Environmental Protection Spending and Local Own-Source Revenue in Indonesia: A Panel Data Analysis

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Abstract

This study examines the impact of environmental protection spending on Local Own-Source Revenue (PAD). The sample consists of 34 provinces in Indonesia from 2016 to 2022. Data were obtained from the Central Statistics Agency (BPS) and the Ministry of Finance. A panel regression model was used. The analysis was conducted at three levels: nationally, classified based on Environmental Quality Index (IKLH) values, and classified based on Western and Eastern Indonesia. The results show that, at the national level, Environmental Protection Expenditures (BPL) have no effect on PAD. For classifications based on the IKLH, in both Moderate and Good categories, BPL has no significant effect on PAD. Regarding the classification by region, in the Western Indonesia region (KBI), BPL has a significant positive effect on PAD. Meanwhile, in the Eastern Indonesia region (KTI), BPL has no effect on PAD. This indicates that spending on environmental protection has not served as an effective fiscal instrument in increasing Local Own-Source Revenue (PAD) in most regions during the 2016–2022 period, except with a very small impact in the Western Indonesia region (KBI). GDP remains the primary factor in increasing Local Own-Source Revenue across all regional categories. However, the central government can contribute to ensuring that local governments focus more on environmental issues by improving the quality and targeting of environmental spending.

Keywords: Environmental Protection Spending, Local Own-Source Revenue (PAD), Panel Data Analysis, Fiscal Decentralization, Environmental Quality Index (IKLH), Indonesia

INTRODUCTION

The fiscal decentralization implemented in Indonesia following the reforms has granted local governments significant authority to manage their regional finances, including efforts to maximize the potential of Local Own-Source Revenue (PAD) (Fatoni, 2020). PAD serves as the primary indicator of a region's financial autonomy, as it reflects the region's ability to fund development without relying too heavily on funds from the central government. In practice, the contribution of PAD to the total Regional Budget (APBD) remains highly variable across regions, often not maximized due to challenges ranging from limited tax bases to inefficient tax administration.

Conversely, environmental issues are increasingly receiving significant attention in local government management. Environmental crises such as floods, air pollution, and deforestation not only threaten ecosystems but also cause substantial economic losses. Local governments are responding by allocating budgets for environmental protection, whose classification is outlined in regulations including the Minister of Home Affairs Regulation No. 90 of 2019. However, budget allocation for environmental protection in the APBD is generally still small compared to spending on infrastructure or education.

An important question arises: does spending on environmental protection constitute a fiscal burden that constricts fiscal space, or can it instead be viewed as an

investment that increases local government revenue (PAD)? Theoretically, a healthy environment provides ecosystem services that serve as critical inputs for sectors generating PAD, such as nature-based tourism, fisheries, and agriculture. Recent empirical research shows that government spending on the environment contributes to improved governance (Niu, 2024).

Nevertheless, the relationship between environmental spending and Local Own-Source Revenue is neither automatic nor linear. In the short term, environmental protection spending may appear to be a consumptive cost, and a reciprocal relationship is also possible, whereby regions with higher Local Own-Source Revenue have greater fiscal space to allocate funds toward environmental protection. Studies on the determinants of PAD in Indonesia have largely focused on variables such as capital expenditure and infrastructure, while studies specifically examining the impact of environmental protection spending on PAD remain scarce. As global commitment to sustainable development grows and the transition to a green economy accelerates, understanding the fiscal contribution of environmental policy becomes increasingly important.

The uneven distribution of development between Western Indonesia (KBI) and Eastern Indonesia (KTI) has long been a concern in national development planning. KBI, encompassing Java, Sumatra, and Bali, has historically experienced significantly better economic growth and infrastructure development than KTI, which encompasses Sulawesi, Kalimantan, Nusa Tenggara, Maluku, and Papua. The Williamson inequality index in Western Indonesia averages 0.83, significantly higher than in Eastern Indonesia at 0.45 (Nurhayani, 2014), a difference influenced by unequal budget distribution favoring the West. These structural differences have a significant impact on regional fiscal capacity: KBI theoretically has a broader tax base and greater opportunity for PAD, while KTI, constrained by limited infrastructure and market access, is less able to maximize its PAD potential. An analysis differentiating KBI and KTI is therefore crucial for understanding the factors influencing PAD in each region.

Environmental quality monitoring is captured through the Environmental Quality Index (IKLH), a composite of the Water Quality Index (IKA), Air Quality Index (IKU), and Land Quality Index (IKL), which provides information for decision-makers in establishing environmental management policy at the central and regional levels.

Theoretical framework

From the public economics perspective articulated by Musgrave (1984), government has three primary roles, allocation, distribution, and stabilization. A clean and healthy environment is a public good because it is non-rivalrous and non-excludable; without government intervention through environmental protection spending, the market fails due to negative externalities such as pollution. Building on endogenous growth theory (Romer, 1994; Lucas, 1988), government spending in certain sectors can stimulate long-term growth: environmental protection expenditure, while not directly increasing output, improves the quality of natural capital as a factor of production. Under the Minister of Home Affairs Regulation, environmental protection expenditure is classified as functional spending covering waste management, pollution control, biodiversity conservation, and restoration of degraded land, though it is often treated as "mandatory spending" with low priority. Law No. 23 of 2014 on Regional Government defines PAD as revenue generated by a region through its own sources local taxes, local fees, proceeds from separate regional asset management, and other legally authorized sources.

Environmental Spending and PAD

Theoretically, environmental protection spending can affect local tax revenue through several channels: (1) improving environmental quality that supports tourism, thereby increasing local tax revenue; (2) improving public health, thereby broadening the tax base through increased productivity; (3) reducing the costs of externalities such as flooding and pollution by protecting taxable economic assets; and (4) creating new fees, such as for waste management or pollution control services. The theory also acknowledges a potential crowding-out effect if environmental spending is too high, and the Environmental Kuznets Curve (EKC) hypothesis (Grossman and Krueger, 1991) suggests a non-linear relationship between economic activity and environmental protection effort.

GRDP, Population, and PAD

Gross Regional Domestic Product (GRDP) growth indicates increased economic activity, which expands regional tax and levy sources; a 1 percent increase in per capita income has been found to increase PAD by 0.875 percent (Wulandari and Ayuningsasi, 2014), while GRDP per capita has an elasticity of 1.002683 on PAD across Indonesian provinces (Utami and Iskandar, 2020), although a study in Banten found no significant effect (Wibowo and Soebagiyo, 2025). Population size is theorized to expand the potential tax base, a finding supported in Pematang Siantar (Purba and Manurung, 2023), South Sumatra (Oktiani and AlMuhariah, 2021), and the former Pati residency (Priyono and Handayani, 2021).

The KBI and KTI Gap

The economic characteristics of KTI differ fundamentally from KBI, particularly in financial inclusion and poverty levels (Erlando et al., 2020). Financial inclusion, which relies heavily on digital infrastructure, has a causal relationship with growth and poverty reduction in the eastern region, but infrastructure constraints often produce development impacts that are less optimal than in the western region (Erlando et al., 2020; Faizah et al., 2021), and the ICT access gap between the two regions is suspected to contribute to differing growth rates (Faizah et al., 2021).

Previous Research and Novelty

Research specifically on environmental protection spending remains limited. Niu (2024) found that environmental protection spending improves governance and welfare; a study of BRICS countries found renewable-energy-related environmental spending had a significant economic effect except in Russia (Zaman et al., 2016); OECD evidence shows a positive short-run but insignificant long-run effect (Arjomandi et al., 2023); a Lampung study (2015–2023) found climate- and agriculture-related spending had a significant positive effect on growth (Yogaswara, Hudaya and Bukit, 2025); and studies of Belt and Road Initiative countries found generally positive effects of environmental spending on the economy (Utami and Iskandar, 2020; Feng et al., 2022). The novelty of this study lies in its specific focus on environmental protection expenditure as a determinant of PAD, together with an exploration of its transmission mechanisms within Indonesia's fiscal decentralization context. On IKLH specifically, GRDP from the agriculture and manufacturing sectors has been found to positively influence IKLH (Setiawan and Primandhana, 2022), while economic growth has a significant negative effect and population density a significant positive effect on IKLH, with the agricultural GRDP sector showing no effect (Yani, Restiatun and Nuratika, 2023) — indicating a two-way relationship between the economy and environmental quality that justifies classifying provinces by IKLH in this study.

Against this background, this paper conducts a conceptual and empirical analysis

of the impact of environmental protection spending on local government revenue, contributing to the development of local government finance theory and providing a basis for policy recommendations on maximizing environmental spending as a tool for increasing PAD.

RESEARCH METHODOLOGY

This research uses secondary annual panel data for 34 provinces in Indonesia from 2016 to 2022, sourced from the Central Statistics Agency (BPS) and the Directorate General of Fiscal Balance, Ministry of Finance (DJPK Kemenkeu). Data on the Environmental Quality Index (IKLH), GRDP, and population are sourced from BPS, while data on environmental protection expenditure (Environmental Protection Spending/EPS) and PAD are sourced from DJPK. The study period was chosen based on the availability of IKLH data.

Table 1. Operational Definition of Variables

Variable Type	Variable	Code	Measurement	Source	Period
Dependent	Ln Local Own-Source Revenue (Ln_PAD)	Y	Natural log of provincial Local Own-Source Revenue	DJPK Kemenkeu	2016–2022
Independent	Ln Environmental Protection Spending (Ln_BPL)	x1	Natural log of provincial environmental protection spending	DJPK, Ministry of Finance	2016–2022
Independent	Ln GRDP	x2	Natural log of provincial GRDP	BPS	2016–2022
Independent	Ln Population	x3	Natural log of provincial population	BPS	2016–2022

The panel data model used in this study is the Fixed Effects Model. The models used in this research are the fixed effect model to control the effects of heterogeneity between provinces, the random effect model to estimate the relationship between all provinces and the dependent variable. The Fix Effects Model was selected following the results of the Hausman test, where the p-value was less than 0.05, indicating that the Fix Effects Model was a better fit than the Random Effects Model. The Fixed Effects Model accounts for the effects of heterogeneous characteristics within provinces, such as cultural and geographical conditions, which remain constant throughout the study. The research model used is as follows:

$$Y_it = \beta_0 + \beta_1 x1_it + \beta_2 x2_it + \beta_3 x3_it + _i + \varepsilon_it$$

where Y is the natural logarithm of the Provincial PAD Value, x1 is the Environmental Protection Expenditure, x2 is the natural logarithm of the GRDP value, x3 is the natural logarithm of the Population, α_i is the provincial fixed effect, and ε is the error term.

Regarding standard errors, this study employs the robust standard error method, utilizing clusters at the provincial level. This

method is used to address issues of heteroscedasticity in the varying variance of error terms and autocorrelation among errors within a single province over time.

RESULTS AND DISCUSSION

Descriptive Analysis

A descriptive analysis of the variables used in this study is presented in Table 2. Table 2 shows that the mean value of variable Y (ln_PAD) for the 34 provinces from 2016 to 2022 was, with a minimum value of 2,88 and a maximum value of 10,73. For variable x1 (ln_BPL), there is a significant disparity among regions, with the lowest x1 value at 0,18 and the highest at 7,89, with a mean of 2,96 and a standard deviation of 1,55. Meanwhile, for variable x2 (ln_PDRB), the lowest value is 9,98 and the highest is 14,48, with a mean of 11,96. For variable x3 (ln_Population), the lowest value is 6,49 and the highest is 10,81, with a mean of 8,38.

Table 2 Descriptive Analysis

Variable	Mean	Standard Deviation	Minimum	Maximum
Y	7,65	1,20	2,88	10,73
x1	2,96	1,55	0,18	7,89
x2	11,96	1,14	9,98	14,48
x3	8,38	1,01	6,49	10,81

Discussion

National Level Analysis

Furthermore, regarding the results of the Hausman test to choose between the FE and RE models, a p-value of 0,000 (less than 0,05) was obtained; therefore, the FE model was selected, Since the classical assumption tests revealed issues with autocorrelation and heteroscedasticity, the FE model with robust cluster standard errors was used, The results of the tests for the FE, RE, and robust cluster standard error RE models are presented in Table 3, below the figure, while table captions should be placed above the table, and both must be cited in the main text,

Discussion includes an interpretation of the research findings and a discussion of how they relate to previously published research findings

Table 3, Regression Results

Variable	FE	RE
x1	0,008 (0,008)	0,019 (0,015)
x2	1,604 *** (0,434)	0,877 *** (0,090)
x3	-0,394 (1,701)	0,169 * (0,102)
_cons	-8,251 (9,740)	-4,316 *** (0,546)
N	238	238
Province	34	34
R^2 Within	0, 2476	0,2320

R^2 Between	0, 8703	0,9265
R^2 overall	0, 8415	0,8939

Note: *** p < 0,01, ** p < 0,05, * p < 0,10, Robust standard errors in parentheses,
Models (1) and (2): Fixed Effects and Random Effects with cluster robust standard errors,

Panel regression results using the Fixed Effects (FE) model and robust cluster standard errors indicate that the environmental protection expenditure variable (Ln_BPL) has a coefficient of 0,008 and is not statistically significant at the conventional significance level (p > 0,10), This indicates that during the 2016–2022 period, increased spending on environmental protection by local governments in Indonesia has not been proven to directly increase Local Own-Source Revenue (PAD),

The Impact of Environmental Protection Expenditure (BPL) on PAD

The environmental protection expenditure variable (Ln_BPL) has a positive coefficient of 0,008 but is not statistically significant (p > 0,10), This result contradicts previous studies that showed a positive and significant effect of environmental protection expenditure on the economy (Zaman et al,, 2016; Utami & Iskandar, 2020; Feng et al,, 2022; Arjomandi et al,, 2023; Niu, 2024), This may be due to the budget for environmental protection in the Regional Budget (APBD) being very low compared to the budget for infrastructure, education, or health, With such limited allocations, its economic impact on regional income is statistically very small, Furthermore, environmental protection expenditure is often long-term in nature, where economic benefits are only felt after a longer period, while the analysis period in this study (2016–2022) may not be sufficient to identify these long-term effects, Furthermore, according to research in Lampung, environmental spending that has a significant impact on economic growth is spending specifically related to productive sectors such as agriculture and climate, not environmental spending as a whole (Yogaswara, Hudaya & Bukit, 2025),

The influence of GRDP on PAD

The GRDP variable (Ln_GRDP) shows a positive coefficient of 1,604 and is statistically significant at the 1% level of significance (p < 0,01), This coefficient indicates that every 1 percent increase in GRDP will result in a 1,604 percent increase in PAD, assuming that other variables remain unchanged,

This result is in line with previous studies which indicate that GRDP has a positive and significant effect on PAD, (Wulandari and Ayuningsasi, 2014; Utami and Iskandar, 2020), A higher GRDP indicates more active economic activity in a region, which subsequently expands the regional tax and levy base, The greater the added value generated by various economic sectors, the higher the potential for regional tax revenues, such as hotel, restaurant, entertainment, and motor vehicle taxes, Furthermore, GRDP growth is generally accompanied by increased purchasing power, which contributes to increased regional tax revenues related to public consumption,

The Influence of Population on PAD

The population variable (Ln_Population) in the FE model shows a negative coefficient of -0,394, and it is not statistically significant at the conventional level (p > 0,10), This result is interesting because it contrasts with a number of previous studies that showed a positive and significant impact of population size on PAD (Oktiani and AlMuhariah, 2021; Priyono and Handayani, 2021; Purba and Manurung, 2023),

The insignificance of the population variable may be due to the fact that the population's impact on Local Own-Source Revenue (PAD) may not be direct, but rather through intermediary variables such as the level of economic activity or tax compliance, In other words, a large population does not automatically result in high PAD if the quality of human resources is low, the unemployment rate is high, or the majority of economic activity is in the informal sector, which is difficult to tax, In the digital and automation era, the link between population size and tax revenue is becoming looser, as many economic transactions take place digitally and are no longer geographically tied to a region's population,

The results of this study indicate that in the Indonesian context from 2016 to 2022, GRDP and spending on environmental protection are variables that have a greater influence on PAD than population size, This indicates that PAD growth is determined more by economic development and appropriate fiscal policies (including budget allocation for environmental protection), rather than solely by population size,

Analysis Based on IKLH Classification

Table 4, Regional Regression Results for Moderate and Good IKLH Categories

Variable	RE	
	Moderate	**Good**
x1	0,010 (0,009)	0,016 (0,012)
x2	1,244*** (0,083)	0, 732*** (0,082)
x3	-0,277*** (0,067)	0, 340*** (0,092)
N	56	182
Province	8	26
R^2 Within	0,7073	0,2005
R^2 Between	0,9736	0,8804
R^2 overall	0,9709	0,8095

Note: *** p < 0,01, ** p < 0,05, * p < 0,10, Robust standard errors in parentheses, Models (1) and (2): Random Effects with cluster robust standard errors,

In areas with a Moderate Environmental Quality Index (IKLH), the Environmental Protection Expenditure (x1) variable has a coefficient of 0,010 and is not statistically significant (p > 0,10), This indicates that in areas with moderate environmental quality, increases in environmental protection spending have not been able to significantly increase Local Own-Source Revenue (PAD), This may be due to the budget allocation for the environment being more focused on handling the consequences of damage that has occurred (such as floods, landslides, or pollution) rather than on long-term environmental investments that can encourage productive economic sectors, Human resources and programs related to environmental sustainability may also influence this,

In areas with a Good Environmental Quality Index (IKLH) category, the Environmental Protection Expenditure (x1) variable has a coefficient of 0,016, but it is not statistically significant (p > 0,10),

This may be because in areas with adequate environmental conditions, additional environmental spending may have reached a maximum (diminishing returns), where

additional budget increases no longer provide positive economic impacts for the region, Furthermore, as shown in research in OECD countries, environmental spending may have a positive impact in the short term but not in the long term (Arjomandi et al,, 2023), indicating that the effectiveness of environmental spending can vary across time periods,

In areas with a Good Environmental Quality Index (IKLH), the GRDP (x2) variable shows a coefficient of 0,732, which is statistically significant at the 1% level ($p < 0,01$), Although significant, this coefficient is lower than the coefficient in areas with a Moderate Environmental Quality Index (1,244), indicating that in areas with good environmental quality, the relationship between GRDP and PAD is not as strong as in areas with moderate environmental quality,

Meanwhile, the population variable (x3) in areas with a Good Environmental Quality Index (IKLH) has a coefficient of 0,340 and is statistically significant at the 1% level ($p < 0,01$), Unlike areas with moderate IKLH, in areas with good environmental quality, population has a significant positive impact on Local Own-Source Revenue (PAD), This can be explained by the fact that in areas with good environmental quality, the quality of human resources, the level of economic formality, and tax compliance tend to be higher, so that population growth can actually transfer into regional income, This is consistent with previous studies showing that population has a positive impact on Local Own-Source Revenue (Oktiani & AlMuhariah, 2021; Purba & Manurung, 2023),

Analysis Based on KBI and KTI

Furthermore, regarding the analysis of the impact of BPL on PAD of provinces in Indonesia, which are divided into the Western Region of Indonesia and the Eastern Region of Indonesia, it is presented in Table 5, Just like in the analysis based on IKLH, this analysis applies the robust cluster model of standard error FE in KBI and RE in KTI because the results of the Hausman Test show that FE is superior to RE in KBI and RE is superior to FE in KTI,

Tabel 5, Regression Results for Western Indonesia and Eastern Indonesia

Variable	FE	RE
	KBI	KTI
x1	0,014* (0,007)	0,010 (0,015)
x2	1,467*** (0,221)	0,776*** (0,077)
x3	0,613 (0,426)	0,411*** (0,098)
N	112	126
Provinsi	16	18
R^2 Within	0,7404	0,1597
R^2 Between	0,9154	0,8791
R^2 overall	0,9103	0,7803

Note: *** p<0,01, ** p<0,05, * p<0,10, Robust standard errors in parentheses,
Models (1) and (2): Fixed Effects for KBI and Random Effects for KTI with cluster robust standard errors,

In the KBI region, the Environmental Protection Expenditure variable (x1) shows a coefficient of 0,014 and is statistically significant at the 10% confidence level ($p < 0,10$), Although significant, this coefficient value is very small, indicating that increasing the environmental protection budget has only a very limited effect on increasing Local Own-Source Revenue (PAD) in the western region, In KBI, the GRDP variable (x2) has a coefficient of 1,467, which is significant at the 1% level ($p < 0,01$), This indicates that PAD in KBI is strongly influenced by the level of economic activity, as KBI is a center for modern manufacturing, trade, and service industries, The population variable (x3) in KBI has a coefficient of 0,613 but is not statistically significant ($p > 0,10$), This indicates that in developed and modern regions, population size is no longer the primary factor driving PAD, In this digital age, economic value is determined not only by population size, but also by productivity, consumption levels, and citizen tax compliance,

In Eastern Indonesia (KTI), the Environmental Protection Spending variable (x1) has a coefficient of 0,010, but it is not statistically significant ($p > 0,10$), This means that environmental protection spending has not been statistically proven to increase Local Own-Source Revenue (PAD), This could be due to the allocation of environmental spending being too low or not being well-directed to produce a statistically detectable impact,

Furthermore, the effectiveness of environmental spending in Eastern Indonesia (KTI) may be hampered by limited institutional capacity and human resources, resulting in inadequate implementation of environmental protection programs, Limited infrastructure and market access in Eastern Indonesia can also result in less than optimal economic value added,

The GRDP variable (x2) in Eastern Indonesia has a coefficient of 0,776, which is statistically significant at the 1% level ($p < 0,01$), Although significant, this coefficient is much lower than the coefficient in the KBI (0,776 vs, 1,467), This indicates that in Eastern Indonesia, the economic structure is not yet fully monetized and structured like in KBI, Most economic activity in Eastern Indonesia (KTI) still occurs in the informal sector, so GRDP growth has not been fully translated into regional tax and levy revenue,

Meanwhile, the population variable (x3) in Eastern Indonesia (KTI) has a coefficient of 0,411, which is statistically significant at the 1% level ($p < 0,01$), Unlike in the Western Indonesia (KBI), population in Eastern Indonesia has a positive and significant effect on PAD, This indicates that in regions with lower levels of development, population growth still contributes to increased basic economic activity and expanded public consumption, which ultimately impacts regional revenue,

CONCLUSION

First, at the national level, environmental protection spending (ESP) shows a positive coefficient of 0,008, but it is not statistically significant, This study shows that overall, increased environmental spending has not been proven to significantly increase Local Own-Source Revenue (PAD) during the 2016–2022 period, This suggests that environmental spending at the national level is still considered a budget burden or has not been properly targeted, so its economic benefits are not yet apparent, Meanwhile, GRDP has a positive and significant effect on PAD with a coefficient of 1,604 ($p < 0,01$), confirming that GRDP remains the primary driver of PAD in Indonesia, On the other hand, the population variable shows a negative coefficient (-0,394) and is not significant, indicating that population size is not a determinant of PAD without the support of quality human resources,

Second, according to the Environmental Quality Index (IKLH) classification, in

regions with a Moderate IKLH category, environmental protection spending has a coefficient of 0,010 and is not significant ($p > 0,10$), This indicates that in regions with moderate environmental quality, environmental spending is still more focused on addressing the consequences of existing environmental damage than on productive investment, Meanwhile, in regions with a Good Environmental Quality Index (IKLH), environmental protection spending also showed an insignificant coefficient of 0,016, indicating that environmental spending has not been effective enough in increasing Local Own-Source Revenue (PAD), In both IKLH categories, GRDP continued to have a positive and significant effect on PAD, with coefficients of 1,244 (Medium) and 0,732 (Good), respectively, Population in regions with a Moderate IKLH had a negative impact (-0,277, $p < 0,01$), while in regions with a Good IKLH it had a positive effect (0,340, $p < 0,01$), indicating that environmental quality plays a role in determining whether population growth becomes a burden or a potential source of regional revenue,

Third, with reference to regional classification, this study reveals striking differences between the Western Region of Indonesia (KBI) and the Eastern Region of Indonesia (KTI), In KBI, environmental protection spending has a coefficient of 0,014 and is significant at the 10% level ($p < 0,10$), Although significant, this coefficient value is very small, indicating that environmental spending has only a very limited impact on PAD, Meanwhile, GRDP plays a very dominant role with a coefficient of 1,467 ($p < 0,01$), indicating that PAD in KBI is mainly based on the manufacturing industry, trade, and modern services sectors, Population in KBI does not have a significant (coefficient of 0,613, $p > 0,10$), Conversely, in KTI, environmental protection spending shows a coefficient of 0,010 and is not significant ($p > 0,10$), which may be caused by small budget allocations, limited institutional capacity and human resources, or inaccurate program targeting, GRDP in KTI still has a positive and significant influence with a coefficient of 0,776 ($p < 0,01$), but is much lower than in KBI, indicating a high informal sector and lack of infrastructure in the eastern region compared to the western region, Population in Eastern Indonesia (KTI) has a positive and significant effect with a coefficient of 0,411 ($p < 0,01$), indicating that in regions with lower levels of development, population growth still plays a role in increasing Local Own-Source Revenue (PAD),

Overall, this study shows that environmental protection spending in Indonesian regions from 2016 to 2022 has not been very effective in increasing PAD, except in the Western Indonesia (KBI) regions, where the effect is very marginal, GRDP remains the primary factor in PAD in each regional group, while the impact of population varies depending on environmental quality and the region's level of economic development,

RECOMMENDATION

For the Central Government

The central government needs to adopt a diversified approach in regulating and supporting environmental protection spending across regions, A one-size-fits-all policy is inappropriate given the significant variation in the effectiveness of environmental spending across regions, For regions with a good Environmental Quality Index (IKLH) and for Eastern Indonesia (KTI) where the impact of environmental spending on Local Own-Source Revenue (PAD) has not been proven statistically significant, the central government needs to consider providing additional fiscal incentives, such as larger matching grants or performance-based transfers, to encourage continued investment in environmental protection,

The central government should consider implementing or strengthening the Ecological Fiscal Transfer (EFT) mechanism, which rewards regions with good environmental performance, This will provide incentives for regions to maintain environmental quality and

additional fiscal resources to further enhance environmental protection efforts, creating a positive cycle between environmental quality and regional revenue,

In regions with a moderate IKLH, where the environmental impact has not yet been significantly demonstrated on Local Own-Source Revenue (PAD), the central government should provide technical support and capacity-building programs, This assistance should focus on improving the quality of environmental spending planning and implementation, to ensure that budgets are allocated for programs with direct economic links, rather than simply for reactive damage control, Improving the quality of human resources and institutional capacity in these regions is crucial,

Given that the limited impact of GDP on PAD in Eastern Indonesia is partly due to inadequate infrastructure and market access, the central government needs to prioritize infrastructure development in eastern Indonesia, Improved connectivity, digital infrastructure, and market access will support the formalization of economic activity and enable GDP growth to be more efficiently transformed into regional tax revenues,

For Regional Governments

The Regional Governments, particularly in regions with a Good Environmental Quality Index (IKLH) and in Eastern Indonesia (KTI), should view environmental protection spending as a strategic investment rather than a consumptive expense, They should ensure that environmental budgets are allocated to programs that not only improve environmental quality but also directly support productive economic sectors such as ecotourism, sustainable agriculture, and fisheries management, This approach will maximize the fiscal returns from environmental spending,

For regions with a Moderate Environmental Quality Index (IKLH), regional governments should conduct a comprehensive review of their environmental spending programs to identify why current spending has not generated significant economic returns, This could include improving program design, strengthening monitoring and evaluation, enhancing coordination with relevant economic sectors, and investing in human resource capacity for environmental management,

Regional governments in regions with a Good Environmental Quality Index (IKLH) should maintain and continuously improve their environmental quality, as this study confirms that good environmental quality can significantly impact the economy,

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