

How Philippine Higher Education Institutions Share Carbon Reduction Practices: Mapping Mechanisms by Institutional Size and Type

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Abstract

Higher education institutions (HEIs) are increasingly recognized as critical actors in climate action, yet the diffusion of carbon footprint reduction practices across diverse institutional contexts remains underexplored, particularly in the Global South. This study mapped the extent and variation of mechanisms used by Philippine HEIs to disseminate carbon reduction initiatives, analyzed through the lenses of institutional size and type. Employing a mixed-methods sequential explanatory design, quantitative survey data were collected from 28 HEIs across Luzon, followed by qualitative interviews to contextualize dissemination pathways. Findings reveal significant disparities: larger institutions (>15,000 students) demonstrate more advanced and structured sharing mechanisms (mean = 3.44, “Often Practiced”), while mid-sized HEIs (5,000–15,000 students) exhibit a “middle-size disadvantage” (mean = 2.72). Public institutions (SUCs and LUCs) consistently outperform private HEIs (PHEIs), which score lowest (mean = 2.28, “Rarely Practiced”) due to limited regulatory mandates and resource allocation. The study concludes that institutional capacity, governance architecture, and mission alignment critically shape how sustainability knowledge is shared. Recommendations include establishing regional sustainability hubs, mandating standardized diffusion metrics, and incentivizing cross-institutional mentorship to bridge capacity gaps. Targeted policy support is essential to transform isolated initiatives into systemic, equitably shared climate action across the Philippine higher education sector.

Keywords: Carbon footprint reduction, sustainability diffusion, higher education institutions, institutional size, institutional typology.

INTRODUCTION

Higher education institutions (HEIs) operate as micro-cities with substantial energy, transportation, and procurement footprints, making them pivotal agents in global climate mitigation efforts (Helmets et al., 2021; Mapar et al., 2022). Universities and colleges are increasingly pressured to align operational practices with the Paris Agreement and national sustainability mandates (Stern et al., 2021; Lasco & Delfino, 2021). While many institutions have initiated carbon reduction programs, the mechanisms through which these practices are disseminated, adapted, and scaled across academic networks remain

poorly understood (Vaughter et al., 2013; Christou et al., 2024). Existing literature heavily emphasizes Western HEIs, where robust funding, standardized reporting frameworks, and mature sustainability offices facilitate knowledge sharing (Casarejos et al., 2017; Ahonen et al., 2024). In contrast, research on sustainability diffusion in developing countries, particularly the Philippines, remains fragmented (Albrecht et al., 2020; Tongco et al., 2020).

Philippine HEIs face distinct structural and operational realities. The sector is highly heterogeneous, encompassing large state universities, mid-sized regional colleges, small private institutions, and locally governed universities (Chao, 2021; Cruz et al., 2022). These variations in size, funding, and governance significantly influence institutional capacity to adopt, adapt, and share sustainability innovations (Vaughter et al., 2016; Christou et al., 2024). Moreover, Scope 3 emissions—which often constitute 60–85% of an institution's total carbon footprint—require cross-departmental and supply chain coordination, making their management highly dependent on effective internal and external communication channels (Lambrechts & Van Liedekerke, 2022; The Carbon Trust, 2022). Despite growing awareness, Philippine HEIs lack standardized pathways for disseminating carbon reduction strategies, resulting in duplicated efforts, inconsistent reporting, and uneven progress (Paredes-Canencio et al., 2024; Valls-Val & Bovea, 2021).

Understanding how HEIs share carbon reduction practices is critical for accelerating systemic change (Stern et al., 2021; Christou et al., 2024). Dissemination mechanisms such as sustainability committees, peer-learning networks, curriculum integration, and community partnerships serve as conduits for institutionalizing low-carbon operations (Casarejos et al., 2017; Vaughter et al., 2016). However, the extent to which these mechanisms are practiced varies widely depending on institutional characteristics (Aleixo et al., 2018; Christou et al., 2024). Smaller or privately governed institutions may rely on informal, champion-driven initiatives, while larger public universities often employ formalized, data-driven sharing structures (Leal Filho et al., 2022; Cruz et al., 2022). Identifying these variations can inform targeted policy interventions and resource allocation (Paredes-Canencio et al., 2024; Lasco & Delfino, 2021).

The purpose of this study is to map the extent of practice of varying mechanisms for disseminating carbon footprint reduction practices across Philippine higher education institutions in terms of institutional size and type.

METHODS

Research design

This study employed a mixed-methods sequential explanatory research design. The quantitative phase utilized a descriptive-survey approach to measure the extent of dissemination mechanisms across institutional profiles.

Participants and Sampling

The sample comprised 28 HEIs located in Luzon, selected through snowball sampling targeting institutions with documented sustainability engagement or rankings in global assessments (e.g., UI GreenMetric, THE Impact Rankings). The sample included institutions categorized by size: fewer than 5,000 students (n=15), 5,000–15,000 students

(n=5), and more than 15,000 students (n=8). Institutional types included State Universities and Colleges (SUCs, n=22), Local Universities and Colleges (LUCs, n=1), and Private Higher Education Institutions (PHEIs, n=5). For the qualitative phase, purposeful and theoretical sampling identified 6–9 participants from high- and low-adoption institutions until thematic saturation was reached. Participants included sustainability officers, facility managers, department heads, and student leaders.

Instrument

A research-made survey questionnaire was developed based on the GHG Protocol, ISO 14064, and Diffusion of Innovation Theory. The instrument measured the extent of practice of dissemination mechanisms using a 5-point Likert scale (1=Not Practiced to 5=Always Practiced). Content validity was assessed using Tagaza's (2019) descriptive equivalence scale, yielding a mean validity rating of 4.32 ("Highly Valid"). Reliability testing produced a Cronbach's alpha of 0.87.

Data collection

Surveys were administered electronically via secure platforms with embedded informed consent. All data were anonymized using institutional case codes. The study received approval from the Lyceum-Northwestern University Research Ethics Committee (Reference No. LNU-IRB-2025-0412).

Data analysis

Quantitative data were analyzed using IBM SPSS v.22. Descriptive statistics (weighted means, frequencies, percentages) were computed to assess dissemination extent across size and type categories.

RESULTS

The study examined how Philippine HEIs disseminate carbon footprint reduction practices, revealing clear patterns linked to institutional size and type. Table 1 presents the demographic profile of participating institutions.

Table 1. Profile of participating higher education institutions

Profile variable	Category	f	%
Institutional Size	Fewer than 5,000 students	15	53.57
	5,000–15,000 students	5	17.86
	More than 15,000 students	8	28.57
Type of Institution	State Universities and Colleges (SUCs)	22	78.57
	Local Universities and Colleges (LUCs)	1	3.57
	Private Higher Education Institutions (PHEIs)	5	17.85

As shown in Table 2, dissemination practices varied significantly by institutional size. Large HEIs consistently reported higher engagement across all mechanism domains (grand mean = 3.44), particularly in forming external partnerships, leveraging digital

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platforms, and integrating sustainability into curricula. Mid-sized institutions demonstrated the lowest extent of practice (grand mean = 2.72), reflecting a pronounced capacity gap in sustaining formal committees, allocating dedicated resources, and scaling community outreach. Smaller institutions performed moderately (grand mean = 3.09), showing strengths in culturally responsive initiatives but limited reach in strategic policy alignment.

The table further illustrates differences by institutional type. Public HEIs (SUCs and LUCs) demonstrated moderate but consistent practice (grand means = 3.26 and 3.28, respectively), driven by public service mandates, government-linked partnerships, and localized sustainability frameworks. In contrast, PHEIs reported the lowest engagement (grand mean = 2.28), with mechanisms such as peer learning networks, curriculum integration, and internship linkages consistently rated as “Rarely Practiced.”

Table 2. Extent of practice of dissemination mechanisms by institutional size and type

Mechanism Category	<5,000 Students (Mean/ Des)	5,000– 15,000 (Mean/ Des)	>15,000 Students (Mean/ Des)	SUCs (Mean/ Des)	LUCs (Mean/ Des)	PHEIs (Mean/ Des)
Internal						
Communication & Committees	3.13/SP	2.80/SP	3.63/OP	3.14/SP	3.50/SP	2.00/RP
External Partnerships & Resource Allocation	3.07/SP	2.60/SP	3.63/OP	3.23/SP	3.50/SP	2.50/RP
Curriculum & Academic Integration	3.07/SP	2.80/SP	3.38/SP	3.27/SP	3.00/SP	2.25/RP
Community & Indigenous Knowledge	3.27/SP	2.65/SP	3.38/SP	3.20/SP	4.00/OP	2.25/RP
Engagement						
Grand Mean	3.09/SP	2.72/SP	3.44/OP	3.26/SP	3.28/SP	2.28/RP

DISCUSSION

The findings reveal that the extent of practice of carbon reduction dissemination mechanisms in Philippine HEIs is strongly mediated by institutional size and governance typology. Large HEIs consistently outperform mid-sized and smaller counterparts, aligning with global evidence that scale correlates with administrative capacity, financial stability, and structured sustainability governance. This supports Christou et al. (2024) and Casarejos et al. (2017), who emphasize that comprehensive frameworks and performance indices are more readily institutionalized in resource-rich academic settings. The pronounced underperformance of mid-sized HEIs (grand mean = 2.72) highlights a “middle-size disadvantage” wherein institutions lack the agility of smaller colleges and the infrastructural advantages of flagship universities. This gap suggests that national sustainability programs often overlook mid-tier HEIs, leaving them without targeted grants, technical mentorship, or standardized reporting templates.

By institutional type, the moderate practice levels among SUCs and LUCs reflect the influence of public mandates, state funding allocations, and community-engagement missions. These institutions frequently leverage regional partnerships, localized climate

adaptation strategies, and indigenous knowledge systems, reinforcing their role as place-based sustainability hubs. Conversely, PHEIs' significantly lower engagement underscores structural and motivational barriers. Without compulsory sustainability reporting or accreditation incentives, private HEIs prioritize financial viability and program rankings over environmental diffusion. This mirrors Aleixo et al. (2018) and Vaughter et al. (2013), who note that environmental sustainability often remains peripheral in private higher education unless explicitly tied to institutional competitiveness or regulatory compliance.

Limitations of this study include its geographic focus on Luzon-based HEIs, which may limit generalizability to institutions in the Visayas and Mindanao. Additionally, reliance on self-reported survey data and a cross-sectional design restricts causal inference and longitudinal tracking of diffusion maturity. Future research should expand the sample nationally, incorporate institutional carbon accounting audits, and pilot the proposed diffusion-based framework to evaluate its effectiveness in accelerating practice sharing.

CONCLUSION

This study demonstrates that the extent of practice of mechanisms for disseminating carbon footprint reduction practices in Philippine HEIs varies significantly by institutional size and type. Large HEIs (>15,000 students) lead in systematic diffusion through formalized governance, digital platforms, and strategic partnerships, while mid-sized institutions face a capacity-driven disadvantage. Public HEIs (SUCs and LUCs) demonstrate moderate, mission-aligned practice, whereas private HEIs lag considerably due to competing priorities and limited regulatory incentives. Overall, sustainability dissemination remains fragmented, relying heavily on awareness initiatives rather than institutionalized knowledge-sharing systems.

To address these differences, HEIs should mandate cross-functional sustainability councils, appoint dedicated sustainability officers, and integrate carbon metrics into performance evaluations. Policymakers and accrediting bodies must develop standardized Philippine HEI Carbon Accounting Guidelines, link sustainability performance to funding and accreditation, and establish regional technical hubs to support mid-sized and private institutions. Peer mentoring networks, reverse knowledge exchange, and tiered certification systems can accelerate equitable diffusion.

Future research should adopt longitudinal designs to track the institutionalization of diffusion mechanisms, expand geographic coverage beyond Luzon, and empirically test the proposed diffusion-based framework. Embedding carbon reduction practices into the academic, operational, and cultural fabric of HEIs requires sustained investment, policy alignment, and collaborative ecosystems that transform sustainability from an isolated initiative into a shared institutional imperative.

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Conflict of interest

The author declares no conflict of interest.

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