (FEM) was selected as the final panel data regression model for this study. Therefore, all subsequent hypothesis testing, including the partial significance test (t-test), simultaneous significance test (F-test), and coefficient of determination (Adjusted R^2), is based on the estimation results of the Fixed Effect Model (FEM).

Hypothesis Testing

Partial Significance Test (t-test)

Table 7. Results of the Partial Significance Test (t-test)

Variable	Coefficient	t-Statistic	Probability
DBH-SDA	-1.807849	-4.929148	0.0000
Capital Expenditure	2.796276	4.294176	0.0000
PAD	-1.053571	-2.209008	0.0282

Source: Processed using EViews 12 (2026).

As presented in Table 7, the Natural Resource Revenue-Sharing Fund (DBH-SDA) variable has a probability value of 0.0000, which is lower than the 5% significance level. This result indicates that Natural Resource Revenue-Sharing Funds have a statistically significant effect on the Human Development Index (HDI). The regression coefficient of -1.807849 indicates a negative relationship between DBH-SDA and the HDI.

The Capital Expenditure variable has a probability value of 0.0000, which is also below 0.05, indicating that Capital Expenditure has a statistically significant effect on

the Human Development Index. The regression coefficient of 2.796276 suggests a positive relationship between Capital Expenditure and the HDI.

Similarly, Local Own-Source Revenue (PAD) has a probability value of 0.0282, which is lower than 0.05, indicating that PAD has a statistically positive effect on the Human Development Index. The regression coefficient of -1.053571 indicates a negative relationship between PAD and the HDI.

Overall, the findings demonstrate that all independent variables examined in this study Natural Resource Revenue-Sharing Funds (DBH-SDA), Capital Expenditure, and Local Own-Source Revenue (PAD)—have statistically significant effects on the Human Development Index (HDI) of regencies and municipalities in North Sumatra Province during the study period.

Simultaneous Significance Test (F-test)

Table 8. Results of the Simultaneous Significance Test (F-test)

Description	Value
F-statistic	45.22840
Prob(F-statistic)	0.000000

Source: Processed using EViews 12 (2026).

As shown in Table 8, the F-statistic is 45.22840, with a corresponding Prob(F-statistic) value of 0.000000. Since the probability value is lower than the 5% significance level, it can be concluded that Natural Resource Revenue-Sharing Funds (DBH-SDA), Capital Expenditure, and Local Own-Source Revenue (PAD) jointly have a statistically significant effect on the Human Development Index (HDI) of regencies and municipalities in North Sumatra Province during the 2017–2024 period.

These results indicate that simultaneous changes in Natural Resource Revenue-Sharing Funds, Capital Expenditure, and Local Own-Source Revenue collectively influence the level of the Human Development **Index** in the regions included in this study.

Coefficient of Determination (Adjusted R²)

Table 9. Coefficient of Determination Results

Description	Value
R-squared	0.874102
Adjusted R-squared	0.854776

Source: Processed using EViews 12 (2026).

Based on Table 9, the Adjusted R-squared value is 0.854776, or 85.48%. This indicates that 85.48% of the variation in the Human Development Index (HDI) can be explained by Natural Resource Revenue-Sharing Funds (DBH-SDA), Capital Expenditure, and Local Own-Source Revenue (PAD). The remaining 14.52% of the variation is explained by other factors not included in the research model.

The relatively high coefficient of determination indicates that the Fixed Effect Model (FEM) employed in this study possesses strong explanatory power in accounting

for variations in the Human Development Index across regencies and municipalities in North Sumatra Province during the 2017–2024 period.

Discussion

Effect of Natural Resource Revenue-Sharing Funds on the Human Development Index

Based on the partial significance test using the Fixed Effect Model (FEM), the Natural Resource Revenue-Sharing Fund (DBH-SDA) variable has a regression coefficient of -1.807849 with a probability value of 0.0000 , which is lower than the 5% significance level. These results indicate that Natural Resource Revenue-Sharing Funds (DBH-SDA) have a negative and statistically significant effect on the Human Development Index (HDI) across regencies and municipalities in North Sumatra Province during the 2017–2024 period. Accordingly, an increase in DBH-SDA revenue is associated with a decline in the HDI, holding other factors constant.

This negative relationship suggests that larger allocations of Natural Resource Revenue-Sharing Funds do not necessarily improve the quality of human development. The findings imply that additional revenues generated from natural resource sectors have not been fully allocated to sectors that directly enhance community well-being, such as education, healthcare, and social protection. Instead, a considerable portion of these funds may still be directed toward administrative expenditures, routine government spending, or programs with only indirect effects on the Human Development Index. Consequently, increases in DBH-SDA revenues do not automatically translate into improvements in human development when the effectiveness of regional fiscal management remains limited.

These findings are consistent with Fiscal Decentralization Theory proposed by Oates (1972), which argues that the success of fiscal transfers depends not only on the amount of funds received by local governments but also on their ability to allocate resources efficiently according to local needs. Furthermore, the results can also be explained by the Resource Curse Theory, which suggests that regions endowed with abundant natural resources do not necessarily achieve higher levels of human development when resource revenues are not managed effectively.

The findings are also supported by previous international studies. James (2017) reported that local governments' dependence on natural resource revenues tends to reduce incentives to improve public service quality, thereby limiting their contribution to human development. Similarly, Badeeb, Lean, and Clark (2017), in their systematic review of the resource curse literature, concluded that natural resource wealth does not necessarily improve social welfare when governance quality and fiscal institutions remain weak. Likewise, Venables (2016) argued that revenues derived from natural resources contribute to development only when accompanied by effective fiscal governance, investment in human capital, and long-term public policies. Therefore, the findings of this study reinforce the view that substantial Natural Resource Revenue-Sharing Funds do not automatically improve the Human Development Index unless they are optimally allocated to sectors directly supporting improvements in people's quality of life.

Based on these findings, increasing Natural Resource Revenue-Sharing Funds should be accompanied by more effective, transparent, and human development-

oriented budget management. Local governments in North Sumatra Province are expected to allocate these funds more proportionally to education, healthcare, and public service provision so that the benefits of natural resource revenues can be directly experienced by the community and contribute to sustainable improvements in the Human Development Index.

Therefore, the negative relationship identified in this study should not be interpreted as indicating that Natural Resource Revenue-Sharing Funds (DBH-SDA) are inherently detrimental to human development. Rather, it suggests that increases in DBH-SDA revenues have not yet been effectively translated into improvements in human development because the effectiveness of fiscal management, budget allocation, and the quality of regional financial governance remain critical determinants of successful human development.

Effect of Capital Expenditure on the Human Development Index

Based on the partial significance test using the Fixed Effect Model (FEM), the Capital Expenditure variable has a regression coefficient of 2.796276 with a probability value of 0.0000, which is below the 5% significance level. These results indicate that Capital Expenditure has a positive and statistically significant effect on the Human Development Index (HDI) across regencies and municipalities in North Sumatra Province during the 2017–2024 period.

This positive relationship indicates that increasing Capital Expenditure contributes to improvements in human development. Capital expenditures allocated to infrastructure development, educational facilities, healthcare facilities, and other public infrastructure enhance public access to essential services required to improve quality of life. Better infrastructure and public services increase opportunities for communities to obtain quality education, adequate healthcare services, and improved economic well-being.

These findings are consistent with the theory proposed by Aschauer (1989), which states that productive public expenditure enhances social welfare and supports economic growth. Likewise, Barro (1990) argued that government spending directed toward public infrastructure increases productivity and promotes long-term economic development. Adequate infrastructure creates an environment that supports improvements in the quality of human resources.

The findings also indicate that Capital Expenditure is one of the key policy instruments available to local governments for promoting human development. Therefore, local governments should continue improving both the effectiveness and quality of capital expenditure so that its benefits can be directly experienced by society and contribute to sustained improvements in the Human Development Index.

Effect of Local Own-Source Revenue on the Human Development Index

The results indicate that Local Own-Source Revenue (PAD) has a negative and statistically significant effect on the Human Development Index (HDI). The regression coefficient of -1.053571 with a probability value of 0.0282 (< 0.05) indicates that increases in PAD during the study period were associated with declines in HDI achievement across regencies and municipalities in North Sumatra Province.

Accordingly, the hypothesis stating that PAD influences the HDI is supported; however, the direction of the relationship identified in this study is negative.

These findings suggest that higher levels of Local Own-Source Revenue do not necessarily improve the quality of human development. Empirically, PAD merely reflects the capacity of local governments to generate revenue from local taxes, service charges, returns on separated regional assets, and other legitimate locally generated revenues. Nevertheless, increases in these revenues do not automatically improve education, healthcare, or living standards unless accompanied by effective budget allocation toward public service sectors. In other words, successful human development depends more on the effective utilization of PAD than on the amount of PAD collected by local governments.

These findings are consistent with Fiscal Decentralization Theory proposed by Oates (1972), which argues that fiscal decentralization improves public welfare when local governments allocate resources efficiently according to community needs. Similarly, Mardiasmo (2018) emphasized that regional fiscal autonomy should not be measured solely by the magnitude of Local Own-Source Revenue, but also by the ability of local governments to manage and allocate financial resources effectively to improve public service quality.

The findings are also supported by several international studies. Rodríguez-Pose and Ezcurra (2011) found that improvements in regional fiscal capacity do not necessarily enhance social welfare when institutional quality and budget management remain inadequate. Likewise, Martínez-Vazquez, Lago-Peñas, and Sacchi (2017) argued that the success of fiscal decentralization largely depends on the quality of public governance. Regions with strong fiscal capacity may still fail to improve human development if public expenditure is not efficiently allocated to education, healthcare, and social services. These findings reinforce the conclusion of the present study that increasing PAD does not automatically improve the Human Development Index unless accompanied by effective fiscal management.

Therefore, the negative effect of PAD on the HDI observed in this study indicates that improvements in regional fiscal capacity have not been fully accompanied by optimal budget utilization to support human development. Local governments should therefore strengthen budget planning and financial management to ensure that Local Own-Source Revenue not only enhances fiscal capacity but also contributes to sustainable improvements in education, healthcare, and public welfare. Accordingly, the negative relationship between Local Own-Source Revenue (PAD) and the Human Development Index should not be interpreted as evidence that increasing PAD directly reduces human development. Instead, it indicates that increased fiscal capacity has not yet been accompanied by effective budget allocation to sectors that directly support human development. Hence, the quality of fiscal governance is more critical than the magnitude of regional revenues alone.

Effect of Natural Resource Revenue-Sharing Funds, Capital Expenditure, and Local Own-Source Revenue on the Human Development Index

Based on the simultaneous significance test, the Prob(F-statistic) value is 0.000000, which is lower than the 5% significance level. This result indicates that Natural

Resource Revenue-Sharing Funds (DBH-SDA), Capital Expenditure, and Local Own-Source Revenue (PAD) jointly have a statistically significant effect on the Human Development Index (HDI) across regencies and municipalities in North Sumatra Province during the 2017–2024 period.

These findings demonstrate that human development is not determined by a single source of public financing but rather results from the combined contribution of various fiscal instruments available to local governments. Fiscal transfers from the central government, regional capacity to generate own-source revenues, and government expenditure policies through Capital Expenditure are interrelated factors that collectively support improvements in people's quality of life.

The findings are consistent with Fiscal Decentralization Theory, which argues that the delegation of fiscal authority to local governments aims to improve the efficiency of public service delivery according to local needs (Oates, 1999). Furthermore, effectively implemented fiscal decentralization enhances human development through the provision of better public services tailored to regional characteristics (Hung & Thanh, 2022). Similarly, Sofilda et al. (2023) found that fiscal decentralization plays an important role in improving human development by strengthening local governments' capacity to provide public services.

Therefore, successful improvements in the Human Development Index depend not only on the amount of financial resources available to local governments but also on their effectiveness in managing and allocating these resources to programs that sustainably improve people's quality of life.

Overall, the findings indicate that not all regional fiscal instruments exert the same influence on human development. Capital Expenditure has a positive effect because it is directly translated into investments in educational infrastructure, healthcare facilities, and public infrastructure that improve community well-being. In contrast, Natural Resource Revenue-Sharing Funds and Local Own-Source Revenue exhibit negative effects because they merely represent regional revenue capacity. Increases in these revenues are not necessarily accompanied by effective budget allocation toward sectors that directly promote human development. Consequently, the effectiveness of budget management is a more decisive factor than the magnitude of regional fiscal revenues in determining improvements in human development.

CONCLUSION

Based on the results of the panel data regression analysis examining the effects of Natural Resource Revenue-Sharing Funds (DBH-SDA), Capital Expenditure, and Local Own-Source Revenue (PAD) on the Human Development Index (HDI) across 33 regencies and municipalities in North Sumatra Province during the 2017–2024 period, it can be concluded that the objectives of this study have been achieved. Partially, Natural Resource Revenue-Sharing Funds (DBH-SDA) and Local Own-Source Revenue (PAD) have a negative and statistically significant effect on the Human Development Index (HDI), whereas Capital Expenditure has a positive and statistically significant effect. These findings indicate that increases in regional fiscal capacity derived from Natural Resource Revenue-Sharing Funds (DBH-SDA) and Local Own-Source Revenue (PAD) do not automatically improve human development. Instead, the effectiveness of fiscal

management and budget allocation determines whether these revenues contribute to improvements in education, health, and living standards. In contrast, Capital Expenditure was found to have no significant effect on the Human Development Index (HDI), suggesting that larger allocations of capital expenditure do not necessarily lead to immediate improvements in human development. This finding indicates that the effectiveness of capital expenditure depends not only on the amount of funding allocated but also on the appropriateness of budget allocation, the quality of program implementation, and the existence of a time lag before infrastructure development generates tangible benefits for society.

Simultaneously, Natural Resource Revenue-Sharing Funds (DBH-SDA), Capital Expenditure, and Local Own-Source Revenue (PAD) have a statistically significant effect on the Human Development Index (HDI). These findings demonstrate that the three regional fiscal instruments collectively contribute to explaining variations in human development across regencies and municipalities in North Sumatra Province. Accordingly, the results support the research hypothesis and reinforce Fiscal Decentralization Theory, which argues that the fiscal capacity of local governments is an important determinant of improvements in public service quality and social welfare. Therefore, the management of regional revenues and the allocation of government expenditures should be implemented in an integrated manner to promote more optimal and sustainable human development.

The novelty of this study lies in its integration of the three principal components of regional public finance Natural Resource Revenue-Sharing Funds (DBH-SDA), Capital Expenditure, and Local Own-Source Revenue (PAD) within a single panel data regression model to examine their effects on the Human Development Index (HDI) at the regency and municipal levels in North Sumatra Province during the 2017–2024 period. Unlike previous studies, which generally employed aggregate indicators of fiscal decentralization or focused on only selected dimensions of regional fiscal capacity, this study provides a more comprehensive understanding of the roles of fiscal transfers, regional fiscal autonomy, and development expenditure in improving the quality of human development. Consequently, the findings are expected to enrich the literature on fiscal decentralization and human development while serving as a valuable reference for local governments in formulating more effective regional financial management policies aimed at enhancing the quality of life of the community.

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