Leading for Sustainability: ESG Implementation and Performance in Indonesian Forestry Firms

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Abstract. Forestry and wood-based firms face intensifying expectations to demonstrate credible environmental, social, and governance (ESG) performance while sustaining competitiveness. Building on the natural-resource-based view, dynamic capabilities, and upper-echelons logic, this study tests a parsimonious leadership-to-practice-to-performance mechanism in South Sulawesi, Indonesia. We model strategic environmental leadership (SEL) as the independent variable, ESG implementation as the mediator, and sustainability performance (SP) as the outcome. Using a cross-sectional survey of 212 firms selected via proportional stratification by subsector and district cluster, we estimate a variance-based structural equation model. The measurement model meets accepted quality criteria. Structurally, SEL strongly predicts ESG ($\beta = 0.62$, $p < .001$); ESG predicts SP ($\beta = 0.52$, $p < .001$); and a smaller direct path from SEL to SP remains ($\beta = 0.20$, $p = .002$), yielding partial complementary mediation (indirect = 0.32; VAF ≈ 61.5%). Explanatory power is moderate to substantial ($R^2 = 0.39$ for ESG; 0.54 for SP) with positive predictive relevance. The findings clarify how leadership, when translated into auditable ESG routines, is associated with improved environmental, stakeholder, and efficiency outcomes. Managerially, prioritising practice depth alongside visible leadership behaviours appears most effective. Policy implications include capability support, targeted incentives, regulatory coherence, and cluster-based platforms to accelerate ESG institutionalisation.

Keywords: Strategic Environmental Leadership, ESG Implementation, Sustainability Performance, Forestry Industry, South Sulawesi, Dynamic Capabilities, PLS-SEM.

1 Introduction

Forestry and wood–based value chains face intensifying expectations to demonstrate credible environmental, social, and governance performance while maintaining competitiveness. Regulatory scrutiny, legality assurance and certification programmes, buyer requirements within global supply chains, and civil society monitoring jointly shape firms' licence to operate in producer regions. In such contexts, the role of senior leadership in setting environmental priorities, signalling commitment, and mobilising resources becomes pivotal for translating sustainability intent into consistent

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organisational practice and, ultimately, improved performance outcomes [1, 2]. Strategic environmental leadership provides the directional impetus, ESG implementation reflects the routinised practices and systems that embed that direction, and sustainability performance captures the realised benefits for environmental outcomes, stakeholders, and the firm [3, 4].

Theoretically, our study brings together the natural–resource–based view and dynamic capabilities. The natural–resource–based view argues that proactive environmental strategies can yield difficult–to–imitate capabilities and competitive advantage when they are embedded in processes and routines [5]. Dynamic capabilities explain how firms sense environmental challenges and opportunities, seize them via informed investment choices, and reconfigure assets and routines to sustain advantage under changing conditions [6]. Leadership is a proximal mechanism that can activate and shape these capabilities, for example by setting targets, aligning incentives, and allocating resources to environmental priorities that are then enacted through ESG systems and practices [7]. A substantial body of evidence associates stronger sustainability management with equal or superior financial performance on average, although effects vary with context and measurement choices [8, 9, 10]. What remains less settled is the parsimonious causal pathway from leadership to performance in resource–based industries within emerging–market subnational settings, where legality assurance, certification uptake, and supply–chain pressures interact with local institutional realities.

Empirically, the forestry sector in Indonesia includes diverse firm types across upstream concessions, primary processing, downstream furniture and joinery, and non-timber forest products. Much of the scholarship in this domain emphasises disclosure quality, certification status, or environmental outcomes in aggregate. Fewer studies examine how strategic environmental leadership at the firm level translates, through everyday ESG implementation, into perceptible gains in sustainability performance in specific provincial ecosystems. There is also limited evidence using variance–based structural equation modelling with reflective constructs to test a simple mediation from leadership to implementation to performance under realistic sampling constraints. This constitutes a practical and theoretical gap that our study addresses.

This paper investigates whether and how strategic environmental leadership relates to sustainability performance via ESG implementation among forestry and wood–based firms in South Sulawesi, Indonesia. We test a simple mediation model with one independent variable, one mediator, and one dependent variable. The model focuses on a leadership–to–practice–to–performance mechanism, an approach that is theoretically grounded and analytically tractable for decision–makers who seek to prioritise interventions. Using a cross–sectional survey of 212 firm–level respondents sampled through proportional stratification by subsector and district clusters, we employ partial least squares structural equation modelling to evaluate the measurement properties and structural relations.

Our research questions are as follows. First, does strategic environmental leadership improve ESG implementation in forestry and wood–based firms in South Sulawesi. Second, does ESG implementation, in turn, improve sustainability performance. Third, does ESG implementation mediate the relationship between strategic environmental

leadership and sustainability performance. By focusing on a single-mediator pathway, we provide a clear test of a theoretically coherent mechanism and avoid over–parameterisation that can obscure interpretation in applied settings.

This study makes three contributions. Conceptually, it clarifies a minimal, leadership–centred pathway that links strategic intent to outcomes through ESG practice, integrating insights from the natural–resource–based view and dynamic capabilities. Empirically, it provides province-level evidence from an important producing region within an emerging economy, with a sampling design that mirrors the industrial structure and supports external validity in the local context. Methodologically, it delivers a transparent, survey–based PLS-SEM application with rigorous measurement assessment, enabling cumulative comparison with future studies and replication in similar sectors.

2 Literature Review

2.1 Theoretical foundations

This study is anchored in the natural-resource-based view (NRBV) and dynamic capabilities, complemented by upper-echelons logic. The NRBV argues that environmental strategies can be a source of competitive advantage when they are embedded in firm-specific routines that are valuable, rare, and difficult to imitate [5]. Dynamic capabilities explain how firms sense environmental challenges and opportunities, seize them through investment and governance choices, and reconfigure assets and routines to sustain performance under change [6]. Upper-echelons theory posits that organisational choices reflect the values and cognitions of top managers, implying that leadership shapes the attention to and integration of environmental priorities [11]. Taken together, these perspectives suggest a leadership-centred pathway in which strategic intent is translated into routinised ESG practices, which then yield sustainability benefits.

2.2 Strategic environmental leadership

Strategic environmental leadership refers to senior leaders' visible commitment to environmental priorities and their integration into corporate strategy, resource allocation, and performance systems [1, 2]. Leaders affect sustainability trajectories by setting targets, signalling priorities, aligning incentives, and mobilising cross-functional coordination [7]. Prior research links top-management commitment to the adoption of environmental management systems, eco-efficiency programmes, and supply-chain requirements that reduce compliance risk and enhance stakeholder legitimacy [12, 13]. In short, leadership is a proximal antecedent of ESG practice depth and consistency.

2.3 ESG implementation as organisational routines

ESG implementation denotes the extent to which environmental, social, and governance practices are formalised, monitored, and improved through policies, processes, and oversight mechanisms. Recognised frameworks, such as GRI 2021 and ISO 14001, codify practices including resource-efficiency programmes, emissions and waste controls, occupational health and safety, community engagement, and governance oversight [3, 4]. From a capabilities perspective, ESG routines embody the sensing, seizing, and reconfiguring of green opportunities; from an institutional perspective, they respond to regulatory, market, and civil-society pressures [12]. Leadership is expected to be a primary driver of the breadth and quality of these routines.

2.4 Sustainability performance

Sustainability performance encompasses improvements in environmental outcomes, stakeholder relationships, and financial efficiency attributable to sustainability practices. Meta-analyses and large-scale reviews generally report a positive association between sustainability management and financial performance, with effect sizes contingent on context and measures [8, 9, 14, 10]. Mechanisms include cost savings from eco-efficiency, risk reduction, revenue from greener products, and reputational gains with supply-chain partners and communities. When ESG implementation is substantive rather than symbolic, it should translate into observable performance gains.

2.5 Hypothesis development

Leaders shape organisational attention and resource deployment. Where leadership is explicit and sustained, firms are more likely to invest in systems and processes that institutionalise environmental and social priorities, including energy-efficiency programmes, waste and emissions management, health-and-safety audits, and governance oversight consistent with international standards [7, 3, 4].

- **H1:** Strategic environmental leadership positively influences ESG implementation.

Substantive ESG routines are associated with efficiency gains, reduced compliance risk, stronger stakeholder relations, and, ultimately, improved financial outcomes on average [8, 9, 14, 10]. Accordingly, firms that implement and monitor ESG practices more extensively should report better sustainability performance.

- **H2:** ESG implementation positively influences sustainability performance.

Leadership can also have a direct effect on performance by shaping culture, investment horizons, and stakeholder engagement beyond codified ESG routines [2, 5]. Hence, a positive direct association is plausible.

- **H3:** Strategic environmental leadership positively influences sustainability performance.

Integrating NRBV, dynamic capabilities, and upper-echelons arguments suggests a leadership-to-practice-to-performance mechanism. Leadership sets direction; ESG routines operationalise that direction; performance gains follow when routines are enacted at scale. Thus, ESG implementation is expected to carry a substantial share of leadership's effect on performance.

- **H4:** ESG implementation mediates the relationship between strategic environmental leadership and sustainability performance.

3 Methods

This study employs a cross-sectional survey to test a simple mediation model within forestry and wood-based firms in South Sulawesi, Indonesia. The independent variable is Strategic Environmental Leadership (SEL), the mediator is ESG Implementation (ESG), and the dependent variable is Sustainability Performance (SP). All constructs are reflective and measured on five-point Likert scales from 1 strongly disagree to 5 strongly agree. Partial least squares structural equation modelling (PLS-SEM) is used given the model's parsimony, prediction orientation, and distributional robustness [15].

All legally registered forestry and wood-based firms operating in South Sulawesi across the value chain: upstream concessions, primary processing, downstream furniture and joinery, and non-timber forest products. A consolidated list was compiled in June 2025 from provincial registries and industry associations. After de-duplication and eligibility screening, the frame contained 512 firms. This research used stratified random sampling to ensure representation by subsector and by spatial clusters that reflect industry distribution. Four subsectors were defined a priori. Six district clusters were used for operational efficiency: (1) Makassar, Gowa, Maros; (2) Bone, Wajo, Soppeng; (3) Bulukumba, Bantaeng, Sinjai; (4) Parepare, Pinrang, Enrekang; (5) Luwu, Luwu Timur, Luwu Utara, Palopo; (6) Tana Toraja, Toraja Utara. Proportional allocation determined invitations per stratum, followed by simple random sampling within each stratum. One knowledgeable manager per firm was targeted, drawn from Operations, HSE, Sustainability, Production, or Quality.

Power analysis for a mediation with the largest regression comprising two predictors, small to medium effect size $f^2 = 0.10$, alpha 0.05, and power 0.80 indicated a minimum of 107 observations [16]. Fieldwork between July and August 2025 approached 420 eligible firms. We obtained 236 returned questionnaires. After quality screening, 212 firm-level responses remained usable, exceeding the a priori minimum and adequate for PLS-SEM with bootstrapping. Table 1 summarises movement from the 512-firm frame to 212 usable responses.

Table 1. Respondent recruitment and reduction flow

Stage and step	Count (n)	% of previous stage	% of initial frame (n = 512)	Notes

Initial sampling frame	**512**	—	**100.00**	Compiled June 2025 from provincial registries and associations
Excluded: duplicate listings	38	—	7.42	Same legal entity listed more than once
Excluded: out-of-scope subsector	22	—	4.30	Not forestry or wood-based
Excluded: ceased operations	12	—	2.34	Inactive or closed
Excluded: invalid or unreachable contacts	20	—	3.91	No valid email or phone after verification
Eligible and approached firms	**420**	—	**82.03**	512 minus exclusions
No contact after three attempts	150	35.71	29.30	Email, phone, then follow-up
Refused or opted out	34	8.10	6.64	Corporate policy or refusal
Returned questionnaires (gross)	**236**	**56.19**	**46.09**	**Prior to screening**
Removed: straight-lining	9	3.81	1.76	Identical responses across scales
Removed: more than 20 percent missing	7	2.97	1.37	Item non-response threshold
Removed: sub-threshold completion time	5	2.12	0.98	Below piloted minimum
Removed: failed attention check	3	1.27	0.59	Instructed-response item
Usable responses (final analytical sample)	**212**	**89.83** of returns	**41.41** of frame	**236 minus 24 screened out**

Source: Authors own estimation (2025)

Items were adapted to the organisational level, written in Indonesian, and back-translated to ensure linguistic equivalence [17]. Content validity was established via an expert panel comprising three academics in strategic management and two industry practitioners. Unless noted, all constructs are reflective with five-point Likert response options.

- **Strategic Environmental Leadership (SEL)**, four items capturing visible top-management commitment and strategic embedding of environmental priorities, adapted from corporate environmental leadership literature [1, 2]. Example items include explicit environmental targets as strategic priorities, visible role-modelling, allocation of resources, and embedding environmental objectives in unit KPIs.
- **ESG Implementation (ESG)**, four items assessing the extent to which environmental, social, and governance practices are implemented and monitored.

Items align with recognised frameworks such as the GRI 2021 Universal Standards and practices consistent with ISO 14001. Examples include energy and resource efficiency programmes being implemented and tracked, waste and emissions managed to recognised standards, regular audits of occupational health and safety systems, and governance mechanisms that monitor ESG progress and policy enforcement [3, 4].

- **Sustainability Performance (SP)**, three items reflecting perceived improvement over the past three years in environmental outcomes, stakeholder relations, and financial efficiency, consistent with prior sustainability performance research [18].

Controls were deliberately minimised to preserve parsimony. Single-indicator firm-level controls, used only in robustness checks, included size, age, ownership type, and certification status.

The instrument comprised four sections: firm and respondent profile, SEL, ESG, and SP. One attention-check item and a minimum completion-time flag were included. A pilot with 25 managers from two subsectors confirmed clarity and timing, after which minor wording refinements were made. Pilot data were excluded from the main analysis. Data collection was supported by a university cover letter describing the study aims, voluntary participation, anonymity, and aggregate-only reporting. No personally identifiable data beyond role and tenure were collected. Ethical approval was granted by the authors' institutional review board prior to fieldwork. Participation implied informed consent.

Returned questionnaires were screened for straight-lining, excessive missingness, and implausibly short completion times. Twenty-four cases were removed, leaving 212 usable responses. Early and late respondents were compared on key variables and showed no statistically meaningful differences, indicating limited non-response bias. Procedural remedies to reduce common method bias included anonymity assurances, varied stems, and separation of constructs in the instrument layout. Statistically, a single-factor test accounted for well below half of total variance, and a marker-variable check suggested negligible shared method variance [19]. As an additional diagnostic, full-collinearity variance inflation factors were inspected and were below conservative thresholds [20].

Analyses were conducted in SmartPLS 3. For reflective measurement, reliability and validity were evaluated using Cronbach's alpha and composite reliability, average variance extracted above 0.50, and discriminant validity via HTMT below 0.85 with confidence-interval checks [21, 15]. Indicator loadings were expected to exceed 0.708, with low-loading items considered for removal only if this improved construct metrics without undermining content coverage.

The structural model was estimated with 5,000 bootstrap resamples. We report path coefficients with bias-corrected confidence intervals, R^2, predictive relevance Q^2, and effect sizes f^2. Mediation was tested through the indirect path SEL → ESG → SP, with significance determined by bootstrap confidence intervals. Robustness checks included adding controls, split-sample analyses by subsector, and sensitivity to item-retention decisions. Descriptive statistics and correlations are reported alongside measurement and structural results in journal-standard tables.

4 Results

Consistent with recommended SEM reporting practice, we first document the sample composition and basic descriptives, then proceed to measurement and structural estimates in subsequent subsections [15, 21].

Table 2. Sample composition by subsector and district cluster

Subsector \ District cluster	Makassar–Gowa–Maros	Bone–Wajo–Soppeng	Bulukumba–Bantaeng–Sinjai	Parepare–Pinrang–Enrekang	Luwu–Luwu Timur–Luwu Utara–Palopo	Tana Toraja–Toraja Utara	Total
Upstream concessions	2	6	4	3	9	4	**28**
Primary processing (sawmill, veneer, plywood)	24	12	10	10	18	4	**78**
Downstream furniture and joinery	24	8	11	8	17	6	**74**
Non-timber forest products	6	6	3	5	8	4	**32**
Total	**56**	**32**	**28**	**26**	**52**	**18**	**212**

Note. Counts by cell are firms. Row and column totals equal n = 212.
Source: Primary Data Process

Table 2 shows a well-distributed sample across subsectors and district clusters (n = 212). At the subsector level, primary processing and downstream furniture and joinery together account for 152 firms (about 71.7 percent), reflecting the provincial value-chain footprint. Upstream concessions account for 28 firms (13.2 percent), which is plausible given the smaller number of concession holders in the frame, while non-timber forest products account for 32 firms (15.1 percent).

Geographically, two clusters serve as principal hubs: Makassar–Gowa–Maros (56 firms; 26.4 percent) and the Luwu axis of Luwu, Luwu Timur, Luwu Utara, and Palopo (52 firms; 24.5 percent). Combined, these represent just over half of the sample and align with the proportional stratification in the Methods. The remaining clusters each contribute roughly 12 to 15 percent, indicating that no single non-metro area dominates the sample. Cross-tab patterns are face-valid: primary processing concentrates in Makassar–Gowa–Maros (24) and the Luwu axis (18); downstream activity follows a similar pattern (24 and 17); and upstream concessions are located where concessions

are administratively present (for example, 6 in Bone–Wajo–Soppeng and 9 in the Luwu axis). Row and column totals reconcile to n = 212, supporting the integrity of the stratified random sampling and proportional allocation.

Table 3. Respondent roles and firm characteristics

Variable	Category	Count (n)	Percent (%)
Respondent function	Operations	52	24.53
	HSE	38	17.92
	Sustainability	34	16.04
	Production	44	20.75
	Quality	28	13.21
	Other senior management	16	7.55
Firm size	< 50 employees	68	32.08
	50 to 249 employees	106	50.00
	≥ 250 employees	38	17.92
Firm age	< 5 years	42	19.81
	5 to 14 years	96	45.28
	≥ 15 years	74	34.91
Ownership	Domestic private	164	77.36
	State-linked	22	10.38
	Foreign-invested	26	12.26
Certification status	None	64	30.19
	SVLK or PHPL only	112	52.83
	FSC or PEFC (any)	36	16.98

Note. Percentages are within-variable column percentages, rounded to two decimals.
Source: Primary Data Process

Respondent functions are appropriately managerial for assessing leadership, implementation, and performance: Operations (24.53 percent), Production (20.75 percent), HSE (17.92 percent), and Sustainability (16.04 percent) together account for nearly four in five respondents. Firm size is anchored in small and medium enterprises (32.08 percent with fewer than 50 employees; 50.00 percent with 50–249 employees), with a smaller large-firm segment (17.92 percent with 250 or more employees). Firm age skews towards established organisations (45.28 percent with 5–14 years; 34.91 percent with 15 years or more), which reduces concerns about start-up idiosyncrasies. Ownership is dominated by domestic private firms (77.36 percent), with state-linked (10.38 percent) and foreign-invested (12.26 percent) minorities. Certification uptake is substantial: SVLK or PHPL only accounts for 52.83 percent and FSC or PEFC for 16.98 percent, indicating that roughly seven in ten firms hold some form of certification,

while three in ten report none (30.19 percent). These distributions mirror the sampling frame and provide useful heterogeneity for robustness checks (see Table 3).

Table 4. Construct-level descriptive statistics

Construct	Items (k)	Mean	SD	Min	Max
Strategic Environmental Leadership (SEL)	4	3.62	0.74	1	5
ESG Implementation (ESG)	4	3.45	0.71	1	5
Sustainability Performance (SP)	3	3.58	0.69	1	5

Note. Composite scores are arithmetic means of item responses per construct. No out-of-range values were observed.
Source: Primary Data Process

Construct means are in the mid-to-upper range of the five-point scale, with Strategic Environmental Leadership mean 3.62 (SD 0.74), ESG Implementation mean 3.45 (SD 0.71), and Sustainability Performance mean 3.58 (SD 0.69). Observed minima and maxima span the full 1–5 range. Standard deviations below one indicate adequate dispersion without extreme variability, limiting concerns about floor or ceiling effects and restriction of range (see Table 3). This supports subsequent variance-based SEM estimation and predictive assessment [15]. The ordering of central tendencies is also face-valid for the theorised mediation: leadership levels slightly exceed practice implementation, while performance reports track close to leadership, which is consistent with partial mediation expectations.

Table 5. Indicator reliability and convergent validity

Construct	Item	Loading	t-value	p-value	Indicator VIF
Strategic Environmental Leadership (SEL)	SEL1	0.80	15.62	< .001	2.04
	SEL2	0.83	18.90	< .001	2.19
	SEL3	0.78	13.75	< .001	1.92
	SEL4	0.82	17.21	< .001	2.12
ESG Implementation (ESG)	ESG1	0.77	12.88	< .001	1.88
	ESG2	0.81	16.44	< .001	2.05
	ESG3	0.84	20.12	< .001	2.22
	ESG4	0.79	15.10	< .001	1.97
Sustainability Performance (SP)	SP1	0.82	18.01	< .001	2.08
	SP2	0.86	22.94	< .001	2.29
	SP3	0.79	14.28	< .001	1.95

Note. All loadings exceed 0.70 and are significant at $p < .001$. Indicator VIF values are below 3.30, indicating no problematic collinearity for reflective items.
Source: Primary Data Process

Furthermore, Table 5 shows that all reflective indicators load strongly on their intended constructs. Loadings range from 0.77 to 0.86 and all are statistically significant at p less than .001 with narrow bootstrap confidence intervals, which indicates stable estimates under resampling. Within constructs, the strongest items are SEL2 for strategic environmental leadership at 0.83, ESG3 for ESG implementation at 0.84, and SP2 for sustainability performance at 0.86. The indicator VIF values lie between 1.88 and 2.29, which is well below conservative cut-offs and suggests no problematic collinearity among items. Given that every loading exceeds the conventional 0.70 benchmark and that content coverage is balanced across items, no indicator deletion was warranted. These results support indicator reliability and the presence of convergent validity at the item level.

Table 6. Construct reliability and convergent validity

Construct	Items (k)	Cronbach's alpha	rho_A	Composite reliability	AVE	Square-root of AVE
Strategic Environmental Leadership (SEL)	4	0.84	0.85	0.89	0.65	0.81
ESG Implementation (ESG)	4	0.85	0.86	0.90	0.65	0.81
Sustainability Performance (SP)	3	0.80	0.82	0.87	0.68	0.82

Note. Reliability coefficients exceed recommended thresholds. Average variance extracted (AVE) is above 0.50, indicating adequate convergent validity.
Source: Primary Data Process

In terms of reliability construct and convergent validity, Table 6 reports internal consistency and convergent validity at the construct level. Cronbach's alpha ranges from 0.80 to 0.85, rho_A from 0.82 to 0.86, and composite reliability from 0.87 to 0.90. All exceed recommended thresholds for variance-based structural equation modelling. Average variance extracted is 0.65 for strategic environmental leadership, 0.65 for ESG implementation, and 0.68 for sustainability performance. These values are above 0.50, which confirms that each latent variable explains more than half of the variance in its indicators. The square roots of AVE, shown in the table, provide the benchmarks used in the Fornell–Larcker assessment that follows.

Table 7. Discriminant validity: Fornell–Larcker criterion

Construct	SEL	ESG	SP
Strategic Environmental Leadership (SEL)	**0.81**		
ESG Implementation (ESG)	0.62	**0.81**	
Sustainability Performance (SP)	0.55	0.66	**0.82**

Note. For each construct, the square-root of AVE (diagonal, bold) is greater than its correlations with other constructs, supporting discriminant validity.
Source: Primary Data Process

For Fornell-Larcker criterion, Table 7 presents the square root of AVE on the diagonal and latent correlations below the diagonal. For every construct, the square root of AVE is larger than its correlations with the other constructs. For example, the square root of AVE for ESG implementation is 0.81 while its correlations with strategic environmental leadership and sustainability performance are 0.62 and 0.66 respectively. This pattern holds across the matrix and supports discriminant validity. The magnitude of correlations is moderate rather than high, which is consistent with the theoretical expectation that leadership, implementation, and performance are related but conceptually distinct.

Table 8. Discriminant validity: HTMT ratios with 95% bias-corrected confidence intervals

Pair	HTMT	95% CI
SEL – ESG	0.74	[0.68, 0.79]
SEL – SP	0.68	[0.61, 0.74]
ESG – SP	0.77	[0.71, 0.82]

Note. All HTMT values and their upper confidence bounds are below 0.85, satisfying the Henseler criterion for discriminant validity.
Source: Primary Data Process

However, Table 8 reports HTMT ratios and their bias-corrected confidence intervals from 5,000 bootstrap resamples. All HTMT values are below 0.85 and their upper confidence bounds remain below 0.85. Specifically, HTMT is 0.74 for strategic environmental leadership with ESG implementation, 0.68 for strategic environmental leadership with sustainability performance, and 0.77 for ESG implementation with sustainability performance. These results confirm discriminant validity according to the Henseler criterion. Together with the Fornell–Larcker findings, they indicate that the three constructs are empirically separable.

The measurement results demonstrate strong indicator performance, satisfactory internal consistency, adequate convergent validity, and consistent evidence of discriminant validity. Collinearity diagnostics at the indicator level are benign. The model therefore meets accepted quality criteria for variance-based structural equation modelling and supports progression to structural path estimation and mediation testing in the next subsection [15, 21].

Table 9. Structural model results

Path	Std. beta	95% CI (bias-corrected)	t-value	p-value	f^2 (effect size)	Inner VIF
SEL → ESG	0.62	0.54 to 0.70	14.25	< .001	0.64 (large)	—
ESG → SP	0.52	0.43 to 0.60	10.72	< .001	0.46 (medium–large)	1.63
SEL → SP	0.20	0.07 to 0.33	3.05	.002	0.09 (small)	1.63

Note. Inner VIF is reported for predictors of SP; ESG and SEL show no problematic collinearity. For ESG as an endogenous construct, SEL is the sole predictor.

Source: Primary Data Process

For structural model results, Table 9 indicates that strategic environmental leadership (SEL) is a strong, positive predictor of ESG implementation (standardised beta 0.62; 95 percent CI 0.54 to 0.70; $p < .001$), with a large local effect size (f-squared 0.64). ESG implementation, in turn, is a substantive predictor of sustainability performance (SP) (beta 0.52; 0.43 to 0.60; $p < .001$), with a medium to large effect (f-squared 0.46). The direct path from SEL to SP is positive but smaller (beta 0.20; 0.07 to 0.33; $p = .002$; f-squared 0.09). Taken together, the pattern is consistent with a leadership-to-practice-to-performance mechanism: leadership signals translate into implemented practices, and those practices yield performance gains, while a residual direct effect of leadership on performance remains [15].

Table 10. Model fit, explanatory power, and predictive relevance

Endogenous construct	R^2	Adj. R^2	Q^2	SRMR (saturated)	SRMR (estimated)	d_ULS	d_G
ESG	0.39	0.38	0.29	0.057	0.061	0.482	0.358
SP	0.54	0.53	0.36	0.057	0.061	0.482	0.358

Note. R^2 values indicate moderate to substantial explanatory power. Q^2 values greater than zero evidence predictive relevance. Global fit indices (for reference in PLS) are within commonly accepted ranges, with SRMR below 0.08.

Source: Primary Data Process

R-squared values show that the model explains a meaningful share of variance in the endogenous constructs: 0.39 for ESG and 0.54 for SP, which is typically interpreted as moderate to substantial in applied management research. Q-squared values are comfortably above zero (0.29 and 0.36), evidencing out-of-sample predictive relevance. Global reference indices for PLS are within accepted bounds: SRMR is below 0.08 in both the saturated and estimated models (0.057 and 0.061), while NFI is 0.91. Although global fit indices are ancillary in variance-based SEM, their values corroborate an overall well-behaved model [15].

Table 11. Collinearity and local effect sizes at the endogenous constructs

Target construct	Predictor	Inner VIF	f^2	Cohen's benchmark
ESG	SEL	—	0.64	Large
SP	ESG	1.63	0.46	Medium–large
SP	SEL	1.63	0.09	Small

Note. f^2 for SEL on ESG is large because SEL is the only predictor of ESG. Inner VIF values below 3.30 indicate no collinearity concerns.

Source: Primary Data Process

Inner VIF values for predictors of SP are 1.63, well under conservative thresholds (for example, 3.3), indicating no collinearity concerns that might inflate standard errors. Local effect sizes mirror the substantive conclusions above: SEL has a large effect on ESG, ESG has a medium–large effect on SP, and SEL's direct effect on SP is small but non-negligible. This pattern supports the theorised sequencing from leadership to implementation and on to performance.

Table 12. Mediation analysis

Effect	Path definition	Std. effect	95% CI (bias-corrected)	t-value	p-value	Mediation type	VAF (%)
Indirect	SEL → ESG → SP	0.32	0.23 to 0.42	7.85	< .001	—	61.5
Direct	SEL → SP	0.20	0.07 to 0.33	3.05	.002	—	—
Total	SEL → SP (total)	0.52	0.43 to 0.61	11.14	< .001	Partial complementary	—

Note. VAF (variance accounted for) is the ratio of the indirect to the total effect. With a significant direct and indirect effect in the same direction and VAF above 20 percent, the pattern supports partial complementary mediation**.**

Source: Primary Data Process

The indirect effect from SEL to SP via ESG is 0.32 and statistically significant (95 percent CI 0.23 to 0.42; $p < .001$). The direct effect from SEL to SP remains significant and positive (0.20; $p = .002$). The variance accounted for (VAF) is 61.5 percent, which, together with significant direct and indirect paths in the same direction, indicates **partial complementary mediation**. Substantively, most of leadership's impact on performance operates through ESG practice implementation, while a smaller, direct channel persists—consistent with leadership effects not fully captured by measured ESG routines [22, 15].

Finally, three checks were conducted. First, adding firm-level controls (size, age, ownership, certification status) did not materially change the estimates; absolute changes in coefficients were within 0.03 and all inferences were preserved. Second, sensitivity to item retention decisions yielded stable structural coefficients with overlapping confidence intervals. Third, split-sample inspection by subsector showed the same ordering of path magnitudes; small differences remained within the reported

confidence bands. These diagnostics jointly reinforce the stability of the reported relationships.

5 Discussion

This study set out to test a parsimonious, leadership-centred pathway from strategic intent to outcomes among forestry and wood-based firms in South Sulawesi. The measurement model satisfied accepted quality criteria: all reflective indicators loaded strongly on their intended constructs; internal consistency reliability and convergent validity were adequate; and discriminant validity was confirmed by the Fornell–Larcker criterion and HTMT ratios [15, 21]. The structural model shows three consistent results. First, strategic environmental leadership relates strongly and positively to ESG implementation, with a large local effect. Secondly, ESG implementation relates positively to sustainability performance with a medium to large effect. Thirdly, the direct leadership–performance link remains positive but smaller in magnitude. The indirect effect from leadership to performance via ESG is statistically significant and accounts for around three-fifths of the total effect, indicating partial complementary mediation. Model explanatory power is moderate to substantial for ESG and sustainability performance, with positive predictive relevance.

Taken together, these results support a leadership-to-practice-to-performance mechanism in which senior managers' direction, resourcing, and signalling are translated into routinised ESG practices that, in turn, underpin improvements in environmental, stakeholder, and efficiency outcomes.

Our findings contribute to three strands of theory. First, within the natural-resource-based view, we show that leadership does not merely espouse environmental intent but is associated with the institutionalisation of ESG routines that embody valuable and difficult-to-imitate capabilities [5]. The sizeable link from leadership to implementation is consistent with the view that advantage arises when strategic intent is embedded in processes, oversight, and continuous improvement rather than in symbolic commitments.

Secondly, the results align with dynamic capabilities by suggesting that the sensing, seizing, and reconfiguring of green opportunities are enacted through concrete ESG systems and practices. Leadership appears to be a proximal mechanism that activates these capabilities by setting targets, aligning incentives, and reallocating resources [6, 7]. The mediation pattern implies that much of leadership's contribution to performance is channelled through these routines, while a smaller direct pathway may capture cultural, reputational, or stakeholder-engagement effects that are not fully measured by our ESG indicators.

Thirdly, the results speak to upper-echelons logic. The observed associations suggest that leaders' priorities and attention shape organisational choices that have measurable performance consequences, even in resource-based industries operating in an emerging-market provincial context [11]. By estimating effect sizes within a transparent, minimal model, this study clarifies how leadership, implementation, and

outcomes are related yet distinct constructs, thereby addressing common concerns about conceptual and empirical conflation in the sustainability literature [8, 9, 10].

The results suggest that senior managers should translate strategic environmental intent into formal systems that can be executed, monitored, and improved. Leadership signals appear to be most effective when they are embedded in programme level routines such as energy and resource efficiency initiatives, structured waste and emissions controls, regular occupational health and safety audits, and governance oversight that reviews progress against clear performance indicators. The strong association between leadership and implementation implies that visible target setting, dedicated budgets, and alignment of unit level key performance indicators can accelerate the institutionalisation of ESG practices. At the same time, the positive direct path from leadership to performance indicates that outcomes do not arise from systems alone. Role modelling by executives, continuous engagement with internal and external stakeholders, and active removal of execution bottlenecks contribute to performance through cultural and reputational channels that complement formal routines. Managers should therefore sustain attention to both the depth of ESG practice and the broader leadership behaviours that signal continuity of commitment.

For provincial government and industry associations, the evidence points to a practical sequence of ecosystem level actions. Capability building should come first, through joint training on ESG management systems, internal audits, and data processes that help firms move from intention to credible practice, particularly among small and medium sized enterprises. Incentives can reinforce this trajectory when they target verifiable improvements, for example support for equipment that reduces energy intensity or safety incidents, combined with recognition schemes for firms that demonstrate audited gains. Regulatory clarity is equally important. Clear guidance and consistent enforcement that align provincial requirements with national legality assurance and international standards reduce uncertainty and make it easier for firms to systematise ESG. Finally, because activity is geographically concentrated, cluster based platforms for knowledge sharing and pooled services, including environmental monitoring and reporting support, can raise practice quality at lower cost and with faster diffusion.

6 Conclusion

This study examined a minimal and theory consistent pathway linking strategic environmental leadership, ESG implementation, and sustainability performance among forestry and wood based firms in South Sulawesi. Using a cross sectional survey of 212 firms and variance based structural equation modelling, we found that leadership relates strongly to the breadth and quality of ESG implementation, that implementation relates positively to sustainability performance, and that a smaller but significant direct leadership effect on performance remains. The indirect path from leadership to performance through implementation accounts for the majority of the total effect, which supports a leadership to practice to performance mechanism.

The findings contribute conceptually by clarifying how the natural resource based view and dynamic capabilities operate through leadership that is translated into routines rather than remaining at the level of aspiration. Methodologically, the study demonstrates a transparent survey based PLS SEM application with rigorous measurement testing and clearly reported effect sizes. Empirically, the work provides province level evidence from a resource based industrial context within an emerging economy, with a sampling design that mirrors the industrial structure and supports external validity in the local setting.

For managers, the implication is straightforward. The most reliable route from intent to outcomes is to convert leadership priorities into auditable ESG systems, while sustaining visible behaviours that maintain momentum and legitimacy. For policymakers and associations, capability support, targeted incentives, regulatory coherence, and cluster based platforms can accelerate practice depth and spread benefits across the ecosystem.

The study remains subject to the usual constraints of cross sectional self reported data, despite procedural and statistical remedies for common method concerns. Future work should extend the design through longitudinal measurement, triangulation with objective indicators, and comparative analyses across provinces or ownership types. Even with these caveats, the present evidence offers a clear and actionable benchmark for both scholars and practitioners who seek to strengthen sustainability performance in resource based industries through leadership that is firmly rooted in organisational practice.

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