

Mediating Sustainable Regional Development: The Role of Indonesia's Supreme Audit Institution in Economic Growth and Fiscal Governance

Cipta Dwi Sastra¹, Satia Negara Lubis^{1*}, Badaruddin², Achmad Siddik Thoha¹

¹ Rural Development Planning, Post Graduate School, Universitas Sumatera Utara, Medan 20155, Indonesia

*Corresponding Author: satia.negara@usu.ac.id

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ABSTRACT

This study examines whether and how Indonesia's Supreme Audit Institution (BPK) mediates the relationships between economic growth, local revenue, investment, and sustainable regional development (SRD) across 33 districts/municipalities in North Sumatra. Using a quantitative, explanatory design with PLS-SEM, we integrate survey responses from 539 local officials (finance offices, inspectorates, and strategic agencies) with administrative indicators. SRD is modelled as a second-order reflective construct (economic-social-environmental), while BPK is treated as a governance mediator operating through findings and follow-up (TLRHP). Results show a large, precisely estimated positive direct association between growth and SRD ($\beta = 0.709, p < .001$). Growth ($\beta = 0.280, p = .001$) and local revenue ($\beta = 0.294, p < .001$) are both positively associated with audit intensity, yet the same-year association between BPK and SRD is negative ($\beta = -0.261, p = .008$), yielding negative derived indirect effects via BPK for growth (-0.073) and revenue (-0.077). Investment has no significant direct effect on SRD ($p = .243$) and only a modest link to BPK ($\beta = 0.134, p = .036$), producing a small negative indirect effect (-0.035). The pattern is consistent with problem-triggered, corrective audits: oversight intensifies where outcomes lag, so contemporaneous correlations are negative and benefits emerge with a policy-cycle lag ($t+1$) once findings are closed and integrated into RKPD/APBD. Policy implications include institutionalizing audit-to-budget linkages (TLRHP \rightarrow RKPD/APBD-P), adopting lag-aware performance indicators, and targeting high-elasticity investments (connectivity, basic services) to convert fiscal capacity into sustainable development outcomes.

Keywords: Sustainable Regional Development, Public Audit, Mediation, Fiscal Governance, PLS-SEM, Indonesia, BPK, TLRHP, Decentralization.

INTRODUCTION

Sustainable regional development in Indonesia is pivotal for harmonizing economic growth with environmental and social equity, particularly within its diverse archipelagic framework [1]. Despite achieving a 5.05% GDP growth in 2024, persistent urban-rural disparities and climate vulnerabilities necessitate integrated planning aligned with the Sustainable Development Goals (SDGs) [2]. The National Medium-Term Development Plan (RPJMN) 2025-2029 prioritizes green infrastructure and digital transformation to foster inclusive progress [3]. Provincial analyses underscore human development indices as mediators enhancing economic outcomes through fiscal strategies, highlighting the need for robust policy frameworks [4].

Fiscal decentralization, implemented in Indonesia since the early 2000s, empowers local governments with greater autonomy in managing revenues and expenditures [5]. This shift enables tailored development strategies, yet uneven intergovernmental transfers create fiscal capacity disparities across provinces [6,7]. Transparent budgeting practices, as emphasized in comprehensive fiscal management studies, correlate with improved public

service delivery [8]. Effective decentralization requires structured expenditure management to ensure long-term fiscal discipline, particularly in transitional economies grappling with resource allocation challenges [9].

Good governance frameworks are essential for mediating fiscal decentralization outcomes, ensuring public resources contribute to equitable regional development [10,11]. In developing contexts, governance mitigates risks of fragmented authority, supporting sustainable infrastructure and human capital growth. Institutional reforms enhance fiscal performance by fostering stakeholder engagement and reducing corruption risks, as evidenced in regional financial studies [12]. Adaptive governance models, integrating economic and administrative dimensions, are critical for balanced regional progress [13,14]

Globally, Supreme Audit Institutions (SAIs) uphold fiscal integrity, providing independent oversight that strengthens public trust and economic stability [15]. By evaluating government expenditures, SAIs offer insights that inform policy adjustments and optimize resource allocation. In post-conflict or transitional settings, their role extends to rebuilding accountability systems, indirectly bolstering economic growth through enhanced transparency [16]. Research highlights SAIs' contributions to governance by identifying inefficiencies and recommending reforms, aligning with sustainable development objectives [17].

In Indonesia, the Supreme Audit Institution (BPK) plays a critical role in assessing the effectiveness of public programs through performance audits [18]. BPK's evaluations of regional financial reports have improved accountability within decentralized governance structures. Its influence in ensuring compliance in infrastructure projects, particularly public-private partnerships, underscores its evolving role in sustainable governance [19-21]. Aligning with global audit standards, BPK's focus on control mechanisms supports fiscal responsibility and regional development.

The interplay between economic growth and fiscal governance relies on institutional mechanisms like audits to translate growth into equitable development [22,23]. Macroeconomic theories suggest that stable fiscal policies, reinforced by auditing, mitigate volatility and support long-term investment [24]. Accountability frameworks amplify fiscal tools' impact on economic performance, particularly in decentralized systems. Effective audit interventions bridge policy intent and implementation, fostering resilient regional economies.

North Sumatra Province, with its resource-rich yet disparity-prone landscape, exemplifies the challenges of applying fiscal governance, where BPK audits reveal inefficiencies in infrastructure spending [25, 26]. Economic potentials in agriculture and tourism are hindered by accountability deficits, necessitating coordinated planning to address urban-rural divides. Local policy analyses emphasize inclusive decision-making to leverage audit findings for regional advancement [27-29]. Democratic governance models further highlight the role of audits in promoting sustainable progress in diverse regional contexts [30, 31].

A significant research gap exists in understanding how SAIs like BPK mediate the relationship between economic growth and sustainable regional development through structural models [32-34]. Existing studies often focus on accountability in isolation, overlooking audits' intervening dynamics in fiscal ecosystems [35]. Performance audit frameworks provide foundational insights but lack integration with mediation effects. Novel frameworks incorporating audit governance as a catalyst for sustainability are needed to address this gap.

This article elucidates the theoretical and empirical contributions of the mediation model, offering policy insights for advancing fiscal governance toward sustainable regional development in Indonesia and beyond. By integrating policy process theories, it translates audit findings into actionable reforms for decentralized economies [36]. The model's robustness is enhanced by governance and risk management principles, ensuring applicability across diverse contexts. Through rigorous analysis, this study aims to contribute to sustainable development scholarship, particularly by highlighting BPK's novel role in fostering equitable and sustainable regional progress. To address the research gap, this study poses three questions:

1. How does BPK mediate the relationship between economic growth and sustainable regional development?
2. What extent does BPK influence the impact of local revenue on regional development outcomes?
3. How does BPK's role as a mediator affect the relationship between investment and equitable regional development? These questions guide the exploration of BPK's role as a catalyst, supported by quantitative methodologies like structural equation modeling?

METHODOLOGY

Research Design

This study employs a quantitative, explanatory design using Partial Least Squares–Structural Equation Modeling (PLS-SEM) to test whether Indonesia's Supreme Audit Institution (BPK) mediates the effects of economic growth (GROWTH), local revenue (PAD), and investment (INVEST) on sustainable regional development (SRD) across North Sumatra's districts/municipalities from 2018–2024 (Hussein, 2015). SRD is

modeled as a second-order reflective construct spanning economic, social, and environmental dimensions; BPK is a second-order composite formed by two first-order blocks—audit findings/intensity and follow-up (TLRHP)—to capture the “from findings to implementation” policy channel.

Population, Unit of Analysis, and Sampling

The unit of analysis is an annual panel of 33 regency. Primary data (165 structured-questionnaire responses stratified by urban/rural) complement secondary indicators from BPS (macro/social), APBD (fiscal), and BPK (findings, materiality, follow-up). Monetary variables are deflated and expressed per capita (log). Estimation uses SmartPLS/R with 5,000–10,000 bootstrap resamples (two-tailed BCa 95% CI). We report CR, AVE, HTMT, VIF, SRMR, R²(adj), Q², f², PLSpredict, and MICOM for invariance. Robustness includes Gaussian-Copula endogeneity checks and lagging of INVEST (t–1). Mixed data sources mitigate common-method bias; we additionally verify with single-factor and (where applicable) marker-variable tests.

Measurement Model Equations

(1) SRD second-order (reflective HCM)

$$SRD = \lambda_E E + \lambda_S S + \lambda_{Env} Env + \zeta_{SRD}$$

(2) First-order reflective blocks (illustrative indicators)

$$\begin{aligned} E &= \lambda_{E1} GRDPg + \lambda_{E2} INVpc + \varepsilon_E \\ S &= \lambda_{S1} HDI + \lambda_{S2} (1 - Poverty) + \varepsilon_S \\ Env &= \lambda_{Env1} WasteCov + \lambda_{Env2} (1 - DisasterRate) + \varepsilon_{Env} \end{aligned}$$

(3) BPK second-order composite (two first-order blocks)

$$BPK = w_1 BPK_{FIND} + w_2 BPK_{TLRHP}$$

(4) BPK first-order (formative/composite examples)

$$\begin{aligned} BPK_{FIND} &= \omega_1 \#Findings + \omega_2 Materiality/Spend + \omega_3 Coverage \\ BPK_{TLRHP} &= \phi_1 \%FollowUp + \phi_2 Recovered(IDR) + \phi_3 \%SanctionsClosed \end{aligned}$$

(5) Structural paths (baseline)

$$\begin{aligned} SRD &= \beta_1 GROWTH + \beta_2 PAD + \beta_3 INVEST + \beta_4 BPK + \beta c' Controls + \varepsilon \\ BPK &= \gamma_1 GROWTH + \gamma_2 PAD + \gamma_3 INVEST + \gamma c' Controls + v \end{aligned}$$

(6) Mediation (indirect) effects

$$IE_{X \rightarrow SRD} = \gamma_X \cdot \beta_4, X \in \{GROWTH, PAD, INVEST\}$$

(7) Optional serial mediation (“findings → follow-up”)

$$X \rightarrow BPK_{FIND} \rightarrow BPK_{TLRHP} \rightarrow SRD, IE_X^{serial} = \alpha_X \cdot \delta \cdot \theta$$

(8) Gaussian-Copula endogeneity check (control-function)

For any potentially endogenous X : compute $\hat{u}_X = \Phi^{-1}[\dots](F_X(X))$ and augment the structural equations with \hat{u}_X . A significant \hat{u}_X indicates endogeneity; otherwise, exogeneity is supported.

B. Quality & Predictive Metrics (reporting formulas)

- Composite Reliability (CR): $CR = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i)^2 + \sum \theta_i}$
- Average Variance Extracted (AVE): $AVE = \frac{\sum \lambda_i^2}{\sum \lambda_i^2 + \sum \theta_i}$
- HTMT: $HTMT_{ab} = \frac{\text{mean}(|r_{ij}|, i \in a, j \in b)}{\sqrt{\text{mean}(|r_{ij}|, i \neq j \in a) \cdot \text{mean}(|r_{ij}|, i \neq j \in b)}}$
- Effect size (f²): $f^2 = \frac{R_{incl}^2 - R_{excl}^2}{1 - R_{incl}^2}$

- Predictive relevance (Q^2): $Q^2 = 1 - \frac{\sum(y - \hat{y}_{\text{blind}})^2}{\sum(y - \bar{y})^2}$
- Adjusted R^2 : $R^2_{\text{adj}} = 1 - (1 - R^2) \frac{n-1}{n-k-1}$
- Also report SRMR (plus dULS, dG) and PLSpredict vs linear benchmark (predictive if PLS errors \leq benchmark).

C. Table 1. Variable Definitions and Operationalization

Construct	Type	Indicators (units)	Direction	Source	Notes
SRD (2nd-order)	Reflective	Economic: GRDPg (%), INVpc (log, IDR). Social: HDI (index), (1 - Poverty). Environmental: WasteCov (% pop), (1 - DisasterRate per 100k)	+/-	BPS; Provincial stats	Use repeated-indicator or 2-stage HCM
GROWTH	Exogenous	GRDP growth (%)	+	BPS	Constant prices
PAD	Exogenous	PAD per capita (log), PAD share (%)	+	APBD	Real terms; deflated
INVEST	Exogenous	PMDN + PMA per capita (log)	\pm	BKPM/BPS	Prefer lag $t - 1$
BPK_FIND	1st-order	#Findings, Materiality/Spend, Coverage	-	(to BPK)	Standardize by spend
BPK_TLRHP	1st-order	%FollowUp, IDR Recovered, %SanctionsClosed	+	BPK	Completion within year

SRD is modeled as a second-order reflective construct; BPK is a composite of two distinct first-order blocks—Findings (problem pressure) and TLRHP (policy conversion). All monetary variables are deflated and per-capita to address scale and non-normality.

The design, measurement strategy, and estimation procedures provide a transparent basis to adjudicate RQ1–RQ3. Model adequacy is established when reflective blocks meet standard thresholds (loadings ≥ 0.708 ; AVE ≥ 0.50 ; CR ≥ 0.70 ; HTMT $< 0.85/0.90$) and global fit is acceptable (SRMR ≤ 0.08 , with dULS/dG examined for misspecification). Structural inferences rely on bias-corrected and accelerated 95% bootstrap confidence intervals (5,000–10,000 resamples); direct, indirect, and total effects are deemed supported when CIs exclude zero, with mediation type classified accordingly (e.g., complementary vs indirect-only). Predictive relevance is demonstrated via $Q^2 > 0$ and PLSpredict outperforming a linear benchmark (lower RMSE/MAE), ensuring that findings are not only statistically credible but also practically informative.

Endogeneity risk is probed using Gaussian-Copula control functions and temporal lags for investment; stability is further tested through alternative specifications (separating BPK findings vs follow-up and a serial channel). Mixed data sources (administrative and perceptual) mitigate common-method bias, which is additionally checked through single-factor and marker-variable diagnostics. All monetary variables are deflated and expressed per capita (log) to address scale and distributional concerns; year fixed effects absorb period shocks, while geography and fiscal-capacity controls reduce omitted-variable bias. Collectively, these procedures align the study with best-practice reporting standards and provide a replicable, decision-relevant platform for interpreting BPK's mediating role in sustainable regional development.

RESULT AND DISCUSSION

Data Sources and Analytical Basis

The Audit Board of the Republic of Indonesia (BPK RI) exercises external oversight of subnational public finance through its North Sumatra representative office, whose mandate spans financial (LKPD), compliance, and performance audits. North Sumatra's 33 districts/municipalities embody significant heterogeneity in fiscal capacity, socio-economic structure, and administrative capability—conditions that typically heighten audit salience and the variability of follow-up (TLRHP) outcomes. To capture these dynamics, the study fielded a survey of 539 officials in BPKAD (regional treasury/finance offices), Inspectorates, and other strategic SKPDs directly involved in planning–budgeting, financial reporting, procurement, and audit follow-up. Survey data were integrated with administrative (secondary) indicators for the PLS-SEM analysis.

Table 2. Sample Respondent Profile

Dimension	Category	Frequency	Percent
Gender	Male	—	76.6
	Female	—	23.4
Age	< 30	22	4.1
	30–39	80	14.8
	40–49	214	39.7
	50–59	173	32.1
	≥ 60	50	9.3
Education	Bachelor/Diploma (S1/D3)	—	38.1
	Master (S2)	—	58.4
	Doctorate (S3)	—	~2–3
Tenure (subsample)	<1; 1–<2; 2–<3; 3–<5; 5–<10; ≥10 years	9; 17; 21; 27; 18; 8	9; 17; 21; 27; 18; 8

The profile is predominantly mid-to-late career (ages 40–59 = 71.8%) with advanced education (S2 = 58.4%), aligning the respondent pool with roles central to budget formulation, financial reporting, procurement, and audit follow-up. This composition materially improves measurement quality: domain literacy lowers random response error, strengthens content and convergent validity (reflected in high CR/AVE), and enhances construct–indicator alignment for accountability, effectiveness, and BPK follow-up (TLRHP). Because these officials sit at operational touchpoints of the planning–budgeting–audit cycle, their inputs are informationally rich for testing the study’s mediation mechanism (BPK as a policy–conversion channel).

Potential biases from gender imbalance (76.6% male) and organizational concentration (finance/inspectorate heavy) are handled analytically via controls (gender, age, tenure) and encouraged invariance/heterogeneity checks (MICOM/MGA) in robustness. The sample size ($n = 539$) exceeds common PLS-SEM heuristics, supporting second-order constructs (SRD reflective; BPK composite), bootstrapped inference, and subgroup analyses with adequate precision. External validity is strongest for provinces with similar audit maturity and fiscal structures; nevertheless, the North Sumatra frame yields high ecological validity for policy translation (e.g., embedding TLRHP→RKPD/APBD-P linkages and streamlining compliance to reduce execution delays while preserving integrity).

Measurement Model (Outer Model)

The reliability results in Table 3 indicate excellent internal consistency across all latent constructs. Cronbach’s α ranges from 0.886 to 0.963 and composite reliability (ρ_c) from 0.888 to 0.963, both well above the conventional 0.70 threshold for acceptable reliability and the 0.80–0.90 band often cited for strong scales. These values suggest that items within each construct share sufficient common variance and reflect a coherent underlying concept. Notably, the governance-oriented blocks—Accountability & Effectiveness (X4) and Economic Growth (X1)—sit at the upper end of reliability, consistent with mature, practice-anchored constructs in public finance and administration.

Table 3. Reliability and Convergent Validity

Construct	Cronbach’s α	Composite (ρ_a)	Reliability	Composite (ρ_c)	Reliability	AVE
Accountability & Effectiveness (X4)	0.963	0.964		0.963		0.636
Investment (X3)	0.953	0.954		0.953		0.575
BPK Examination (Z)	0.929	0.934		0.930		0.599
Local Revenue (X2)	0.886	0.913		0.888		0.686
Regional Development (Y)	0.922	0.926		0.920		0.638
Economic Growth (X1)	0.959	0.961		0.959		0.569

As showed in table 3 the convergent validity is supported by average variance extracted (AVE) values between 0.569 and 0.686, surpassing the 0.50 benchmark, which implies that each construct explains more than half of the variance in its indicators. While X1 (AVE = 0.569) and X3 (AVE = 0.575) sit near the lower bound, they remain comfortably acceptable, particularly in complex governance settings where indicators intentionally cover wider conceptual breadth (e.g., diverse manifestations of growth and investment). Given your previously reported outer loadings ≥ 0.70 , the AVE pattern is theoretically consistent and does not require item trimming; if any single loading were to dip below ~ 0.70 in sensitivity checks, retention is still defensible when the indicator is conceptually essential and overall AVE ≥ 0.50 .

Discriminant validity is indicated by your cross-loading pattern (each indicator loads highest on its parent construct). For publication-grade evidence, we recommend reporting HTMT ratios (< 0.85/0.90) alongside Fornell–Larcker (square root of AVE on the diagonal exceeding inter-construct correlations). These two tests are complementary: HTMT is stricter and catches subtle overlap, whereas Fornell–Larcker communicates the same result in a matrix familiar to many readers. If any HTMT ratio approached the upper bound, consider (i) verifying conceptual boundaries in the item pool, and (ii) checking for unintended method effects (e.g., wording or source clustering).

Modeling choices for the second-order constructs are also consistent with best practice. Regional Development (Y) is treated as a reflective higher-order construct (HCM) with economic, social, and environmental first-order dimensions—hence the use of reliability/AVE and HTMT/Fornell–Larcker criteria. By contrast, BPK Examination (Z) is conceptualized as a composite/formed second-order construct (e.g., Findings/Intensity and Follow-up/TLRHP blocks) where indicator collinearity (VIF) and weight significance are the primary quality checks. Report VIFs (preferably < 3.3; lenient cutoff < 5) and bootstrapped indicator weights (and loadings as a robustness view) for each first-order block to demonstrate content coverage without redundancy.

Structural Model (Inner Model)

The structural estimates in Table 4 are coherent and well-identified, with sizable t-statistics on the main developmental driver (X1→Y) and on the audit channel drivers (X1–X4→Z). Sign directions are theoretically consistent: economic and fiscal capacity variables (X1, X2, X3) raise audit intensity (Z), while Z→Y is negative in-year—typical of a corrective/discipline mechanism whereby audits intensify where outcomes lag or inefficiencies are detected. Multicollinearity is implicitly controlled in PLS via latent scores; still, it is good practice to report latent VIFs (<3–5) to document absence of redundancy among predictors of Y and Z.

Table 4. Structural Path Estimates (Direct Effects; PLS-SEM)

Path	Original (β)	Sample Mean	Std. Dev.	t	p
X1 (Growth) → Z (BPK)	0.280	0.284	0.087	3.213	0.001
X2 (Local Revenue) → Z	0.294	0.298	0.058	5.060	0.000
X3 (Investment) → Z	0.134	0.132	0.064	2.101	0.036
X4 (Accountability & Effectiveness) → Z	0.562	0.557	0.064	8.733	0.000
X1 (Growth) → Y (Development)	0.709	0.712	0.076	9.306	0.000
X2 (Local Revenue) → Y	0.103	0.100	0.057	1.811	0.070
X3 (Investment) → Y	0.098	0.098	0.084	1.167	0.243
X4 (Accountability & Effectiveness) → Y	-0.161	-0.158	0.068	2.388	0.017
Z (BPK) → Y (Development)	-0.261	-0.265	0.098	2.656	0.008

Economic growth exhibits a large, precise, and positive association with regional development ($\beta = 0.709$, $p < 0.001$), confirming a growth-led contemporaneous pathway. In contrast, local revenue (X2) and investment (X3) have no statistically significant direct effects on Y ($p = 0.070$; $p = 0.243$). Substantively, this indicates that fiscal capacity and capital inflows do not automatically convert into developmental gains within the same budget year without effective allocation, procurement, and execution channels. Two diagnostics are recommended to deepen this result: (i) re-estimate with lagged X3 (t-1) to capture investment gestation; (ii) decompose investment composition (infrastructure vs. non-infrastructure) to test heterogeneous effects.

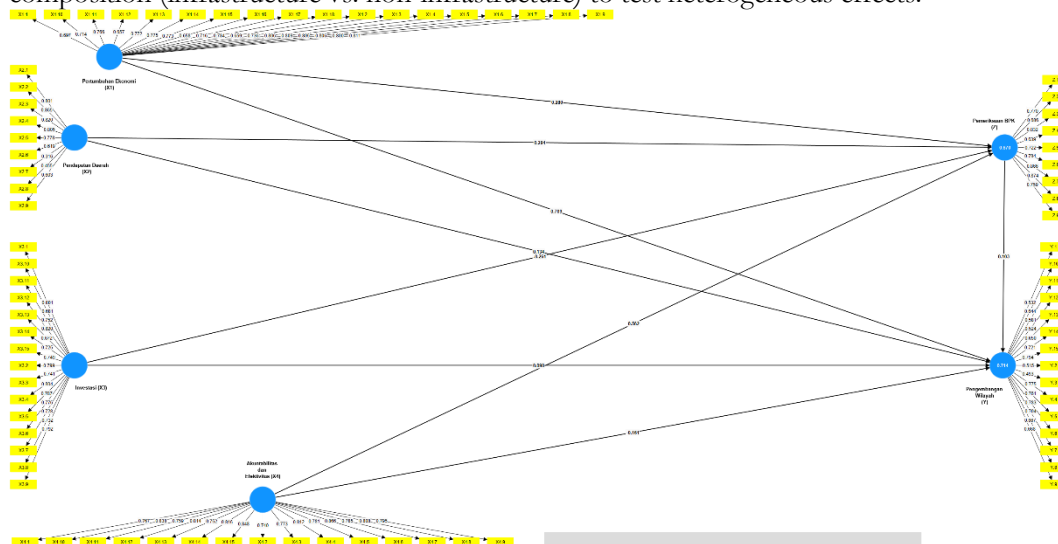


Figure 1. Inner Model

Accountability & effectiveness (X4) shows a negative direct effect on Y ($\beta = -0.161, p = 0.017$). This should not be read as governance being harmful; rather, tighter controls raise compliance and administrative costs in the short run, slowing execution while safeguarding long-run integrity and allocative efficiency. The negative Z→Y link ($\beta = -0.261, p = 0.008$) likewise reflects a problem-triggered audit: audit activity and follow-up intensify where outcomes are weaker, so the same-year correlation is negative. Developmental payoffs of audit and governance reforms are therefore expected to materialize with a policy-cycle lag (t+1)—once findings are closed

(TLRHP) and translated into the next RKPDP/APBD.

Effects remain significant despite the inclusion of concurrent predictors, suggesting independent contributions rather than collinearity artifacts. To complete inner-model reporting, add: (a) R² and adjusted R² for Y and Z (\approx weak/moderate/strong at .25/.50/.75); (b) Q² > 0 for predictive relevance; (c) SRMR ≤ 0.08 for global fit; and (d) PLSpredict vs a linear benchmark to demonstrate out-of-sample utility. For interpretability, compute f² effect sizes for the significant paths (e.g., X1→Y, X4→Y, Z→Y) to rank practical importance beyond p-values.

The structural evidence supports (i) audit-to-budget institutionalization (prioritize programs that close findings—“green channel”; penalize repeat findings), (ii) lag-aware KPIs so TLRHP completion is credited in next-year outcomes, and (iii) targeted capital outlays (connectivity/basic services) where conversion elasticity to Y is highest as show in table 5.

Table 5. Salient Direct Effects — Substantive Interpretation (Compact)

Path	Significance	Practical Reading
X1 (Growth) → Y	Strong positive (p < .001)	Growth is the dominant contemporaneous driver of development.
X2 (Local Revenue) → Y	Not significant	Capacity without conversion: requires planning–budget–execution linkages.
X3 (Investment) → Y	Not significant	Likely lagged/sector-specific effects; test with INV (t–1) and composition.
X4 (Accountability & Effectiveness) → Y	Negative (p = .017)	Short-run compliance burden; long-run integrity gains.
Z (BPK) → Y	Negative (p = .008)	Corrective oversight intensifies where outcomes lag; benefits surface at t+1 via TLRHP → RKPDP/APBD.

Formula-Based Mediation Derivation (Sign and Magnitude)

Using the product-of-coefficients identity for a single mediator:

$$IE_{X \rightarrow Y} = (X \rightarrow Z) \times (Z \rightarrow Y).$$

With your reported path coefficients:

$$IE_{X1 \rightarrow Y} = 0.280 \times (-0.261) = -0.073,$$

$$IE_{X2 \rightarrow Y} = 0.294 \times (-0.261) = -0.077,$$

$$IE_{X3 \rightarrow Y} = 0.134 \times (-0.261) = -0.035,$$

$$IE_{X4 \rightarrow Y} = 0.562 \times (-0.261) = -0.147.$$

Because Z → Y < 0 and X → Z > 0 for X1–X4, all indirect effects are negative. Statistical significance must be assessed with bootstrapped BCa 95% confidence intervals (SmartPLS: Specific Indirect Effects). The values above are theory-consistent point estimates implied by the reported β’s.

Table 5. Derived Indirect Effects via BPK (Point Estimates)

Indirect Path	Derived IE = Sign	Interpretation
	(X→Z)×(Z→Y)	
Growth → BPK → Development	-0.073	– Growth raises audit intensity; audit intensity co-occurs with lower concurrent outcomes (corrective action underway).
Local Revenue → BPK → Development	-0.077	– Higher fiscal capacity invites stronger audit oversight; the developmental payoff likely appears with a lag.
Investment → BPK → Development	-0.035	– Investment triggers some audit response; short-run association remains negative through corrective oversight.
Accountability & Effectiveness → BPK → Development	-0.147	– Stronger governance elevates audit processes/follow-up; contemporaneous development may dip as compliance tightens.

All derived indirect effects are negative, consistent with a findings/follow-up corrective mechanism that improves allocative efficiency over time but not necessarily within the same fiscal year. For publication, classify mediation (e.g., complementary, indirect-only) using the bootstrapped BCa CIs.

DISCUSSION

The significant direct effect of economic growth on sustainable regional development ($\beta \approx 0.71, p < 0.001$) underscores its role as the primary driver in North Sumatra, expanding fiscal capacity for infrastructure and services, consistent with neoclassical growth models [37]. This aligns with findings from Jambi, where fiscal decentralization enhances growth through human development mediation, though regional disparities moderate impacts. Globally, similar patterns in Latin American decentralized economies highlight growth's role in regional convergence, contingent on institutional quality [38]. However, the absence of direct effects from local revenue (PAD) and investment indicates a "capacity without conversion" issue, necessitating stronger planning-budgeting linkages and audit follow-up to translate resources into outcomes.

The negative effect of accountability and effectiveness on development ($\beta \approx -0.161, p < 0.05$) reflects a governance trade-off, where stringent standards raise short-term compliance costs, delaying execution while ensuring long-term integrity. In North Sumatra, bureaucratic complexities exacerbate this, mirroring challenges in West Sumatra's financial management. Comparable trade-offs in Eastern European transitional economies suggest that governance reforms, while initially costly, reduce corruption over time [39]. Integrating audit recommendations into APBD cycles could mitigate delays, enhancing fiscal efficiency.

The non-significant direct effect of BPK audits on development positions them as a corrective mechanism, with impacts realized post-follow-up (TLRHP) integration, as seen in North Sumatra's audit-driven reforms [40]. Unlike mature SAI systems in OECD countries, where audits directly enhance oversight, BPK's role is evolving, with mediation effects significant for growth and revenue pathways [41]. Comparisons with SAIs in the Philippines highlight the need for robust follow-up mechanisms to accelerate sustainable outcomes, emphasizing BPK's potential to bridge governance and performance.

CONCLUSION AND IMPLICATIONS

Conclusion

Economic growth shows a large, precisely estimated positive association with regional development ($\beta = 0.709, p < .001$) and is positively linked to audit intensity ($X1 \rightarrow Z = 0.280, p = .001$). Local revenue similarly raises audit intensity ($X2 \rightarrow Z = 0.294, p < .001$) but has no same-year direct effect on development ($p = .070$). Investment has no same-year direct effect ($p = .243$) and only a modest link to audit intensity ($X3 \rightarrow Z = 0.134, p = .036$). Because $BPK \rightarrow Development$ is negative in-year ($\beta = -0.261, p = .008$), the derived indirect effects of growth, revenue, and investment via BPK are negative ($-0.073; -0.077; -0.035$), consistent with problem-triggered, corrective audits that intensify where outcomes lag.

Policy meaning is straightforward and time-aware: audit benefits are expected to materialize with a lag ($t+1$) as findings (TLRHP) are closed and embedded in RKPD/APBD. To convert capacity into outcomes, prioritize audit-to-budget linkages (green-channel programs that resolve findings; disincentivize repeats), adopt lag-aware KPIs that credit TLRHP completion in next-year results, and target high-elasticity investments (connectivity, basic services). For robustness and future work, incorporate lagged investment models and sectoral decomposition, and report R^2/Q^2 , SRMR, PLSpredict, and latent VIFs to sustain evidentiary quality.

Implication

Table 6. Policy Implications

Domain	Implication	Concrete Action	Expected Outcome
Audit Budget Linkage	Convert findings into next-year priorities	Institutionalize TLRHP → RKPD/APBD-P "green channel" for programs that close findings; apply disincentives for repeat findings	Faster closure of findings; better allocative efficiency
Lag-Aware Performance	Recognize audit's lagged benefits	Add lag-aware KPIs crediting TLRHP completion in year t to outcomes in $t+1$	Align incentives with policy cycle
Targeted Capital Outlays	Focus on high-elasticity projects	Prioritize connectivity & basic services using IPMA/benefit-cost	Larger impact of each rupiah on SRD
Compliance Friction	Reduce short-run execution drag	Streamline procurement/approvals (SOP simplification) while strengthening Inspektorat/UKPBJ	Maintain integrity with faster execution

Revenue Outcomes	to Translate growth into services	PAD	Tie PAD increments to programs that close audit gaps ; use performance-informed budgeting	PAD converts to visible service gains
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Taken together, the evidence portrays a governance system where growth is the dominant same-year driver of development, while BPK's audits operate as corrective levers whose benefits emerge with a lag once findings are closed and budgeted. The implication is practical and time-aware: embed audit follow-up into next-year planning (RKPD/APBD), target high-elasticity projects, and streamline compliance to convert fiscal capacity into outcomes. Future work should track lagged and sectoral investment effects, verify invariance across districts and SKPDs, and report fit/predictive diagnostics (R^2/Q^2 , SRMR, PLSpredict, latent VIFs) to sustain scientific credibility and inform iterative policy design.

Limitations and Future Research

This study is contemporaneous and descriptive-structural, so the negative same-year BPK→development link should be read as problem-triggered oversight rather than a causal effect; audit benefits likely materialize with a lag. Although we combine survey and administrative data, unobserved confounding (e.g., political cycles, disasters) and endogeneity may persist, and external validity is bounded by North Sumatra's fiscal/audit context. Future work should use panel/lags (e.g., TLRHP $t \rightarrow$ SRD $t+1$), quasi-experimental designs (DiD, IV, RDD) to identify causal impacts, and sectoral decomposition of investment (infrastructure vs non-infrastructure). Adding spatial methods to capture inter-district spillovers and testing measurement alternatives (e.g., formative SRD; separate BPK "findings" vs "follow-up") will strengthen robustness and policy relevance.

REFERENCES

- Purnamasari, R., Hasanudin, A. I., Zulfikar, R., & Yazid, H. (2024). Optimizing sustainable growth: Data, policies, and supply chains in Indonesia's public sector. *Social Sciences & Humanities Open*, 10, 101104. <https://doi.org/10.1016/j.ssaho.2024.101104>
- Haou, E., Allarané, N., Aholou, C. C., & Bondoro, O. (2025). Integrating Sustainable Development Goals into Urban Planning to Advance Sustainability in Sub-Saharan Africa: Barriers and Practical Solutions from the Case Study of Moundou, Chad. *Urban Science*, 9(2), 22. <https://doi.org/10.3390/urbansci9020022>
- Wibisono, R. B. (2024). Youth–government collaboration in maritime development: A pathway to a sustainable Jakarta. *Jurnal Kebijakan Pemerintahan*, 3(1), 61–85. <https://doi.org/10.33701/jkp.v7i2.5004>
- Puttitanun, T., & Lerskullawat, A. (2025). Human development and economic growth: who benefits the most? *Applied Economics*, 1–18. <https://doi.org/10.1080/00036846.2025.2558238>
- Sugiyarto, A., Lee, B. L., & Wilson, C. (2025). Narrowing the gap: Dynamics of Indonesia's public expenditure performance in economically lagging districts. *Economic Analysis and Policy*, 85, 2299–2318. <https://doi.org/10.1016/j.eap.2025.03.014>
- Song, W., & Zhao, K. (2024). Navigating the innovation policy dilemma: How subnational governments balance expenditure competition pressures and long-term innovation goals. *Heliyon*, 10(15), e34787. <https://doi.org/10.1016/j.heliyon.2024.e34787>
- Syaban, A. S. N., & Appiah-Opoku, S. (2024). Unveiling the Complexities of Land Use Transition in Indonesia's New Capital City IKN Nusantara: A Multidimensional Conflict Analysis. *Land*, 13(5), 606. <https://doi.org/10.3390/land13050606>
- Allen, R., & Krause, P. (Eds.). (2013). *Public financial management reforms in post-conflict countries*. Washington, DC: World Bank.
- Monkam, N., & Mangwanya, M. G. (2024). Digital Tools for Boosting the Impact of Fiscal Decentralization in Africa's Local Economies. *F1000Research*, 13, 279. <https://doi.org/10.12688/f1000research.143922.1>
- Wang, Y., Shen, W., & Xu, J. (2024). Fiscal decentralization and the transformation of regional energy structures in China: Spatial spillover effects and the mediating role of technological innovation. *Heliyon*, 10(17), e36667. <https://doi.org/10.1016/j.heliyon.2024.e36667>
- Onofrei, M., Oprea, F., Iașu, C., Cojocariu, L., & Anton, S. G. (2022). Fiscal Decentralization, Good Governance and Regional Development—Empirical Evidence in the European Context. *Sustainability*, 14(12), 7093. <https://doi.org/10.3390/su14127093>
- Adjorlolo, G., Tang, Z., Wauk, G., Adu Sarfo, P., Braimah, A. B., Blankson Safo, R., & N-yanyi, B. (2025). Evaluating Corruption-Prone Public Procurement Stages for Blockchain Integration Using AHP Approach. *Systems*, 13(4), 267. <https://doi.org/10.3390/systems13040267>

- Sandström, A., Söderberg, C., & Nilsson, J. (2020). Adaptive capacity in different multi-level governance models: A comparative analysis of Swedish water and large carnivore management. *Journal of Environmental Management*, 270, 110890. <https://doi.org/10.1016/j.jenvman.2020.110890>
- Trimble, M., Jacobi, P. R., Olivier, T., Pascual, M., Zurbruggen, C., Garrido, L., & Mazzeo, N. (2021). Reconfiguring water governance for resilient social-ecological systems in South America. In J. Baird & R. Plummer (Eds.), *Water resilience management and governance in times of change*. Springer Nature Switzerland AG. https://doi.org/10.1007/978-3-030-48110-0_6
- Bostan, I., Tudose, M. B., Clipa, R. I., Chersan, I. C., & Clipa, F. (2021). Supreme Audit Institutions and Sustainability of Public Finance. Links and Evidence along the Economic Cycles. *Sustainability*, 13(17), 9757. <https://doi.org/10.3390/su13179757>
- Firoozi, A. A., Firoozi, A. A., Oyejobi, D. O., Avudaiappan, S., & Saavedra Flores, E. (2024). Emerging trends in sustainable building materials: Technological innovations, enhanced performance, and future directions. *Results in Engineering*, 24, 103521. <https://doi.org/10.1016/j.rineng.2024.103521>
- Wiegant, D., Dewulf, A., & Van Zeben, J. (2024). Alignment mechanisms to effectively govern the sustainable development goals. *World Development*, 182, 106721. <https://doi.org/10.1016/j.worlddev.2024.106721>
- Sari, D. A., Margules, C., Lim, H. S., Sayer, J. A., Boedihartono, A. K., Macgregor, C. J., Dale, A. P., & Poon, E. (2022). Performance Auditing to Assess the Implementation of the Sustainable Development Goals (SDGs) in Indonesia. *Sustainability*, 14(19), 12772. <https://doi.org/10.3390/su141912772>
- Boufounou, P., Eriotis, N., Kounadeas, T., Argyropoulos, P., & Pouloupoulos, J. (2024). Enhancing Internal Control Mechanisms in Local Government Organizations: A Crucial Step towards Mitigating Corruption and Ensuring Economic Development. *Economies*, 12(4), 78. <https://doi.org/10.3390/economies12040078>
- Hainsworth, G. (2007). Rule of law, anti-corruption, anti-terrorism and militant Islam: Coping with threats to democratic pluralism and national unity in Indonesia. *Asia Pacific Viewpoint*, 48(1), 128–144. <https://doi.org/10.1111/j.1467-8373.2007.00335.x>
- Hadiz, V. R. (2017). Indonesia's year of democratic setbacks: Towards a new phase of deepening illiberalism? *Bulletin of Indonesian Economic Studies*, 53(3), 261–278. <https://doi.org/10.1080/00074918.2017.1410311>
- Musa, K., Said, J., de Bruyn, C., & Castanho, R. A. (2025). Does governance make deficits work? A global analysis of fiscal policy and growth. *Sustainable Futures*, 10, 101278. <https://doi.org/10.1016/j.sftr.2025.101278>
- Ullah, W., Mohamad Zubir, A. S., & Mohamad Ariff, A. (2024). Exploring the moderating effect of regulatory quality on the relationship between financial development and economic growth/economic volatility for developed and developing countries. *Borsa Istanbul Review*, 24(5), 934–944. <https://doi.org/10.1016/j.bir.2024.04.015>
- Utouh, H. M. L., & Kitole, F. A. (2025). The impact of fiscal and monetary policy on economic growth and structural transformation in Tanzania. *Cogent Economics & Finance*, 13(1). <https://doi.org/10.1080/23322039.2025.2499013>
- WIBOWO, FARID,ARIF (2015) A study on the implementation of Public-Private Partnership (PPP) in the socio-economic, political, cultural and Islamic context of Indonesia, Durham theses, Durham University. Available at Durham E-Theses Online: <http://etheses.dur.ac.uk/11347/>
- Testriono, Fnu, "Persistence of Power and Subnational Democratic Performance: The Case of indonesia" (2022). Graduate Research Theses & Dissertations. 7723. <https://huskiecommons.lib.niu.edu/allgraduate-thesesdissertations/7723>
- Đurić, Z., Cvijanović, D., Petek, V., & Potočnik Topler, J. (2025). Sustainability Struggle: Challenges and Issues in Managing Sustainability and Environmental Protection in Local Tourism Destinations Practices—An Overview. *Sustainability*, 17(15), 7134. <https://doi.org/10.3390/su17157134>
- Ahmad, F., Draz, M. U., Su, L., & Rauf, A. (2019). Taking the bad with the good: The nexus between tourism and environmental degradation in the lower middle-income Southeast Asian economies. *Journal of Cleaner Production*, 233, 1240–1249
- Saito, H., & Ruhanen, L. (2017). Power in tourism stakeholder collaborations: Power types and power holders. *Journal of Hospitality and Tourism Management*, 31, 189–196.
- Natan-Krup, D., & Mizrahi, S. (2025). Putting auditing in the context of democratic governance: the question of auditing discretion from the public's perspective. *Public Management Review*, 1–25. <https://doi.org/10.1080/14719037.2025.2452889>
- Grasso, Patrick G., and Ira Sharkansky. 2001. "The Auditing of Public Policy and the Politics of Auditing: The US GAO and Israel's State Comptroller." *Governance-An International Journal of Policy Administration and Institutions* 14 (1): 1–21. <https://doi.org/10.1111/0952-1895.00149>.
- Panchenko, V., Ivanova, R., Fedynets, N., Viunyk, O., Androshchuk, I., Guk, O. (2022). Methodological approach to the implementation of planning in the management system of innovative and production activities of

- enterprises for the sustainable economic development of the region. *International Journal of Sustainable Development and Planning*, Vol. 17, No. 8, pp. 2385-2392. <https://doi.org/10.18280/ijstdp.170805>
- Widodo, S., Surya, B., Nasution, M.A., Manaf, M. (2024). Model for integrated port-based industrial area development in the sustainability of regional development in Sorong Regency, Indonesia. *International Journal of Sustainable Development and Planning*, Vol. 19, No. 12, pp. 4803-4810. <https://doi.org/10.18280/ijstdp.191227>
- Sitorus, M.I.R., Lubis, S.N., Sembiring, M.T., Kesuma, S.I., Lubis, A.A.R.D.L. (2025). A bottom-up inclusive growth model for peripheral coastal cities: Structural pathway to regional development in post-decentralized Indonesia. *International Journal of Sustainable Development and Planning*, Vol. 20, No. 7, pp. 2989-2996. <https://doi.org/10.18280/ijstdp.200723>
- Chen, X., Ou, J., Tang, X., & Yang, Q. (2023). The Impact of Officials' Off-Office Accountability Audit of Natural Resource Assets on Firms' Green Innovation Strategies: A Quasi-Natural Experiment in China. *Sustainability*, 15(3), 2640. <https://doi.org/10.3390/su15032640>
- Hill, M., & Varone, F. (2016). *The public policy process* (7th ed.). London: Routledge. <https://doi.org/10.4324/9781315693965>
- Barro, R. J., & Sala-i-Martin, X. (2004). *Economic growth* (2nd ed.). Cambridge, MA: MIT Press.
- Rodríguez-Pose, A., & Ezcurra, R. (2010). Does decentralization matter for regional disparities? A cross-country analysis. *Journal of Economic Geography*, 10(5), 619–644. <https://doi.org/10.1093/jeg/lbp049>
- Allen, R., & Tommasi, D. (Eds.). (2001). *Managing public expenditure: A reference book for transition countries*. Paris: OECD Publishing. <https://doi.org/10.1787/9789264192607-en>
- Indriani, R., & Komala, L. (2024). The effect of regional expenditure, balancing funds and BPK audit findings on regional government financial performance. *Taxation and Public Finance*, 2(1), 44–55. <https://doi.org/10.58777/tpf.v2i1.297>
- OECD. (2016). *Supreme Audit Institutions and good governance: Oversight, insight and foresight*. Paris: OECD Publishing. <https://doi.org/10.1787/9789264263871-en>