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Corporate Governance and Regional Ecological Restoration: Insights from an Environmental Science Perspective

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ABSTRACT

The growing destruction of natural ecosystems highlights the importance of the urgency to provide frameworks that would efficiently involve corporate governance principles in the ecological restoration of the regions. Ecological restoration that aims at restoring the degraded ecological settings so that ecological functionality is restored entails cooperation between industries, policymakers, and the community. This research explores the effects of Transparency (Tr), Accountability (Ac), environmental responsibility (ER), and Corporate Social Responsibility and Stakeholder engagement Integration (CSI) in corporate governance mechanisms on sustainable ecological restoration. Respondents were sampled from 520 participants in industries, environmental groups, and governmental agencies, with regional reports on environmental and corporate sustainability added as supplementary data. It proved the governance restoration framework using Structural Equation Modeling (SEM) and Confirmatory Factor Analysis (CFA) with SPSS, using outstanding model fit indices (CFI = 0.95, RMSEA = 0.043). The results found that ER ($\beta = 0.41$) and Tr ($\beta = 0.38$) have the greatest positive impact on the restoration's performance, followed by Ac ($\beta = 0.35$) and CSI ($\beta = 0.33$). The analytical findings demonstrated that the positive impact on the success of the restoration in the regions was higher in terms of governance Tr and stakeholder Ac than environmental disclosure practices and cross-sector partnerships. The quality of governance was found to be a significant factor in ecological efficiency, with regions of high quality showing around 26% improvement in ecological

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efficiency, which confirms that corporate integrity and openness have a significant impact on improving biodiversity recovery, pollution mitigation, and community involvement.

Keywords: Corporate Governance; Ecological Restoration; Sustainability; Transparency; Accountability; Biodiversity

1. Introduction

The growing pressure on natural ecosystems through industrialization, urban growth, and unsustainable human practices is causing degraded forests, polluted water bodies, and reduced biodiversity^[1]. The concept of ecological restoration, which involves restoring environments that are damaged to restore ecological functionality, has become very critical to environmental sustainability^[2,3]. Meanwhile, companies have a major impact on environmental performance, hence the reasons to investigate how corporate governance affects the effectiveness of the restoration process^[4]. Although numerous initiatives are undertaken to preserve the damaged ecosystems, the achievement of success frequently seems to be far away^[5]. The restoration projects occasionally operate autonomously, where one side plants trees here, and another manages the pollution there, without communicating with each other. Industries, government agencies, and local communities often operate in separate bubbles, and corporate responsibility is rarely woven into the bigger plan^[6,7]. Consequently, the ecosystems remain in distress, and the restoration process may seem like trying to close the leaking roof but not the foundation^[8]. The results of many restoration efforts that include tree planting, pollution control, and habitat management are successful in some areas. Nevertheless, these achievements are usually brief or one-sided since they concentrate more on the ecological solutions but not on the larger system^[9]. There is inadequate coordination among industries, policymakers, and communities, and corporate responsibility is seldom incorporated in the long-term planning^[10]. Because of this, natural ecosystems are still under intense pressure from industrialization, urbanization, and human activities, which have caused the degradation of forests, contamination of water, and the loss of biodiversity.

Research found that environmental transparency and performance were positively connected with CEO duality, gender diversity, and younger boards, but not with board size, in an investigation^[11] that examined 361 U.S. companies with green patents from 2007 to 2016. Nevertheless, they

only apply to the U.S. firms and thus make them less globally generalizable. Likewise, analysis^[12] completed systematic research to discover that transparency and accountability enhance the performance of environmental and social governance, but the theoretical character of the research restricts empirical validation.

Research^[13] emphasized that robust governance, ethical leadership, independent boards, and such technologies as AI and blockchain contribute to improving accountability and transparency. Nevertheless, they have concentrated on financial governance and compliance primarily, which lacks detailed information on direct environmental or sustainability performance. Analysis^[14] has studied Indonesian companies (2010–2020) and discovered that effective corporate governance was a significant factor in improving sustainability performance, but there was also a lack of shareholder fairness and disclosure. Nevertheless, the regional nature of the analysis restricts the generalizability of the results.

Moreover, research^[15] analysed Italian public interest organizations and concluded that good governance improves environmental disclosure. Nevertheless, impression management continues to hide the negative aspect of many firms, which points to the persistence of attaining real transparency in sustainability reporting. Lastly, research^[16] conducted a decade-long SysGMM analysis of Chinese firms and found that board size, independence, gender diversity, and CEO duality have a positive influence on environmental accountability, which was moderated by CEO traits. However, the research's China-specific context limits the generalization of its findings globally.

The project evaluated adaptive, technology-driven, and community-based conservation across multiple sites^[17]. Data from remote sensing, biodiversity, and surveys showed enhanced resilience and stewardship, while long-term scalability and cost-effectiveness remained uncertain. The investigation examined corporate and national governance effects on biodiversity reporting across 36 countries^[18]. Data analysis showed that strong corporate and national governance improved reporting, while national governance moder-

ated Corporate Social Responsibility (CSR) and shareholder treatment effects; management effectiveness remained unaffected.

An analysis of 18,545 firm-year observations from 2013 to 2024 examined corporate emission reduction policies and greenhouse gas emissions^[19]. Stronger governance and higher ERP adoption reduced emission intensity, with trend analyses confirming long-term effectiveness; robust governance ensured credibility and mitigated greenwashing. An analysis of 8 hotel companies (32 firm-year observations) examined governance and environmental citizenship^[20]. Higher board independence and ownership concentration improved CEC scores, while CEO duality reduced performance, highlighting governance as a key driver of environmental stewardship.

Analysis of Morocco's ecological and economic data (1990–2022) examined climate change impacts^[21]. Water stress and rising temperatures significantly reduced GDP, while deforestation, greenhouse gas emissions, and temperature increased, worsening biodiversity loss and ecosystem degradation, impacting economic performance. Biodiversity disclosures of 47 top-revenue global firms (2023–2024) were assessed using coding and content analysis^[22], revealing limited transparency, shallow methodology, and sectoral differences, with energy highest and finance lowest in reporting depth.

The ecological and participatory dimensions of climate adaptation in Settat, Morocco, were examined using field surveys and participatory assessments^[23], revealing growing environmental awareness but limited citizen inclusion, highlighting the importance of nature-based solutions for resilience. Governance mechanisms of 336 multinational firms across 32 countries over 15 years showed that board gender diversity, CEO duality, and environmental, social, and governance (ESG) committees reduced carbon emissions, while board independence and compensation increased emissions. An ESG index of corporate performance across economic, social, and environmental metrics was built for multiple companies, revealing correlations with share prices, return on equity (ROE), and profits, while highlighting stronger impacts of diversity and limited reflection of waste, water, and CO₂ emissions. Although studies show corporate governance board diversity, CEO duality, and ESG committees enhance environmental transparency and performance, most

are region- or sector-specific, focus on financial compliance, or omit direct ecological outcomes. Limited multi-regional, cross-sector empirical research exists linking governance to measurable ecological restoration, emissions reduction, and community-based sustainability, revealing a significant research gap.

This research addresses these gaps by examining how the concepts of corporate governance can revolutionize restoration processes. Bringing business choices in line with ecological priorities as well as collaboration between the industries, communities, and policymakers, it identifies a route to sustainable, long-term ecological restoration outcomes that transcends the isolated interventions.

Hypothesis Development

H1. Transparency → Ecological Restoration Outcomes

- *Greater transparency in corporate reporting is expected to enhance ecological restoration by promoting accountability, informed stakeholder participation, and effective monitoring.*

H2. Accountability → Ecological Restoration Outcomes

- *Companies that take responsibility for environmental impacts are likely to implement more effective restoration practices.*

H3. Environmental Responsibility → Ecological Restoration Outcomes

- *Firms actively implementing environmental responsibility practices are expected to achieve better ecological results.*

H4. Corporate social responsibility and Stakeholder engagement Integration → Ecological Restoration Outcomes

- *Integration of environmental objectives into CSR programs supports sustainable restoration initiatives.*

The conceptual framework of ecological restoration is shown in **Figure 1**.

2. Methodology

The role of corporate governance in the restoration of the ecological situation in the regions was investigated with the help of a systematic approach that aimed to solve

the problem of complexity in ecosystems and governance systems. Environmental reports, corporate disclosures, and stakeholder survey data were combined to evaluate quan-

tifiable ecological performance, as well as governance practices, such as Tr, Ac, ER, and CSI, to determine their effect on ERO (Figure 2).

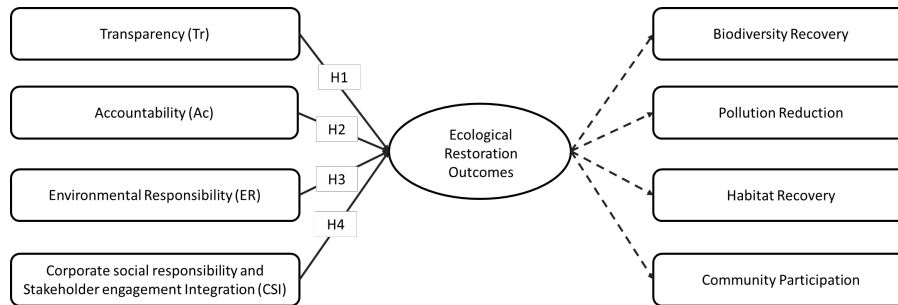


Figure 1. Conceptual Framework of Ecological Restoration.

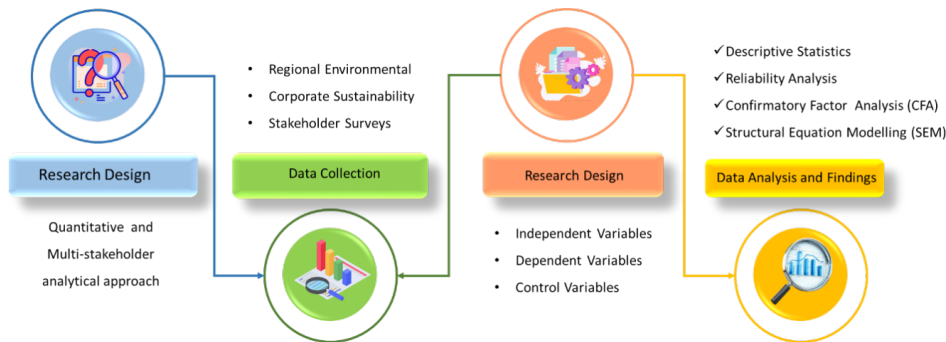


Figure 2. Methodological Framework for Assessing Corporate Governance Impact on Ecological Restoration.

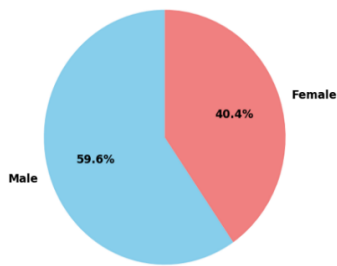
2.1. Data Collection

To collect data that could be utilized in this analysis, a triangulated methodology was adopted, and it involved not only secondary data sources but also primary survey data to provide a comprehensive picture of the outcomes of corporate governance and ecological restoration. The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the Accounting School, Nanfang College, Guangzhou (protocol code NFAC-EC-2023-017, date of approval 12 September 2023). Informed consent was obtained from all subjects involved in the study. The research examines regions with mixed land use, encompassing industrial activity, urban development, and ecologically sensitive areas requiring restoration. These regions experience environmental pressures such as habitat degradation, pollution, and biodiversity loss alongside ongoing restoration and sustainability initiatives, making them an appropriate context for assessing the influence of corporate governance on ERO.

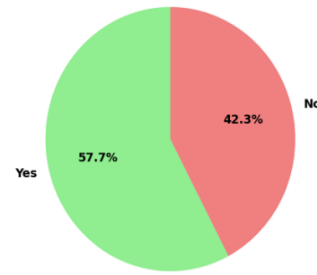
- (1) **Regional Environmental Reports:** Official reports that evaluated the ecological state and restoration programs in progress. Four environmental indicators were used to measure the performance in restoration: Biodiversity Recovery (BR), Pollution Reduction (PR), Habitat Recovery (HR), and Community Participation (CP).
- (2) **Corporate Sustainability Reports:** Reports of companies in the region were evaluated to measure Tr, Ac, ER, and CI. These report disclosures offered uniform measures of governance.
- (3) **Stakeholder Surveys:** The survey distributed questionnaires to 520 participants. Likert scales were used to measure governance effectiveness, stakeholder engagement, and restoration outcomes in respondents. Qualitative information is garnered in open-ended questions that are offered in **Appendix A**. The demographic profile of respondents is presented in **Table 1** and **Figure 3**.

Table 1. Demographic Profile of Survey Respondents.

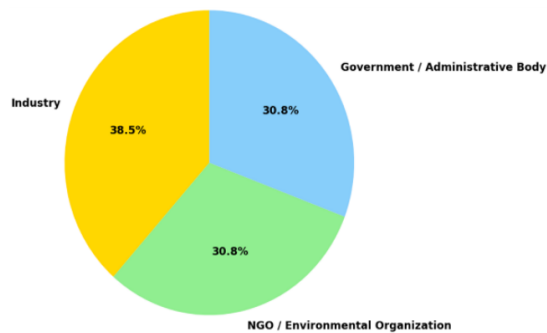
Demographic Variable	Category/Subgroup	Frequency (n = 520)	Percentage (%)
Age	21–30 years	120	23.1
	31–40 years	180	34.6
	41–50 years	140	26.9
	Above 50 years	80	15.4
Gender	Male	310	59.6
	Female	210	40.4
Job Role/Designation	Executive/Staff	220	42.3
	Manager/Officer	180	34.6
	Director/Senior Management	120	23.1
Years of Experience	Less than 5 years	100	19.2
	5–10 years	180	34.6
	11–20 years	160	30.8
Years in Current Organization/Role	More than 20 years	80	15.4
	Less than 3 years	120	23.1
	3–7 years	180	34.6
Type of Organization	8–15 years	140	26.9
	More than 15 years	80	15.4
	Industry	200	38.5
Organizational Size/Sector	NGO/Environmental Organization	160	30.8
	Government/Administrative Body	160	30.8
	Small/Medium Industry	180	34.6
Educational Qualification	Large Industry	160	30.8
	Multi-sector/Mixed	180	34.6
	Diploma/Bachelor's Degree	180	34.6
Field of Expertise	Master's Degree	240	46.2
	Doctorate/PhD	100	19.2
	Environmental Science/Ecology	180	34.6
Participation in Environmental Projects	Corporate/Management	200	38.5
	Policy/Administration	140	26.9
	Yes	300	57.7
	No	220	42.3



(a) Gender.



(b) Types of Organization.



(c) Participation in Environment Projects.

Figure 3. Distribution of Respondents involved in Governance and Restoration initiatives.

2.2. Measurement of Variables

To evaluate the impact of corporate governance on the restoration of the ecology in the region systematically, both independent and dependent variables and the control variables were operationalized as follows. Measurability provides the replicability and rigor of

statistical analysis.

2.2.1. Independent Variables (Corporate Governance Practices)

Corporate governance was evaluated on four major dimensions (**Table 2**), which were measured by stakeholder surveys, as well as corporate sustainability reports:

Table 2. Measurement of Independent Variables: Corporate Governance.

Variable	Indicator
Tr	Openness in reporting environmental initiatives, corporate decisions, and policies, measured through survey and report analysis
Ac	Corporate responsibility for environmental impacts; assessed via stakeholder perception and CSR disclosures
ER	Implementation of sustainable environmental practices and ecological initiatives, measured from corporate reports and survey ratings
CSI	The degree to which environmental objectives are integrated into broader CSR programs, as measured by both surveys and corporate disclosures

2.2.2. Dependent Variables (Ecological Restoration Outcomes)

The results of the ecological restoration were measured by key indicators (**Table 3**) obtained with the help of regional environmental reports and observations of the stakeholders.

Table 3. Measurement of Ecological Restoration Outcomes.

Variable	Indicator
BR	Improvement in species richness and ecosystem diversity in the study region
PR	Decrease in air, water, and soil pollution levels using standardized metrics.
HR	Percentage of degraded land or ecosystems restored over time
CP	Level of local community involvement in restoration activities

HR and BR represent distinct but complementary dimensions of ecological restoration. HR refers to the physical

and structural recovery of ecosystems, measured through indicators such as the proportion of degraded land restored, improvements in vegetation cover, and rehabilitation of habitat structure over time. In contrast, BR captures biological recovery, reflected in increases in species richness, diversity, and ecosystem composition. For example, reforestation initiatives may improve HR by restoring forest cover, while BR reflects the subsequent recovery of native species within the restored habitats.

2.2.3. Control Variables

To deal with the external factors that could affect the outcomes of ecological restoration, multiple control variables were used in the research. The following variables (**Table 4**) were used to isolate the impact of corporate governance practices on the ecological restoration outcomes:

Table 4. Measurement of Control Variables: Influence of Governance and Restoration.

Control Variable	Indicator
Organizational Size (OS)	Even though larger organizations might have more funding for environmental initiatives, accounting for size guarantees that variations in repair results cannot solely be the result of corporate capability.
Organizational Type (OP)	Government agencies, businesses, and NGOs may have different goals or use different restoration techniques. This accounts for variations in institutions.
Years of Experience (YE)	The experience of the respondents may have influenced how they perceive sustainability reporting and practices. Accounts for the impact of experience and knowledge on survey answers.
Field of Expertise (FE)	Governance and restoration could be viewed differently by experts in corporate management and environmental science. Aids in preventing bias in measures that rely on perception.
Participation in Environmental Projects (PEP)	Evaluation of recovery achievement could be influenced by direct participation. Controls for how survey responses are influenced by first-hand experience.

These control variables also make sure that the relationships between corporate governance and ERO are not confounded by organizational or individual traits.

2.3. Data Analysis

The data obtained was processed through a multi-step statistical process to assess the correlations between corporate governance practices and ecological restoration results, with the variables of organizational and personal attributes held constant.

2.3.1. Descriptive Statistics

The stakeholder demographics, practices of governance, and ERO were analyzed by descriptive statistics. The average level of practice and consistency of responses (\bar{Y}_1) and standard deviation (SD) were estimated to determine how consistent and well-established these measures are across regions.

$$\bar{Y}_1 = \sum_{j=1}^N Y_j, \quad SD = \sqrt{\frac{\sum_{j=1}^N (Y_j - \bar{Y})^2}{N - 1}} \quad (1)$$

Where Y_j is the individual observed value for the j^{th} respondent or region, N is the total number of observations, and $(Y_j - \bar{Y})^2$ is the squared deviation of each observation from the mean. The test determines the mean of the corporate governance practices and ecological restoration results and their consistency, and at which point the responses may be steady or highly volatile.

2.3.2. Reliability Analysis (Cronbach's α)

Reliability test measures the internal consistency of survey instruments. High reliability means that items included in a construct are always used to measure the same underlying concept.

$$\alpha = \frac{1}{l - 1} \left(1 - \frac{\sum \alpha_j^2}{\alpha_{\text{total}}^2} \right) \quad (2)$$

However, where l represents the number of items in the construct, α_j^2 is the variance of item j , and α_{total}^2 is the variance of the cumulative scale. Make sure that question items that measure a construct (Tr, Ac) contain internal consistency, and the responses of the stakeholders can be reliably obtained.

2.3.3. CFA

CFA tests the reliability of observed indicators to measure their latent constructs, Corporate Governance Latent Variables (Tr, Ac, ER, CI), and Ecological Restoration Latent Variables (BR, PR, HR, CP). The expression for the CFA model is:

$$y = \Lambda_y \xi + \delta \quad (3)$$

Where y is the observed variable (ecological indicator), ξ is the latent variable (corporate governance or ecological outcome), Λ_y is the factor loading matrix, which is a measure of the strength of the association between the observed and the latent variable, and δ is the measurement error. This ensured that all the observed variables are an appropriate measure of their respective latent factors to continue for further analysis.

2.3.4. SEM

The test is applied to test the interdependences between independent and dependent latent variables, including measurement error and interdependencies. SEM is appropriately chosen because corporate governance practices and ERO are latent constructs measured by multiple indicators and involve simultaneous estimation of multiple structural relationships. It is calculated using:

$$\eta = A_\eta + \Gamma \xi + \zeta \quad (4)$$

Where η is ERO (dependent latent variable), ξ is Corporate Governance and Stakeholder Engagement factors (Tr, Ac, ER, CSI), Γ is governance and engagement impacts on the restoration outcomes, A_η is outcome dimension relationships, and ζ is the unaccounted variance.

This framework is tested to determine the effects of CSI on ERO and to measure error and latent constructs.

3. Results

The results section provides a summary of statistical tests to prove the measurement reliability and model fit that demonstrates a strong positive correlation between the dimensions of corporate governance and the ERO across regions, which confirms the framework of the proposed study.

3.1. Results of Descriptive Statistics

The central tendency and variability measures of important variables of the corporate governance and ecological restoration results were summarized using descriptive statistics.

tics.

According to the descriptive findings shown in **Table 5** and **Figure 4**, the overall degree of corporate governance engagement and favourable ecological performance of restoration is observed in the surveyed regions.

Table 5. Descriptive Statistics of Corporate Governance Practices and Ecological Restoration Outcomes.

Variable	Mean (M)	Standard Deviation (SD)	Minimum	Maximum	N
Tr	4.21	0.63	2.75	5.00	520
Ac	4.10	0.58	2.60	5.00	520
ER	4.05	0.71	2.40	5.00	520
CSI	3.92	0.69	2.20	5.00	520
BR	4.13	0.65	2.80	5.00	520
PR	4.00	0.74	2.10	5.00	520
HR	3.94	0.70	2.30	5.00	520
CP	4.08	0.68	2.50	5.00	520

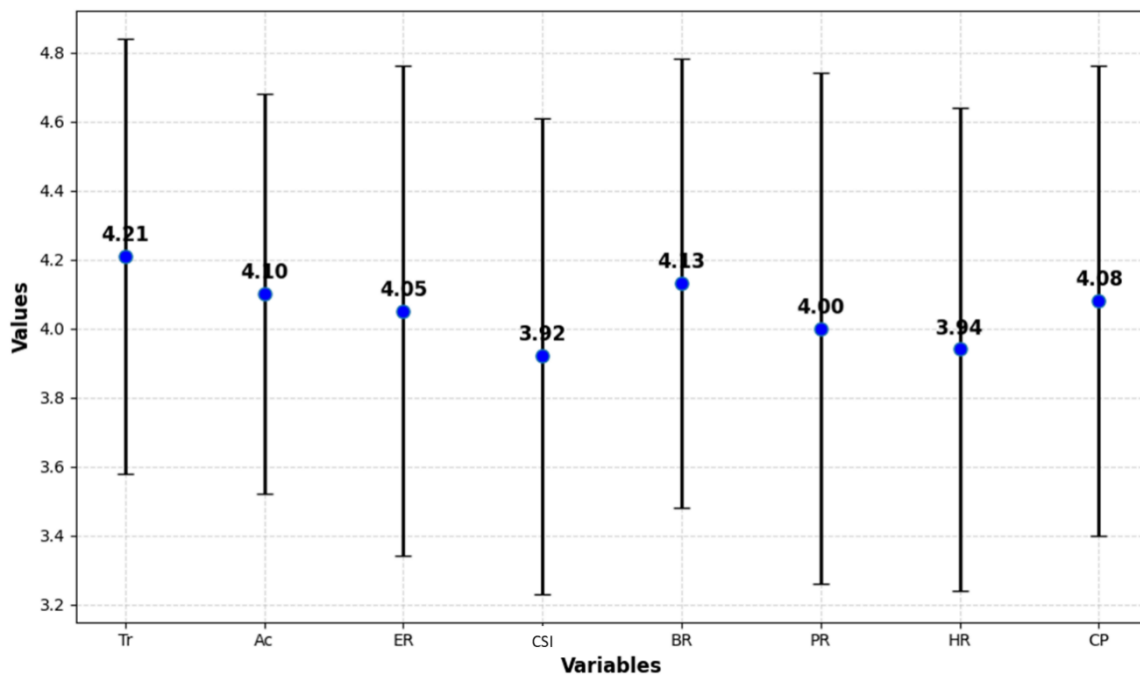


Figure 4. Outcomes of Corporate Governance Practices and Ecological Restoration of Statistics.

Note: Variables: Tr = Transparency, Ac = Accountability, ER = Environmental Responsibility, CSI = Corporate social responsibility and Stakeholder engagement Integration, BR = Biodiversity Recovery, PR = Pollution Reduction, HR = Habitat Recovery, CP = Community Participation.

The mean score was highest in Tr ($M = 4.21$), which indicated that organizations were becoming more open to reporting their environmental activities and governance policies. Ac ($M = 4.10$) and ER ($M = 4.05$) were also high and indicate the increase in awareness of environmental compliance and sustainability responsibility by firms. BR ($M = 4.13$) and CP ($M = 4.08$) also had significant means among the outcomes of restoration, which can be interpreted as the successful ecological interaction and so-

cialization. The variability ($SD = 0.58$ to 0.74) is relatively moderate, which indicates consistency in the level of understanding and implementation between the respondents, with slight differences existing between organizations and regions.

In general, the descriptive analysis proves that the regions engaged have well-developed governance systems and consistent ecological restoration processes, which create a solid foundation for further inferential testing.

3.2. Reliability Test

Internal consistency was determined by the reliability of each construct using Cronbach's Alpha (α). The Alpha (0.7) above 0.8 shows that its reliability is good to excellent. The summarization of the reliability results is given in **Table 6**

The reliability test assures that every survey construct in this research is internally consistent. Tr, ER, and HR

are excellent in their reliability, whereas Ac, CSI, PR, and CP are good in their reliability. These findings (**Figure 5**) demonstrate that the items of the survey are consistent in the measurement of the intended concepts and that the responses of stakeholders offer a valid data source to analyze the outcomes of ecological restoration and corporate governance practices.

Table 6. Reliability Analysis of Corporate Governance.

Variable	No. of Items	Cronbach's Alpha (α)	Reliability Level
Tr	5	0.871	Excellent
Ac	4	0.844	Good
ER	5	0.882	Excellent
CSI	4	0.857	Good
BR	5	0.868	Excellent
PR	4	0.835	Good
HR	5	0.872	Excellent
CP	4	0.848	Good

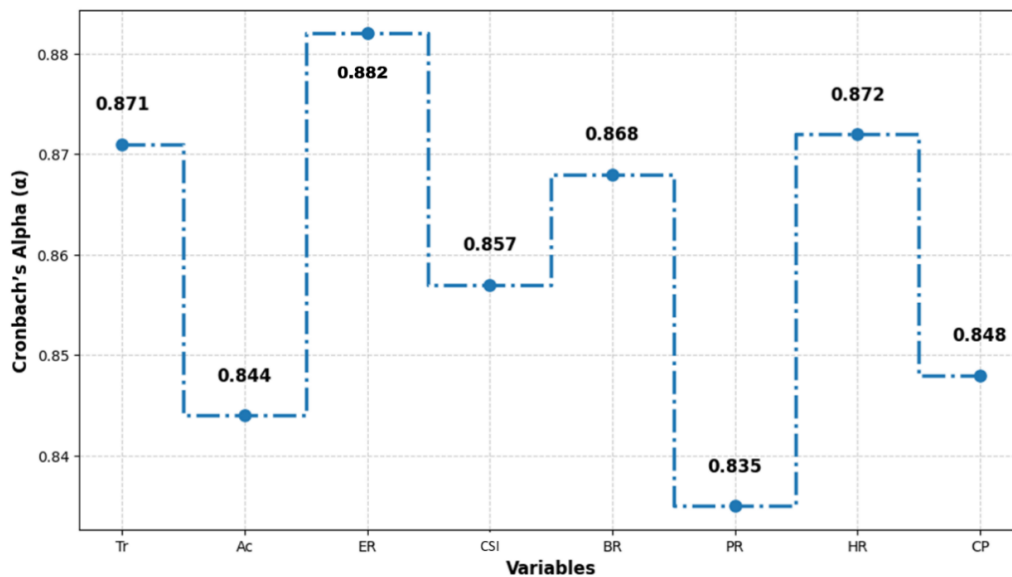


Figure 5. Reliability Distribution Based on Cronbach's Values Across Stakeholder Response.

3.3. Results of CFA

CFA was conducted to confirm the measurement model and determine convergent construct validity. Factor loadings (λ) and Composite Reliability (CR) greater than 0.7, and Average Variance Extracted (AVE) are good signs of validity. **Table 7** represents the CFA results.

The model of measurements of this analysis is confirmed by the CFA results shown in **Figure 6**. The factor loadings

are all above 0.77, meaning that every survey item is a strong indicator of its respective construct. The CR values are between 0.86 and 0.90 and can be used to indicate good internal consistency, whereas AVE values of between 0.60 and 0.68 verify convergent validity. This means that the measures of corporate governance practices constructs (Tr, Ac, ER, CSI) and ERO (BR, PR, HR, CP) are precise enough to be used in further analyses of the connections between corporate governance practices and the ERO.

Table 7. CFA Result for Governance and Restoration Construct.

Construct	Indicator	Factor Loading (λ)	AVE	CR
Tr	Tr1	0.82	0.60	0.88
	Tr2	0.79		
	Tr3	0.77		
	Tr4	0.81		
Ac	Ac1	0.80	0.61	0.87
	Ac2	0.83		
	Ac3	0.78		
ER	ER1	0.84	0.64	0.89
	ER2	0.86		
	ER3	0.80		
CSI	CSI1	0.81	0.63	0.88
	CSI2	0.85		
	CSI3	0.80		
BR	BR1	0.82	0.68	0.90
	BR2	0.86		
	BR3	0.83		
PR	PR1	0.78	0.60	0.86
	PR2	0.81		
	PR3	0.79		
HR	HR1	0.84	0.63	0.88
	HR2	0.86		
	HR3	0.79		
CP	CP1	0.80	0.62	0.87
	CP2	0.82		
	CP3	0.79		

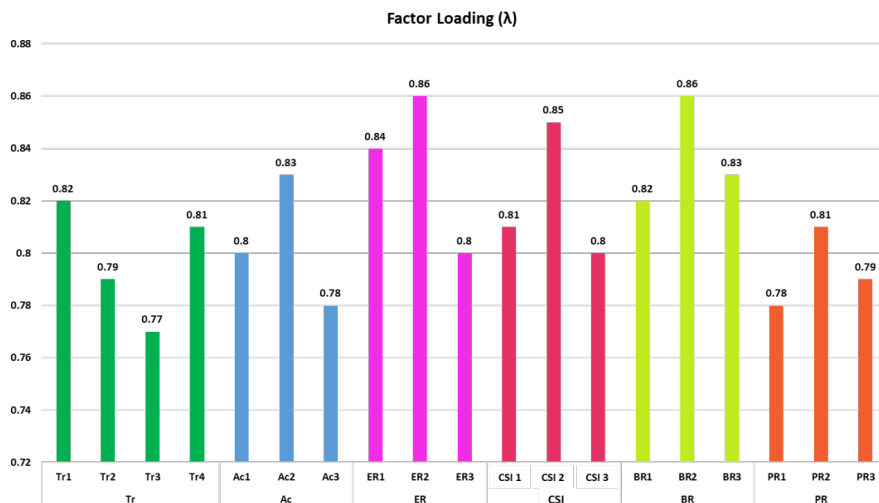


Figure 6. Outcome of Standardized FL and Validated Measurement Model.

3.4. Results of SEM

The SEM analysis confirms that all four independent variables (Tr, Ac, ER, and CSI) significantly and positively influence ERO (BI, PL, HR, and CP).

The SEM analysis proves that the four independent variables (Tr, Ac, ER, and CSI) have a significant, positive impact on the ERO (BI, PL, HR, and CP). According to the SEM analysis, Tr ($p = 0.001$; $\beta = 0.38$) has a positive effect on the restoration outcomes of ecological restorations (Table 8), thus demonstrating that the more

transparent the governance practices of an organization, the higher the performance of the restorations. Likewise, the outcomes of ecological actions are strengthened by Ac ($\beta = 0.35$, $p = 0.001$), and ER ($\beta = 0.41$, $p = 0.001$) has the best positive influence on the restoration outcomes presented in Figure 7, making it clear that collaboration plays a significant role.

The model fit indices point to an excellent model fit; the indices, as presented in Table 9, indicate that the proposed SEM model is a good model that reflects the relationship between corporate governance variables, stakeholder involve-

ment, and ecological restoration successes. This high model fit is a reinforcement of the reliability of the framework in

explaining the positive influence of governance practices in stimulating the performance of ecological restoration.

Table 8. SEM Path Analysis of Governance and Stakeholder Factors on Ecological Restoration Outcomes.

Path	Standard Error (SE)	Estimate (β)	<i>p</i> -Value	<i>t</i> -Value	Significance
H1: Tr → ERO	0.07	0.38	<0.001	5.43	Significant
H2: Ac → ERO	0.08	0.35	<0.001	4.38	Significant
H3: ER → ERO	0.06	0.41	<0.001	6.83	Significant
H4: CSI → ERO	0.07	0.33	<0.001	4.71	Significant

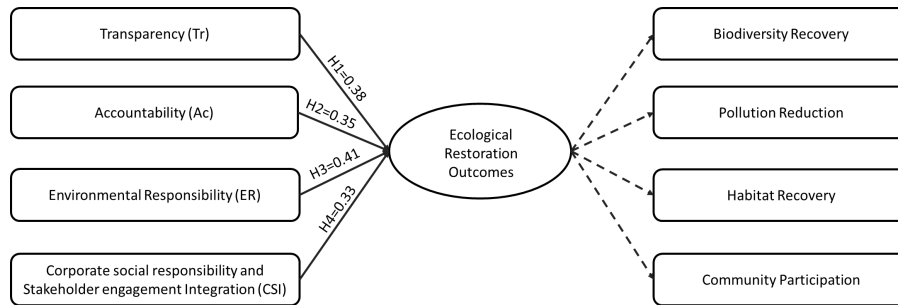


Figure 7. Outcome of SEM Path Analysis of Factors on Ecological Restoration Outcomes.

Table 9. Model Fit Indices.

Fit Index	Value	Recommended Threshold
χ^2/df	1.92	<3
CFI	0.95	>0.90
TLI	0.94	>0.90
RMSEA	0.043	<0.08
SRMR	0.037	<0.08

4. Discussion

The previous research on corporate governance and environmental performance was limited by major shortcomings, including a confined geographical area scope and the lack of variables. As an example, Efunniyi et al. [13] and AlHares [19] analyzed the performance of single countries, which does not allow generalization. This limitation has been critically reviewed by Aguilera et al. [1], who emphasize the urgent need for integrated research designs that move beyond siloed perspectives. Whereas previous research tended to focus on a single aspect of environmental performance. This research bridges those gaps by having a multi-stakeholder, cross-regional design that combines four governance constructs, Tr, Ac, ER, and CSI, with four ERO, BR, PR, HR, and CP.

The results indicate a high level of engagement in governance and a stable performance in ecology CSI and Tr ($M = 3.92$ and 4.21) with a good degree of reliability PR and ER ($\alpha = 0.835$ and 0.882) in proving a high level of inter-

nal consistency. Construct strength is confirmed by CFA results ($FL > 0.77$, $CR = 0.86090$, $AVE = 0.60-0.68$), and the SEM results indicate that all the governance variables have a significant and positive effect on the restoration outcomes ($p < 0.001$). This finding aligns with recent cross-country evidence from Ben Jabeur and Serret [24], which suggests that robust governance mechanisms are essential drivers for superior environmental transparency and outcomes. The strongest influence is placed on ER ($\beta = 0.41$), which highlights proactive environmental practices. Good model fit statistics ($CFI = 0.95$, $RMSEA = 0.043$) validate the framework, which shows that good governance is a leading cause of ecological restoration and sustainability.

Beyond statistical significance, the findings indicate important practical implications for ecological restoration governance. Given the strong influence of ER ($\beta = 0.41$), policymakers should promote regulatory incentives for proactive environmental practices. Corporations can improve restoration outcomes by integrating ER into core operations through sustained investment and best-practice standards, while en-

vironmental agencies should strengthen monitoring systems linking corporate performance to measurable restoration indicators. These results emphasize that effective restoration relies not only on Tr and Ac but on the institutionalization of ER across sectors.

5. Conclusions

The analysis shows that proper incorporation of the principles of corporate governance is directly related to improved ERO. Tr ($\beta = 0.38, p = 0.001$), and ER ($\beta = 0.41, p = 0.001$) both have a significant positive impact on ERO, and Ac ($\beta = 0.35, p = 0.01$), and SE ($\beta = 0.33, p = 0.001$) increase the success of community participation and ecological restoration. The validity of such relationships is supported by the strong model fit (CFI = 0.95, RMSEA = 0.043). These results indicate that companies with an emphasis on responsible governance and the active involvement of the firms perform better in terms of ERO and sustainability. In general, the research strengthens the idea that incorporating open, accountable, and ecologically responsible governance regimes is crucial in the realization of ecological resilience and sustainable development of the region over the long term. The research is, however, constrained to particular regional data and stakeholder groups, which might inhibit generalization. The future directions of the research should focus on cross-country comparisons and longitudinal studies to understand the dynamics of changing governance practices in relation to ecological restoration over time.

Author Contributions

Conceptualization, J.B. and A.A.A.; methodology, K.Z.; software, K.Z.; validation, J.B., A.A.A. and S.M.S.; formal

analysis, K.Z.; investigation, J.B.; resources, J.B. and S.M.S.; data curation, K.Z.; writing—original draft preparation, J.B.; writing—review and editing, K.Z. and A.A.A.; visualization, K.Z.; supervision, S.M.S.; project administration, J.B. and A.A.A.; funding acquisition, A.A.A. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the Accounting School, Nanfang College, Guangzhou (protocol code NFAC-EC-2023-017, date of approval 12 September 2023).

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The datasets generated and/or analyzed during the current study are not publicly available due to institutional and project restrictions, but are available from the corresponding author upon reasonable request. Data access can be obtained by contacting the corresponding author, Kezhen Zhang.

Conflicts of Interest

The authors declare no conflict of interest.

Appendix A

Table A1. Open-Ended Questionnaire.

Construct	Item Code	Questionnaire Item	Response Scale
Transparency (Tr)	Tr1	How openly does your organization report environmental initiatives?	
	Tr2	How clearly are environmental policies and decisions communicated to stakeholders?	
	Tr3	How accurate and accessible is the data on your organization's environmental performance?	
	Tr4	How regularly are stakeholders informed about corporate governance decisions?	

Table A1. Cont.

Construct	Item Code	Questionnaire Item	Response Scale
Accountability (Ac)	Ac1	How responsible is your organization for its environmental impacts?	1 = Not at all, 5 = Very much
	Ac2	How promptly are environmental issues addressed when identified?	
	Ac3	How effectively are policies in place to monitor and report environmental responsibilities?	
Environmental Responsibility (ER)	ER1	How well does your organization implement sustainable environmental practices?	
	ER2	How sufficient are resources allocated for ecological restoration activities?	
	ER3	How extensively do your environmental initiatives go beyond regulatory requirements?	
Corporate Social Responsibility and Stakeholder Engagement Integration (CSI)	CI1	How integrated are environmental objectives into broader CSR programs?	
	CI2	How actively do CSR initiatives involve local communities in restoration projects?	
	CI3	How well does CSR reporting include measurable ecological outcomes?	
Biodiversity Recovery (BR)	BR1	How much have efforts increased species richness in your region?	
	BR2	How much has ecosystem diversity improved over recent years?	
	BR3	How effectively are protected areas managed?	
Pollution Reduction (PR)	PR1	How much have air, water, and soil pollution levels decreased due to initiatives?	
	PR2	How effectively do waste management practices reduce environmental hazards?	
	PR3	How effective are organizational initiatives in controlling pollution?	
Habitat Recovery (HR)	HR1	How effectively have degraded ecosystems been restored?	
	HR2	How successful are reforestation and rehabilitation programs?	
	HR3	How much are wildlife habitats preserved or improved?	
Community Participation (CP)	CP1	How actively do local communities participate in restoration projects?	
	CP2	How much are community members involved in environmental awareness programs?	
	CP3	How much does community input influence restoration planning and implementation?	

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