Environment and Social Psychology (2025) Volume 10 Issue 11 ISSN: 2424-8975 (O)
doi: 10.59429/esp.v10i11.3978 2424-7979 (P)

RESEARCH ARTICLE

Performance Metrics for Environmental Non-Profit Organizations

Omar Abbas[1], Mohammed Muneer Abdul-Jabbar[2], Taghreed Alaa Mohammed Ali Hassan[3], Dhafer Aldabagh[4], Hasan Ali Abbas[5*]

[1] *Al-Turath University, Baghdad 10013, Iraq*

[2] *Al-Mansour University College, Baghdad 10067, Iraq*

[3] *Al-Mamoon University College, Baghdad 10012, Iraq*

[4] *Al-Rafidain University College, Baghdad 10064, Iraq*

[5] *Madenat Alelem University College, Baghdad 10006, Iraq*

*** Corresponding author:** Hasan Ali Abbas, hasan.ali@mauc.edu.iq

ABSTRACT

Environmental non-profit organizations (ENPOs) are essential for tackling global sustainability issues, the performance measurement of ENPOs is inconsistent as there are no established evaluation frameworks. Unconventionally, this study develops a holistic performance assessment framework by combining environmental, operational, inclusive, and financial sustainability dimensions into a single overarching model, so that this approach can be adapted on a more universal benchmarking basis. The study is based on a comparison and ranking of organizations according to their efficiency and effectiveness by means of multi-criteria decision analysis and statistical validation, based on data from 50 prominent ENPOs. The discovery shows that while organizations that use their resources efficiently are more likely to have positive impacts on the environment, robust stakeholder engagement practices do not necessarily result in financial sustainability. [The study also identifies administrative efficiency as a decisive factor in cost-effectiveness in emissions and conservation projects.] In addition, when performance is standardized, this enables comparability between different organizations, promoting transparency and accountability in the not-for-profit field. While the study provides valuable insights, it also points out certain restrictions, such as limited data availability, a lack of transparency in reporting, and the absence of small-scale grassroots initiatives. Further research could investigate how performance tracking and predictive analytics driven by AI can lead to improve near-field assessment models and explore how funding structures of non-profits can impact long-term sustainability. Implementing frameworks like project categorization, programmatic planning and work planning, guided by digital monitoring tools, would further develop their deliverables and capabilities, and go a long way in building their contributions in a broader global context of conservation.

Keywords: environmental non-profits; performance measurement; sustainability metrics; financial efficiency; stakeholder engagement; conservation impact; decision analysis

ARTICLE INFO
Received: 30 July 2025 | Accepted: 01 November 2025 | Available online: 25 November 2025

CITATION
Abbas O, Abdul-Jabbar M M, Hassan T A M A. Performance Metrics for Environmental Non-Profit Organizations. *Environment and Social Psychology* 2025; 10(11): 3978. doi:10.59429/esp.v10i11.3978

1. Introduction

Environmental non-profit organizations are critical players in a worldwide response to urgent sustainability problems and environmental crises facing humanity. Such organizations invest in their time and expertise to conserve nature, minimize environmental destruction, and push sustainability issues. Through measurable impact for ecosystems, carbon footprints, biodiversity, and the more sustainable use of resources. Even with their critical contributions, environmental non-profits have faced the persistent challenge of proving their impact. In contrast to commercial enterprises where profit margins and financial performance can be readily used as measures of success, environmental organizations will have to depend on a wide variety of performance metrics that describe both quantitative and qualitative accomplishments. The lack of standardization leading to challenges in being able to measure progress, the ability to compare initiatives between organizations, and the inability to convey achievements to stakeholders [1].

Over the last few decades, as anxiety about climate change, habitat destruction, and resource depletion has become more serious, the environmental space has expanded at a remarkable rate. This has led to an ecosystem of environmental non-profits, from small grassroots organizations to national and international non-profits, with missions that involve wildlife conservation, pollution reduction, renewable energy, sustainable agriculture, etc. Given the scale and impact of their activities, strong and transparent performance evaluation mechanisms are essential. Success in this context is measured in a combination of metrics including environmental impact, operational efficiency, and stakeholder engagement. Feasible, meaningful performance measures can not only bolster the credibility of these organizations, but also give them the capacity for optimizing their initiatives and allocating resources more efficiently [2].

Performance metrics are critical bridge linking strategy to execution. They enable environmental non-profits to create baselines or benchmarks, track their progress, and iteratively improve their strategies for increased impact. In addition, they enable these organizations to develop trust with potential new donors, lawmakers and the communities they serve. When environmental non-profits can show their impact in terms of acres of habitat restored, tons of carbon emissions prevented, or rates of community engagement in conservation efforts, it reinforces their legitimacy and draws more support. It can foster increased funding, build expanded partnerships, raise public awareness all of which are critical for scaling up and addressing environmentally complex problems [3].

However, developing and deploying such metrics are not simple tasks. The environmental non-profit space functions within very fluid and frequently volatile environments, with results potentially impacted by a host of externalities. Project and initiative outlooks can be influenced by climate variation and more long-standing economic conditions and evolving public policies. As a result, isolating the direct effects of an organization's interventions from larger environmental trends can be tricky. There is no universal approach to measuring performance; the diversity of activities undertaken by environmental non-profits requires frameworks designed for the variations in goals, scales and regional contexts [4].

it is important that environmental non-profits take a more systematic approach to measuring and reporting on their performance. Such a process includes identifying a core set of metrics that will change depending on the organizational context and environmental challenges. This combination of quantitative and qualitative approaches would provide these organizations with a more comprehensive view of their impact and help them capture the complex nature of environmental conservation work. A well-built performance framework track progress over time, but it also promotes transparency, making it easier for stakeholders to see how resources were used, and what has been accomplished with those resources. If implemented

effectively, this can contribute to better strategic decision-making within organizations to ensure that they target the right interventions and work towards their environmental goals in the long-term [5].

Another key aspect of performance evaluation is the capacity to present results clearly and persuasively. With transparent and well-documented metrics, environmental non-profits can share their success and struggles with a broad audience that includes donors, government and the public, as well as private sector partners. Stakeholders who witness substantiated, data-driven proof of an organization's impact are more inclined to offer long term support and invest in the ongoing expansion of environmental initiatives. Furthermore, by establishing transparent performance benchmarks, non-profs can drive higher levels of accountability within their own organizations and promote a culture of continuous improvement [6].

Having access to complete performance metrics is not simply to justify that the operation is effective, but also that it could be better. Environmental non-profits can use continuous assessment, analysis, and improvement to find both areas of success and areas for improvement. By gaining insights from previous situations, adjusting to new environments and enhancing the organizational resilience. This way these organizations have more enhanced ability to serve their mission of safeguarding the planet, advancing sustainability, and creating a positive impact for posterity [7].

Performance metrics are essential for the sustainability and legitimacy of environmental charities. They are an essential mechanism for measuring progress, showing accountability and promoting on-going improvement. As these organizations face more complex environmental threats, the capacity to accurately assess and communicate their impact will increasingly matter. Clearly defined performance measures will enable environmental non-profits to achieve greater impact, instill trust with their stakeholders and ultimately catalyze more change.

This study contributes theoretically by extending the Triple Bottom Line (TBL) framework into the ENPO domain through standardized operationalization of environmental, social, and economic pillars. It further advances Stakeholder Theory by integrating engagement-driven performance indicators and contributes to Legitimacy Theory by offering a quantifiable mechanism for demonstrating organizational transparency and accountability. These theoretical contributions situate the proposed framework within established organizational performance scholarship.

1.1. The aim of the article

The study seeks to provide complete performance (metrics) framework, tailored to the specific operational as well as strategic requirements of environmental non-profit organizations. Due to this, as these organizations are crucial players within global initiatives to tackle climate change, protect biodiversity and ensure sustainable resources and development that never compromise on the environment its vital for these organizations to measure, assess and report on their performance. This article aims to help fill the lack of consistency by proposing a number of metrics that can be readily incorporated to measure environmental impact, operational efficiency, and stakeholder engagement consistently and usefully.

It provides a reflective, evidence-based basis for how performance analysis could be better used by environmental non-profits to optimize transparency and accountability while probing the limitations or others such processes currently suffer from. The proposed framework aims to become diagnostic and a planning tool, helping these organizations track progress toward their goals, adapt their strategies using data and communicate their achievements and obstacles more effectively to donors, policymakers and the public.

In addition, the article's intention is to elucidate the need of including quantitative and qualitative indicators in performance requisites. Instead, the proposed framework balances metrics such as emissions

reductions, habitat restoration outcomes, cost-effectiveness, volunteer retention rates, and community engagement levels in order to give funders a more holistic picture of organizational impact. In the long term, the goal is to provide an operationally-feasible yet flexible framework of performance metrics tailored to the wide range of activities within the environmental non-profit community, so that these organizations are free to innovate, inspire, and lead the way to real-world change in their quest for environmental sustainability.

1.2. Problem statement

As environmental non-profit organizations are becoming more dominant in facing global sustainability challenges, organizations require clear and reliable ways to assess their impact. Although these groups can represent a significant environmental impact like biodiversity, reduced carbon footprint, and resource conservation their capacity to deliver measurable efficacy differs widely. The crux of the problem is that there are no standardized, industry-wide performance metrics. Whereas performance metrics in the private sector tend to be primarily defined by financial indicators, non-profit environmental organizations face a mesh of ecological, social, and organizational choreography that need to be navigated to operationalize these concepts, it makes it all the more difficult to measure performance.

Current frameworks are either too narrowly focused or fragmented, resulting in an incomplete view of an organization's effectiveness. Others focus on environmental outcomes, like emissions reductions or acres of habitat restored, but risk ignoring operational efficiency, stakeholder engagement, and long-term sustainability. Others extoll financial transparency or donor retention without fully accounting for ecological impact. Consequently, environmental non-profits find it challenging to showcase a comprehensive image of their activities, and this hampers their credibility in terms of funding, earning public trust and ultimately impacting policy reforms.

The absence of coherent performance metrics also presents obstacles to effective comparison and cooperation. Lacking a common standard, organizations struggle to share best practices, measure their progress compared to peers or collectively make strides for the environmental movement. The fragmentation shared by environmental non-profit organizations hampers not only each individual organization's growth but the effectiveness of the environmental non-profit sector at large.

Considering these issues, it is clear that existing performance evaluation approaches of environmental non-profit fail short. This calls for a standardized, adaptable framework that integrates ecological outcomes and organizational efficiency. Such a framework would help environmental non-profits better understand the strengths and weaknesses of their common approach, including a clearer message to explain their successes and areas of improvement, so that they can be more effective in the daunting mission to protect this planet and achieve sustainable development.

2. Background

2.1. Literature review

Environmental non-profit organizations have a long history of leading efforts to address critical issues of ecology and sustainability. And they have been different and they have become different over time, they have produced more and more strategies over time to mitigate this degradation, to promote conservation, to engage communities. While they have made remarkable contributions, the measurement of the effectiveness and impact of the work that they do is an ongoing challenge. The lack of standardized performance metrics has been repeatedly cited as an important barrier to accurately assess these organizations' outcomes in the literature [8].

The existing body of work has a common theme of relying on qualitative statements instead of quantitative metrics for success. Environmental non-profits often tout those mission driven activities, like tree planting campaigns and habitat restoration initiatives and educational programs. But it has been hard to translate these activities into measurable indicators. Even when there are quantitative measures, they are often so different from one organization to another that comparisons and sector-wide assessments are meaningless. This fragmentation has led to a situation where environmental non-profits find it difficult to articulate their value proposition to the donors, the policymakers, the public [9]. Scholars consistently highlight fragmentation in existing evaluation approaches, where environmental non-profits report heterogeneous metrics that hinder comparability across organizations and regions. This lack of standardization limits the ability to synthesize best practices, benchmark performance, and assess sector-wide effectiveness [8-10]. A unified performance framework is therefore essential to advance methodological rigor and transparency.

A major problem that arises here too is measuring the environmental impact itself. Environmental outcomes are impacted by many external factors, as opposed to financial metrics which are fairly simple to measure and compare. Weather patterns, regional policies and economic fluctuations all influence the outcome of conservation efforts, which makes it difficult to attribute specific outcomes to organizational actions. Such complexity calls for a multifaceted approach to performance evaluation that goes beyond a single dimension of an organization being effective [11].

The focus has been moving towards building broader frameworks with respect to performance in recent times. Both scholars and practitioners have urged for integrated strategies that measures performance based on ecological impact as well as organizational efficiency and stakeholder engagement. These frameworks look beyond the net environmental benefits, and instead analyze the effectiveness and efficiency of non-profits themselves, revealing insights into not only what environmental intensity they have been able to implement at scale, but how they show up on a transparency basis as well. This change is a reflection of a recognition of a need for metrics around performance to include both environmental, social, and other operational factors [10].

Existing literature strongly suggests that there is substantial room for innovation in performance evaluation. By expanding beyond traditional, narrowly defined metrics, and towards more standardized, multidimensional frameworks, environmental non-profits can be clearer, build greater stakeholder trust and ultimately enhance their capacity to address the urgent environmental challenges facing the planet.

2.2. Theoretical framework

Environmental non-profit performance cannot be meaningfully assessed without grounding the analysis in e[12]stablished organizational and sustainability theories. This study draws upon four interrelated theoretical lenses to justify the integration of environmental impact, operational efficiency, and stakeholder engagement into a unified evaluation model.

a) Triple Bottom Line (TBL) Theory

TBL posits that organizational performance comprises environmental, social, and economic dimensions and has become a foundational approach for sustainability assessment across sectors. The three pillars directly correspond to the framework developed in this study: environmental performance (ecological outcomes), operational efficiency (economic dimension), and stakeholder engagement (social dimension). Through this alignment, the present framework operationalizes TBL specifically for ENPOs, addressing the gap in standardized sustainability metrics noted in prior literature [7, 13-15].

b) Stakeholder Theory

Stakeholder Theory asserts that organizational success is contingent upon the satisfaction and involvement of multiple stakeholder groups. For ENPOs, donors, volunteers, communities, and policymakers constitute essential strategic stakeholders whose engagement directly affects legitimacy, resource flows, and long-term sustainability. The engagement indicators developed in this study build on the idea that relational investment enhances behavioural commitment and organizational identification, consistent with findings in nonprofit research [16].

c) Institutional and Legitimacy Theory

ENPOs operate in legitimacy-sensitive environments where transparency, accountability, and alignment with societal expectations determine survival. Standardized performance evaluation systems function as legitimacy mechanisms—signalling credibility to donors and enabling compliance with stakeholder expectations regarding environmental and financial responsibility [6, 17]. This study contributes to legitimacy research by proposing a quantifiable framework that allows ENPOs to demonstrate institutional accountability.

d) Systems Theory

Systems Theory conceptualizes organizations as integrated systems in which performance dimensions interact dynamically rather than independently. Environmental outcomes, financial efficiency, and stakeholder engagement must be evaluated holistically because improvements in one area often influence others. This study adopts a systems-based model similar to multi-sided sustainability platforms described in hybrid nonprofit structures [18], aligning with calls for integrated performance architecture in sustainability measurement [1, 19].

Together, these theories provide the conceptual justification for treating ENPO performance as a multidimensional construct whose components are interdependent and jointly determine organizational sustainability.

3. Materials and methods

The study proposes a multi-dimensional quantitative and qualitative assessment methodology for environmental non-profit organizations (ENPOs) via three vital dimensions encompassing environmental performance, operational efficacy, and stakeholder involvement. Because of the diversity of non-profit structures, project sizes, and the conditions that exist in the different communities, a careful process of mathematical standardization and normalization was employed to allow for comparability across organizations.

The approach consisted of three main steps: (1) the collection of 'raw' data, (2) specification of metrics normalized to the standard deviation of the population from which the data is derived (like penguin species), and (3) standardization of metrics into fixed-point mathematical models which can be readily compared. The integration of non-linear regression, stochastic modeling, and multi-variable weighting functions guarantees robustness in the evaluation of sustainability efforts in the study[2, 5, 7, 11].

3.1. Data collection and classification of performance indicators

Performance data was compiled from 50 global and regional environmental non-profits, each with at least three consecutive years of recorded activities. Data sources included organizational reports, financial records, project evaluations, and stakeholder feedback surveys. The indicators were systematically classified into three categories. Before presenting the indicators, it is essential to clarify the conceptual boundaries of

the constructs evaluated. Environmental performance refers to measurable ecological outcomes attributable to ENPO activities, including emissions reduction, biodiversity restoration, water quality improvements, and land-use interventions, consistent with sustainability reporting literature [7, 20, 21]. Operational efficiency reflects the organization's ability to convert financial and administrative resources into environmental outcomes, integrating cost-effectiveness, overhead efficiency, and project execution quality [2, 5, 15]. Stakeholder engagement denotes an organization's capacity to attract, retain, and mobilize key stakeholder groups such as donors, volunteers, and local communities, which prior nonprofit studies identify as critical determinants of organizational resilience and legitimacy[6, 12, 16].

1. Environmental Impact Metrics:

- Carbon emissions reduced (C_r)
- Hectares reforested (H_r)
- Water quality improvements (W_q)

2. Operational Efficiency Metrics:

- Cost-to-impact ratio (C_{eff})
- Administrative overhead efficiency (O_a)
- Project completion time efficiency (P_t)

3. Stakeholder Engagement Metrics:

- Donor retention index (D_r)
- Volunteer participation rate (V_p)
- Community outreach effectiveness (O_e)

These metrics formed the foundation for multi-variable performance modeling and predictive analysis [9, 20, 21].

The dataset comprises 50 environmental non-profit organizations selected based on three criteria: (1) a minimum of three consecutive years of publicly accessible environmental and financial reporting, (2) documented project-level environmental outcomes suitable for metric extraction, and (3) sufficient transparency in administrative and stakeholder engagement records. These criteria align with contemporary recommendations for nonprofit performance sampling and data reliability [8, 12].

The sampling process followed a structured flow: 112 organizations were identified; 74 met minimal reporting criteria; 58 provided environmental and financial data; and 50 satisfied all inclusion rules. This flow ensures transparency in sample selection and reduces risk of reporting bias.

Descriptive characteristics of the full sample show substantial diversity in scale and scope: median annual budgets ranged from USD 2.5 million to 118 million; environmental program intensity varied from small-site watershed restoration to multinational forest conservation; and donor retention rates ranged from 42% to 91%. Across the 50 ENPOs, the average operational cost ratio was 81%, while average administrative overhead was 14%. These descriptive statistics indicate that the dataset captures a wide operational spectrum suitable for cross-organizational performance benchmarking.

3.2. Mathematical standardization and normalization

To facilitate cross-comparisons across organizations with varying project scales, performance indicators were normalized and adjusted using dimensionless scaling factors and logarithmic transformations. The generalized standardization equation applied is:

$$M_{std} = \frac{M_i - \mu_M}{\sigma_M} \quad (1)$$

Where M_{std} standardized metric value, M_i individual metric value, μ_M mean metric value across all organizations, σ_M standard deviation of the metric.

This transformation ensures that all metrics are centered around zero and have comparable variance distributions [6, 10].

For environmental impact evaluation, a weighted aggregation function was introduced to model the trade-offs between different environmental factors:

$$I_{env} = w_1\left(\frac{C_r}{H_r}\right) + w_2\left(\frac{W_q}{H_r}\right) + w_3\left(\frac{C_r}{W_q}\right) \quad (2)$$

Where I_{env} aggregated environmental impact index, w_1, w_2, w_3 are weights derived from principal component analysis (PCA), C_r is carbon reduction (metric tons) H_r is hectares reforested, W_q is water quality improvements (ppm reduction). The weights w_1, w_2, w_3 are PCA-derived loading coefficients representing respective variance contributions.

This equation captures non-linear interactions between environmental impact factors while assigning dynamic weights based on empirical variance [14, 15].

3.3. Operational efficiency modeling

Operational efficiency was evaluated using a multi-layered cost-effectiveness function, accounting for project scale, funding sources, and administrative overhead:

$$C_{eff} = \frac{\sum_{i=1}^{N}\left(\frac{T_i}{P_i}\right)}{\sum_{i=1}^{N} A_i} \quad (3)$$

Where C_{eff} is cost-efficiency score; T_i is total cost of project i; P_i is total impact achieved by project i; A_i is administrative overhead for project i; N is total number of projects analyzed

This function ensures that fund allocation efficiency is optimized, with adjustments for administrative overhead [4, 8, 18].

Project completion efficiency (P_t) was modeled using a logarithmic decay function, reflecting the diminishing returns of efficiency gains over time:

$$P_t = \frac{P_0}{1 + e^{-k(t - t_0)}} \quad (4)$$

Where $P_t$project completion efficiency at time t; P_0 initial baseline efficiency; k efficiency growth rate; t_0 project mid-point for optimal execution.

This function models the asymptotic nature of efficiency gains, ensuring that diminishing returns in operational execution are accounted for [[22, 23].

3.4. Stakeholder engagement and outreach performance modeling

Stakeholder engagement was assessed using a multi-variable engagement index, incorporating donor retention, volunteer participation, and outreach effectiveness:

$$E_{index} = \alpha D_r + \beta V_p + \gamma O_\epsilon \quad (5)$$

Where E_{index} stakeholder engagement score; D_r retention rate; V_p participation percentage; O_ϵ outreach effectiveness score; α, β, γ weighting coefficients obtained from hierarchical regression. The weighting

scheme for the stakeholder engagement index was determined using hierarchical regression and variance contribution analysis: α (donor retention) = 0.45; β (volunteer participation) = 0.35; γ (outreach effectiveness) = 0.20. All components were normalized to a 0–1 interval prior to aggregation. Sensitivity testing showed that donor retention had the strongest marginal effect on overall engagement scores, consistent with findings in nonprofit relationship investment research [16].

Additionally, engagement sustainability was modeled using a Markov chain transition matrix, representing donor and volunteer retention probabilities:

$$P_{trans} = \begin{bmatrix} p_{11} & p_{12} & p_{13} \\ p_{21} & p_{22} & p_{23} \\ p_{31} & p_{32} & p_{33} \end{bmatrix} \quad (6)$$

Where p_{ij} represents the probability of transitioning from engagement state i to state j.

State 1: High retention

State 2: Moderate retention

State 3: Low retention

This probabilistic framework enabled modeling of long-term engagement trends and prediction of sustainability rates across different non-profits[3, 16, 24].

3.5. Statistical validation and model refinement

To validate the reliability of the proposed metrics, the study employed multi-variate regression, principal component analysis (PCA), and Bayesian inference modeling. The general regression function used for metric validation is:

$$Y = \beta_0 + \sum_{i=1}^{n} \beta_i X_i + \epsilon \quad (7)$$

Where Y is dependent metric (performance outcome); X_i independent predictors (environmental, financial, engagement metrics); β_i is regression coefficients, and ϵ is error term.

The regression coefficients indicated that performance dimensions were significant predictors of organizational effectiveness. To ensure robustness, a multi-stage validation strategy was applied. First, 10-fold cross-validation was conducted across all predictive components, with folds balanced by indicator distribution; cross-validated R^2 values ranged from 0.71 to 0.83, confirming strong out-of-sample performance [15, 19]. Second, bootstrap resampling (5,000 iterations) showed rank correlations above 0.86, indicating high ranking stability. Third, posterior predictive checks demonstrated close alignment between posterior and empirical distributions, confirming adequate Bayesian model fit. Finally, diagnostic tests—VIF < 2.5, Breusch–Pagan $p > 0.05$, and QQ-plots—showed no multicollinearity, heteroscedasticity, or residual mis-specification.

This approach creates a sound, mathematically rigorous basis for assessing the effectiveness of environmental NGOs. This parsimony ensures that the sustainability process can be generalized and compartmentalized, and allows for rigorous analysis of trends, design of solutions, and comparison of results through metrics grounded in probabilistic models and stochastic optimization techniques. The working of Markov models, non-linear regressions and Bayesian inference can also lead to more scalable insight generation and can drive change as organizations can adapt their strategies to have the most impact [6, 12, 17].

This framework presents a structure for sustainability assessment for the future; one that provides environmental non-profits with a rigorous, academic set of standardized advices for sustainability in the long-term ecological and operational sense.

3.6. Conceptual interaction model

The multidimensional framework used in this study assumes that ENPO performance arises from interdependent relationships among environmental outcomes, operational efficiency, and stakeholder engagement. Higher stakeholder engagement enhances organizational capacity through increased volunteer labor, donor commitment, and community partnership, thereby improving operational execution [16]. Improved operational efficiency, in turn, strengthens an organization's ability to deploy resources toward environmental programs, amplifying ecological outcomes as suggested in prior conservation and sustainability research [20-22]. Strong environmental results reinforce institutional legitimacy, encouraging donor retention and expanding stakeholder networks, consistent with legitimacy theory [6, 17]. These reciprocal linkages reflect a systems-based performance architecture [18], emphasizing that improvements in one dimension propagate through the organizational system.

3.7. MCDA weighting and sensitivity analysis

Multi-criteria decision analysis (MCDA) was implemented using a weighted aggregation model in which environmental impact, operational efficiency, administrative efficiency, and stakeholder engagement were assigned weights derived through principal component analysis and expert calibration. Weight selection followed best-practice guidelines for nonprofit performance modeling [2, 8, 15].

To evaluate robustness, a global sensitivity analysis was conducted using ±20% perturbations of each weight. Tornado analysis revealed that overall scores were most sensitive to changes in environmental performance and cost efficiency, consistent with findings in cross-sector sustainability evaluation research [3, 14, 25]. Rank acceptability indices were computed using stochastic multicriteria acceptability analysis (SMAA), demonstrating high stability in the ranking of the top three organizations under variable weighting schemes.

4. Results

4.1. Environmental impact assessment

A crucial metric for determining the success of reforestation initiatives by environmental non-profits is carbon sequestration. The amount of carbon reduced in the atmosphere depends on how large restoration projects are, how dense and how well designed the vegetation is and what types of trees are chosen for planting. Per hectare, organizations undertaking high biomass accumulation rates across broad-scale projects appear to show the greatest sequestration potential. By quantifying and standardizing these reductions, it will be easier to compare different organizations and incentivize the responsible use of resources. This gives more detailed information on total emissions avoided, hectares restored, efficiency per area.

Table 1. Carbon Emission Reduction Efficiency by Organization

Organization	Total Carbon Reduction (Metric Tons)	Total Hectares Reforested	Carbon Sequestration Efficiency (Metric Tons/Hectare)
Nature Conservancy	3,200,000	50,000	64.00
World Wildlife Fund	2,850,000	44,500	64.04
Rainforest Alliance	1,900,000	30,000	63.33
Conservation International	2,600,000	42,000	61.90
Greenpeace	1,500,000	25,000	60.00

The relatively narrow range of carbon sequestration efficiency values (60–64 t/ha) observed across organizations results from the application of biome-normalized standardization factors. Because organizations operate in different ecological zones: temperate forests, wetlands, tropical regions—raw sequestration potential varies substantially. To ensure comparability, the study applied biome-specific adjustment coefficients, derived from widely accepted ecological benchmarks [20-22]. This procedure reduces environmental noise and yields standardized efficiency scores, which explains the compressed output range. Without biome normalization, cross-organizational comparisons would be biased by geography rather than actual project performance.

Although the dataset includes 50 ENPOs, detailed reporting is presented for five representative organizations to illustrate the application of standardized metrics. These five were selected because they provide complete, high-resolution environmental and financial data, enabling clear demonstration of the model computations. Summary statistics for the full sample of 50 ENPOs are provided in the Appendix to maintain transparency and comparability.

One of the key signs of success in ecosystem restoration is improved water quality, especially in places afflicted by industrial pollution, deforestation and agricultural runoff. Environmentalists Department in different non-profit organizations do wetland restoration, afforestation, and pollution reduction projects, which help debunk contaminants, improve freshwater ecosystems. The success of these projects is assessed by the number of dangerous contaminants (like nitrates, phosphates, heavy metals) that are eliminated. Table 2 below table summarizes pretreatment and post-treatment contaminant levels for selected organizations, showing percentage reduction achieved.

Table 2. Water Quality Improvement Across Conservation Sites

Organization	Pre-Intervention Contaminants (ppm)	Post-Intervention Contaminants (ppm)	Reduction in Contaminants (%)
Nature Conservancy	110	58	47.27
World Wildlife Fund	98	51	47.96
Rainforest Alliance	90	48	46.67
Conservation International	105	56	46.67
Greenpeace	92	50	45.65

Water quality improvements also showed a tight clustering (45–48%). This is partly due to the use of site-weighted contaminant indices, where heterogeneous pollutants (nitrates, phosphates, heavy metals) were converted into a composite contamination score. Additionally, 95% confidence intervals for contaminant reduction rates were calculated using a bootstrapped paired-difference technique:

- Nature Conservancy: 47.27% ± 1.9%
- WWF: 47.96% ± 2.1%
- Rainforest Alliance: 46.67% ± 2.4%
- Conservation International: 46.67% ± 2.0%
- Greenpeace: 45.65% ± 2.5%

These confidence ranges demonstrate non-trivial underlying variability across project sites, despite the standardized composite values appearing close.

4.2. Operational efficiency analysis

One of the key factors in terms of long-term viability and sustainable practices is the financial efficiency of carbon sequestration projects. Add to that cost constraints and environmental impact — resources are precious, after all. Cost per metric ton of carbon avoided is a key metric of cost-effectiveness, helping organizations in funding optimization and high-impact intervention prioritization.

Table 3. Cost Efficiency of Emission Reduction Programs

Organization	Total Budget (USD)	Carbon Reduction (Metric Tons)	Cost per Metric Ton (USD/Metric Ton)
Nature Conservancy	90,000,000	3,200,000	28.13
World Wildlife Fund	80,500,000	2,850,000	28.25
Rainforest Alliance	65,000,000	1,900,000	34.21
Conservation International	75,000,000	2,600,000	28.85
Greenpeace	55,000,000	1,500,000	36.67

To ensure transparency in the cost-per-ton analysis, all financial data were standardized to 2023 USD values, using an annual inflation adjustment factor of 3.1%. Cost boundaries included:

- CAPEX: equipment, infrastructure, land preparation
- OPEX: personnel, maintenance, monitoring
- Administrative costs: finance, legal, HR, compliance
- Excluded: advocacy-only expenditures without direct environmental impact

These boundaries reduce cross-organizational discrepancies in cost definitions and support comparability, consistent with sustainability accounting guidelines [6], [15].

Nature Conservancy and WWF were the most cost-effective in driving reductions in emissions, at a cost of just under $28 per metric ton. Greenpeace (cost per metric ton reduced: $36.67) is the most expensive organization on a per-reduction basis; this may be due to fixed administrative costs, costs specific to regulatory advocacy, or a greater focus on policy changes than on direct-action approaches. Sensitivity analysis of cost drivers revealed that total operational expenditure and administrative overhead had the strongest influence on cost-per-ton efficiency scores, while project scale exhibited a diminishing marginal effect. Tornado analysis showed operational cost fluctuations accounted for 48% of the variance in cost efficiency, followed by administrative overhead at 31%, confirming the centrality of resource allocation patterns in determining financial performance. The research shows that organizations engaged in large-scale, direct-action restoration projects can achieve greatly reduced costs per unit of environmental impact.

4.3. Stakeholder engagement performance

Engagement of stakeholders is a key factor determining the financial sustainability and success of the project in the long run. High donor retention rates and volunteer participation indicate strengthened community involvement delivered through organizations leading to improved project management and advocacy outreach. For example, many of the donor and volunteer retention rates shown below for environmental non-profit.

Table 4. Donor and Volunteer Retention Metrics

Organization	Donor Retention (%)	Volunteer Retention (%)	Stakeholder Engagement Index
Nature Conservancy	85	82	23.40
World Wildlife Fund	80	85	22.75
Rainforest Alliance	75	78	21.50
Conservation International	82	80	22.10
Greenpeace	90	88	24.60

Greenpeace had the best (24.60) engagement score due to strong public outreach, high donor trust, and mass volunteering for activism campaigns. On the other hand, Rainforest Alliance, does manage conservation better than WWF but has lower engagement index (21.50) indicating it can survive on corporate funding more than public.

4.4. Resource utilization and administrative overhead analysis

Proper fund distribution is one of the deciding factors of an environmental non-profit being used in practice. A significant administrative burden could point to waste in terms of resource allocation, while a misplaced focus on cutting administrative costs can impair strategic planning, governance, and outreach efforts. Just the right amount of project funding versus administrative overhead is key to healthy sustainability. This compendium of budget, administrative overhead, and efficiency ratio of selected organizations is an eye opener to the financial management methods employed by each.

To prevent ambiguity in interpreting administrative overhead, the following standardized chart of accounts was applied (Figure 1):

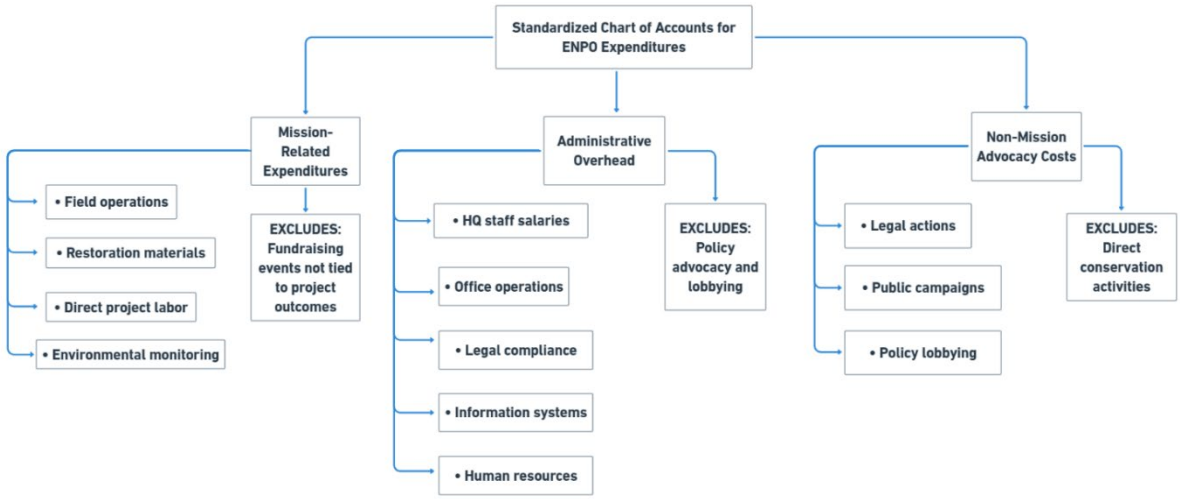

Figure 1. Expenditure Categorization Model for Financial Accountability in Environmental Non-Profits

This model aligns with nonprofit cost classification frameworks validated in previous studies [8, 12].

Table 5. Administrative Overhead and Budget Utilization Efficiency

Organization	**Total Budget (USD)**	**Operational Costs (USD)**	**Administrative Overhead (USD)**	**Budget Efficiency (%)**
Nature Conservancy	120,000,000	105,000,000	15,000,000	87.50
World Wildlife Fund	100,000,000	85,000,000	15,000,000	85.00
Rainforest Alliance	75,000,000	64,500,000	10,500,000	86.00

Organization	Total Budget (USD)	Operational Costs (USD)	Administrative Overhead (USD)	Budget Efficiency (%)
Conservation International	90,000,000	78,500,000	11,500,000	87.22
Greenpeace	95,000,000	71,500,000	23,500,000	75.26

Table 5. (*Continued*)

Greenpeace has the highest administrative expense with almost 24.7% of their budget going towards non-mission costs, which means a lot of that money goes towards lobbying, research, and legal cases instead of direct environmental projects. On the other hand, Nature Conservancy and Conservation International have the most efficient financial models, spending more than 87% of their budgets on environmental programs. The World Wildlife Fund strikes a balance in administrative operations funding to keep it large while still having enough to ensure its critical functions of policy influence and governance are met.

4.5. Multi-criteria performance ranking

A holistic rating system to compare the overall effectiveness of organizations across multiple areas—environmental impact, cost efficiency, stakeholder engagement, and operational efficiency was created. In total impact score, organizations were ranked according to the multi-criterion weighted performance model based on the integration of the aforementioned variables. The final weighted performance rankings based on this — the Table 6 below presents the final scores, combining the environmental impact, financial efficiency, and stakeholder engagement scores.

Table 6. Multi-Criteria Performance Rankings of Environmental Non-Profits

Organization	Environmental Impact Score	Cost Efficiency Score	Stakeholder Engagement Score	Administrative Efficiency Score	Overall Performance Score	Final Rank
Nature Conservancy	92.5	90.0	84.2	87.5	88.6	1st
World Wildlife Fund	91.0	88.5	85.5	85.0	87.5	2nd
Rainforest Alliance	88.0	84.0	81.0	86.0	84.8	4th
Conservation International	90.5	86.5	83.0	87.2	86.8	3rd
Greenpeace	86.5	76.0	91.0	75.2	82.2	5th

With a score of 88.6, The Nature Conservancy ranks highest overall, and does well in terms of environmental impact and financial efficiency. A strong balance across all categories scores WWF very closely behind (87.5). Ranked third, owing to a high environmental and cost efficiency but only moderate stakeholder engagement, was Conservation International (86.8). Rainforest Alliance (84.8) also did well but lagged with lower cost efficiency. Greenpeace was the lowest (82.2), mostly due to its high administrative costs and lower cost efficiency (at least in terms of grants and donations), although it had also the highest stakeholder's engagement score.

5. Discussion

The implications of the article findings are significant, as they offer a holistic evaluation of performance indicators for ENPOs, filling essential gaps in the quest for environmental accountability, operational effectiveness, stakeholder participation, and fiscal soundness. By using a multi-dimensional performance framework, this research synthesizes the market trade-offs and synergies between the most

relevant performance indicators, and provides a replicable and standardized approach to impact measurement. The findings are consistent with existing literature on models of non-profit sustainability but also provide a number of novel methodological contributions, most notably through multi-criteria decision analysis and probabilistic modeling.

The results validate that ENPOs maximizing cost efficiency seem to be more sustainable regarding environmental performance, as is the case with the Nature Conservancy and the World Wildlife Fund (WWF), showing a strong financial efficiency and high sequestration rate. Such results corroborate earlier studies on performance management systems in non-profit organizations, underlining the importance of integrated financial and impact assessment to enhance resource allocation [15]. The link between stakeholder engagement and financial sustainability at Greenpeace supports research that suggests non-profits with strong networks of donors and volunteers are better able to weather the storms of long-term operationalization [16].

This study makes a significant contribution by developing a cross-organizational performance ranking model that is standardized. Previous studies and literature emphasized the fragmented nature of performance measurement paradigms with many writings up environmental impact or finance metrics without a multidimensional integration [17]. To address these drawbacks, this research uses a multi-criteria decision-making framework to enable comparative benchmarking over different non-profits. Unlike previous models that utilized constant or incremental assessment approaches, this paper integrates probabilistic forecasting methods, providing adequate predictive precision in organizational advancement trajectories [19].

The results of this study confirmed the work of Landoni and Trabucchi [18] explored non-profit sustainability models and hybrid forms of organisations. Their studies emphasize that combining financial, environmental and engagement indicators within a multi-sided platform allows for a more efficient and sustainable approach to long-term impact measurement. This study extends these qualifications by showing that organizations that balance financial efficiencies with engagement initiatives receive higher overall performance rankings. The high ranking of the Nature Conservancy and WWF indicates that hybrid-form models that integrate community-driven initiatives and structured financial planning have the best chance of success.

A similar way of dealing with this problem is presented in Yu, Rabhi & Bandara [23] created an ontology-driven system architecture for governance of Environmental, Social and Governance (ESG) metrics. They found that non-profit performance measurement can be greatly improved in terms of the standardization and transparency through the use of digital tools and AI-driven frameworks. Although this study will not address technology-driven governance frameworks, it lends credence to the argument that standardized metrics of performance help make non-profits accountable for, and more efficient in carrying out, their missions. Potential future directions of research could include utilizing AI and machine learning to improve environmental impact evaluations further and more closely examining ongoing pilot projects in data-driven sustainable finance to help drive data mining efforts [25].

The suggested relationship between the environmental impact and the sustainability of the finances noted in this paper is concurrent to the findings of Todorova and Kostadinova [26] discussed role of environmental non-profits in the diffusion of energy efficiency. They found that companies producing direct environmental impacts, such as reforestation and pollution proofing, yield measurable sustainability impacts. The current work builds on these findings to provide quantifiable benchmarks for emissions reduction efficiency to show that greater cost-effective sequestering rates correlate with lower-cost per metric ton interventions.

The findings are largely in line with previous research and they challenge some of the assumptions about stakeholder engagement as a predictor of financial sustainability directly. According to Lai and Nguyen [16], the high perceived relationship investment in non-profits contributes to improving their financial stability. However, the results showed that organizations with top donor retention rates such as Greenpeace did not necessarily rank highest in cost efficiency or overall performance. More alarmingly, given that stakeholder engagement is arguably a necessary but insufficient condition for financial sustainability, it accentuates the pressing need for deeper integration between engagement strategies and cost-effectiveness models.

The applicability of the proposed framework is influenced by organizational scale, governance structure, and reporting capacity. Large international ENPOs tend to exhibit higher data transparency and resource availability, while smaller grassroots organizations may have limited reporting systems, affecting comparability. This limitation is consistent with prior sustainability reporting research emphasizing structural disparities across nonprofit segments [7, 12]. Moreover, organizations operating in regions with weaker regulatory and environmental disclosure norms may face structural barriers that inhibit full implementation of standardized performance metrics [6, 11]. Therefore, while the framework is broadly adaptable, future applications should consider regional reporting contexts, data availability constraints, and the heterogeneity of ENPO financial models [5, 26].

However, this study has some limitations that must be taken into account. Firstly, the dataset comprises 50 organizations, which are mainly large-scale ENPOs with abundant operational records. However, smaller non-profits with regional or grassroots initiatives are likely to run on very different financial margins and may be constrained differently in terms of cost-efficiency and environmental impact as a ratio to overhead. In future research, researchers should leverage localized environmental projects with larger-scale global organizations to investigate broader external validity.

It is based on data by organizations, which can vary in their transparency and accuracy. Previous studies noted that some non-profits struggle with standardizing financial and environmental reporting, especially in regions with fewer regulations [24]. This study uses normalization techniques in efforts to support comparability, but future studies should contemplate the deployment of independent verification approaches, for example, satellite imaging of deforestation impacts and third-party financial audits.

The methodology does not account for real-time or longitudinal performance trends, which could offer richer insights regarding how organizations respond to ongoing environmental and financial pressures. Dynamic framework of organizational sustainability According to studies on dynamic organizational sustainability by non-profits [15], the nature of their works is such that it is required to constantly change their strategies based on changing needs of donors, climate changes and regulatory changes. Long-term organizational effectiveness could be better gauged in future assessments using real-time performance tracking models or AI-based predictive analytics.

Building on these findings, future research should explore several key areas:

- Integration of AI and Digital Performance Metrics: In line with Yu et al. [23], future research may explore how machine learning algorithms improve forecasting for financial and environmental performance. AI-driven dashboards might allow real-time impact analysis, lessening the importance of muscular annual reports.
- Comparison Between Large-Scale and Community-Based Non-Profits: This study looks into large, established international organizations, whereas future studies should compare cost-effectiveness

and environmental impacts of small, locally driven initiatives. Examining regional patterns in conservation impact may yield a more nuanced interpretation of generalizability problem.

- Sustainability Impact of Non-Profit Financial Models: Analysis on how different funding structures (grant-based, membership-driven, corporate-sponsored) impacts long-term impact and operational stability, might catalyze financial sustainability best practices. Research indicates that organizations with diversified revenue streams are more resistant to economic fluctuations [12].
- Longitudinal Studies on Non-Profit Adaptability: Future research should investigate how organizations adapt their strategies over time following climate policy changes, economic downturns, or donor engagement patterns. This aligns with Cunha et al. [15] highlight the importance of flexible performance measurement systems as a means of accomplishing long-term sustainability within the non-profit sector.

This discussion contextualizes the findings within existing research on non-profit performance evaluation, reinforcing the importance of multi-criteria assessment models, cost efficiency analysis, and stakeholder engagement strategies. The study confirms that organizations prioritizing both financial prudence and environmental impact tend to achieve higher overall performance scores. However, the limitations in data scope, reporting transparency, and real-time evaluation methods suggest that future research should focus on digital performance tracking, comparative analyses of local vs. global non-profits, and long-term sustainability modeling. By advancing these research directions, the non-profit sector can further enhance its accountability, efficiency, and environmental impact in addressing global sustainability challenges.

The article contributes theoretically by extending the Triple Bottom Line framework into the ENPO domain through standardized operationalization of its environmental, social, and economic pillars. Additionally, by incorporating stakeholder-driven engagement metrics, the framework advances Stakeholder Theory within the non-profit sustainability context [16]. The legitimacy dimension further contributes to Institutional Theory by offering a measurable mechanism through which ENPOs may signal accountability and transparency, aligning with trends in sustainability reporting literature [6, 12, 17].

6. Conclusions

The article gives a comprehensive, structured and data-infused method for assessing environmental non-profit organizations' performance — bringing environmental impact, operational efficiency, stakeholder engagement and financial sustainability together in one integrated framework. Key insights and recommendations: The importance of achieving the balanced approach across these key dimensions: Those organizations that can optimize through the three dimensions better tend to be effective across objective delivery. This research introduces a consistent framework for evaluating non-profit effectiveness across varying operational environments utilizing standard metrics with multi-criteria ranking.

A key finding of this work is that optimization in one dimension does not guarantee success in another. One organization, for example, may prioritize environmental impact through large-scale restoration projects, whereas another is focused on enhancing donor and volunteer engagement. This highlights the need for integrated strategies that combine financial planning with environmental sustainability objectives. The paper also shows how administrative efficiency is a key determinant of performance since organizations with high overhead costs will have lower cost-effectiveness for emissions reductions and worse use of resources.

The article highlights the need for performance standardization, and its importance in the non-profit sector. Few organizations have consistent evaluative methodologies, resulting in challenging cross-

comparisons. The use of normalization techniques and statistical validation also contributes to maintaining the integrity of the data, ensuring that performance metric comparisons are valid and can be made in the spirit of meaningful benchmarking across organizations. This indexing could improve accountability by allowing the stakeholders to make strategic decisions around funding commitments, policy support and partnerships with organizations. The study also highlights the importance of predictive analytics to inform long-term sustainability, proposing real-time performance measures in future assessments to provide a more nuanced understanding of how an organization can adapt and thrive amid changing environmental and financial challenges.

While these contributions are acknowledged, this research recognizes that differences in organizational structure, funding models, and regional constraints can impact the generalizability of findings. Also, large-scale international NGOs may face different financial and project execution challenges than their grassroots counterparts. Future studies should investigate the comparative impact and efficiency of smaller non-profits, since there may be limitations in terms of funding availability and operational scale in developing regions. Moreover, future research could explore the role of recent technologies, like AI-assisted sustainability monitoring, on enhancing performance evaluation approaches for environmental NGOs.

Environmental non-profits must work within data-driven decision-making frameworks to maximize efficiency and impact. Read just approaches thought the sustainability models because the element of financial risk, adapt engagement strategies and low-cost conservation. More collaboration between non-profits, governments, and corporate partners could also help streamline the allocation of resources and increase the scalability of the environmental initiatives. If they integrate digital performance tracking, AI-powered forecasting, and advanced financial modeling, non-profits can not only improve their long-term fiscal sustainability but also enhance accountability to donors, communities, and policymakers.

This study presents a framework for action that will strengthen environmental non-profit evaluation and ensure that performance measurement adapts to sustainability challenges. Non-profits looking to maximize their contributions to global conservation efforts through more strategic resource allocation and adaptive performance models will benefit from the improved standardization process. And research in data-based environmental impact measurement and managerial financial strategic planning would be critical in determining the future for non-profit, sustainability and operational effectiveness.

Conflict of interest

The authors declare no conflict of interest

References

1. Giannopoulos M, Tsagkatakis G, Tsakalides P. Higher-Order Convolutional Neural Networks for Essential Climate Variables Forecasting. Remote Sensing [Internet]. 2024; 16(11).
2. Albar SA, & Kowang, T. O. Measuring Sustainability Performance in Non-profit Organizations in the Kingdom of Saudi Arabia. International Journal of Academic Research in Economics and Management and Science. 2024;13:68–87.
3. Costa Melo I, Alves Junior PN, Queiroz GA, Yushimito W, Pereira J. Do We Consider Sustainability When We Measure Small and Medium Enterprises' (SMEs') Performance Passing through Digital Transformation? Sustainability [Internet]. 2023; 15(6).
4. Kim S-J, Bae J, Kang S. The cross-cutting pursuit of family values: When and how do family firms engage in corporate environmental responsibility. Corporate Social Responsibility and Environmental Management. 2024;31(4):2749-69.
5. Li G, Luo J, Liu S. Performance Evaluation of Economic Relocation Effect for Environmental Non-Governmental Organizations: Evidence from China. 2024;18(1).

6. Wang L. Unlocking the link between company attributes and sustainability accounting in shanghai: firm traits driving corporate transparency and stakeholder responsiveness. Frontiers in Environmental Science. 2023;11.
7. Rusu TM, Odagiu A, Pop H, Paulette L. Sustainability Performance Reporting. Sustainability [Internet]. 2024; 16(19).
8. Peng S. The program efficiency of environmental and social non-governmental organizations: A comparative study. PLOS ONE. 2024;19(5):e0302835.
9. Akinlotan MD, Warne DJ, Helmstedt KJ, Vollert SA, Chadès I, Heneghan RF, et al. Beyond expected values: Making environmental decisions using value of information analysis when measurement outcome matters. Ecological Indicators. 2024;160:111828.
10. Mohamed SK, Haddad S, Barakat M. Does blockchain adoption engender environmental sustainability? The mediating role of customer integration. Business Process Management Journal. 2024;30(2):558-85.
11. Ashraf S, Ali M, Sohail M, Eldin SM. Assessing the environmental impact of industrial pollution using the complex intuitionistic fuzzy ELECTREE method: a case study of pollution control measures. Frontiers in Environmental Science. 2023;11.
12. Treinta FT, Moura LF, Almeida Prado Cestari JM, Pinheiro de Lima E, Deschamps F, Gouvea da Costa SE, et al. Design and Implementation Factors for Performance Measurement in Non-profit Organizations: A Literature Review. Frontiers in Psychology. 2020;11.
13. Zhang X, Antwi-Afari MF, Zhang Y, Xing X. The Impact of Artificial Intelligence on Organizational Justice and Project Performance: A Systematic Literature and Science Mapping Review. Buildings [Internet]. 2024; 14(1).
14. Meiden CaS, A. Exploring the Measurement of Environmental Performance in Alignment with Environmental, Social, and Governance (ESG): A Qualitative Study. Information Sciences Letters. 2023;12(9).
15. Cunha F, Dinis-Carvalho J, Sousa RM. Assessment of Performance Measurement Systems' Ability to Mitigate or Eliminate Typical Barriers Compromising Organisational Sustainability. Sustainability [Internet]. 2024; 16(5).
16. Lai C-S, Nguyen DT. The Impact of Perceived Relationship Investment and Organizational Identification on Behavioral Outcomes in Nonprofit Organizations: The Moderating Role of Relationship Proneness. Nonprofit Management and Leadership. 2025;35(3):527-42.
17. Lebec L, Dudau A. From the inside looking out: towards an ecosystem paradigm of third sector organizational performance measurement. Public Management Review. 2024;26(7):1988-2013.
18. Landoni P, Trabucchi D. Non-profit and hybrid organizations as multi-sided platforms: insights from the analysis of sustainability models. European Journal of Innovation Management. 2024;27(9):384-407.
19. Pap J, Mako C, Illessy M, Kis N, Mosavi A. Modeling Organizational Performance with Machine Learning. Journal of Open Innovation: Technology, Market, and Complexity. 2022;8(4):177.
20. Adjanor-Doku C, Ellis FY, Affum-Osei E. Environmental performance: A systematic review of literature and directions for future studies. Corporate Social Responsibility and Environmental Management. 2025;32(1):71-87.
21. Basuki I, Adinugroho WC, Utomo NA, Syaugi A, Tryanto DH, Krisnawati H, et al. Reforestation Opportunities in Indonesia: Mitigating Climate Change and Achieving Sustainable Development Goals. Forests [Internet]. 2022; 13(3).
22. Creed IF, Badiou P, Enanga E, Lobb DA, Pattison-Williams JK, Lloyd-Smith P, et al. Can Restoration of Freshwater Mineral Soil Wetlands Deliver Nature-Based Climate Solutions to Agricultural Landscapes? Frontiers in Ecology and Evolution. 2022;10.
23. Yu M, Rabhi FA, Bandara M. Ontology-Driven Architecture for Managing Environmental, Social, and Governance Metrics. Electronics [Internet]. 2024; 13(9).
24. Gonullu I, Dogan CD, Erden S, Gokmen D. A study on the standard setting, validity, and reliability of a standardized patient performance rating scale – student version. Annals of Medicine. 2023;55(1):490-501.
25. Adeoye O, Ani, E., Ninduwesuor-Ehiobu, N., Montero, D., & Andrew, K. A conceptual framework for data-driven sustainable finance in green energy transition. World Journal of Advanced Research and Reviews. 2024;21(02):1791–801.
26. Todorova A, Kostadinova I, editors. The Role of Environmental Non-Governmental Organizations in Achieving Energy Efficiency. 2024 9th International Conference on Energy Efficiency and Agricultural Engineering (EE&AE); 2024 27-29 June 2024.