



Research Article

Environmental Sustainability Performance and Efficiency in Thailand's Rajabhat Universities: A Cross-Regional Analysis of THE Impact Rankings

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Abstract

Higher education institutions (HEIs) are expected to increasingly communicate their contributions to the United Nations' Sustainable Development Goals (SDGs), with the rise of alternative sustainability rankings serving as prominent reporting instruments for institutional transparency. In Thailand, Rajabhat Universities, a network of government HEIs historically associated with their mission of teacher training and local development, have been actively participating in the Times Higher Education (THE) Impact Rankings, presenting a unique case study to explore cross-regional sustainability efforts in relation to global benchmarks. To evaluate trends, regional disparities, and engagement performance across the sustainability pillars, this study uses a descriptive quantitative design to analyze the performance of 37 Rajabhat University between 2022 and 2025 and uses secondary data from the THE Impact Rankings. The performance was evaluated through the development of two efficiency metrics: the performance efficiency index (PEI) and the area efficiency score (AES). The findings indicate that while the People and Partnerships pillars show the highest level of engagement, efficiency varies across the pillars. Partnerships achieve the highest efficiency, while the People pillar demonstrates moderate efficiency despite extensive reporting, suggesting diminishing returns. In contrast, the planet pillar records both low participation and the lowest efficiency, whereas the peace pillar shows relatively high efficiency concentrated in a limited number of institutions. These results reveal uneven sustainability engagement across pillars, with stronger institutionalization in social domains and more selective performance in others. This study contributes to understanding how sustainability engagement is distributed across different sustainability domains within Thailand's Rajabhat university system by distinguishing between participation breadth and performance efficiency. It further demonstrates that differences in sustainability performance are associated not only with the extent of participation but also with how sustainability commitments are embedded within institutional practice.

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Introduction

Higher education institutions (HEIs) are increasingly recognized as critical actors in advancing the UN's

Sustainable Development Goals (SDGs), calling for a shift toward a whole institution approach (Buckler & Creech, 2014) that entails activities aimed at the natural environment and an integrated understanding

of sustainable development (Findler et al., 2019). This broader role, often described as the “third mission” of HEIs, calls for a direct contribution to society through outreach, policy engagement, and local development initiatives, repositioning the SDGs as comparison benchmarks toward those efforts (Compagnucci & Spigarelli, 2020). Despite these expectations, the actual impact of those targeted activities on sustainable development remains unexplored and underresearched, particularly in terms of the measurable societal and environmental outcomes (Koehn & Uitto, 2014; Vaughter et al., 2013).

One mechanism for reporting and comparing those impacts is the Times Higher Education (THE) Impact Ranking, a framework that, according to THE’s Chief Global Affairs officer, has been developed to “recognize, measure, benchmark and incentivize” universities to report their sustainability-related work on a global scale (Baty, 2024). They aim to assess universities’ contributions to research, stewardship, research and outreach toward the 17 SDGs across different disciplines (Derakhshan et al., 2021) to improve their socioenvironmental performance and demonstrate their accountability for sustainable development (Muñoz-Suárez et al., 2020).

The SDGs are often categorized under five thematic pillars (5Ps): People, Planet, Prosperity, Peace, and Partnerships, a holistic framework that can examine sustainability across multiple dimensions. In higher education, studies show that social dimensions (People) are often prioritized in the reporting of universities (Leal Filho et al., 2021), while planet-oriented SDGs such as SDG 14 (Life Below Water) and SDG 15 (Life on Land) appear less frequently and are more challenging to implement (Urbano et al., 2025).

In recent years, the pursuit of world-class university status has been steadily increasing across Asia, creating pressures that can affect both research-intensive institutions and locally oriented institutions. Steadily, the utilization of global university rankings is adopted as a mechanism to enhance both university performance and prestige in the competition for recognition as a world-class university (Yonezawa et al., 2017; Ganotice et al., 2017). In Thailand, the Ministry of Higher Education, Science, Research and Innovation (MHESI) has categorized universities into five strategic groups, with only 16 placed in the prestigious global and frontier research category. The remaining institutions are classified as technology and innovation (18 universities), area-based and community (48 universities), moral and intellectual cultivation (2 universities), and specialized and professional (18 universities) (Subcommittee on University Re-invention, 2021).

Rajabhat universities play a distinctive role in Thailand’s higher education. Formerly known as teacher training colleges, they were granted university status under the Rajabhat Act of 2004 (Ministry of Higher Education, Science, Research and Innovation, 2004). Today, a network of 38 area-based and community institutions across six regions operates under four main missions: supporting local development, producing and developing teachers, improving the quality of education, and strengthening management systems (Saengthong et al., 2021). Their 20-year strategic framework (2017–2037) places local development at the center of their mission, encompassing four key domains: economic, social, environmental, and educational. Despite being often associated with their educational role, their strategy emphasizes their key role in driving sustainable development in local communities, measured through data collection and the implementation of local development projects in villages and schools (Council of Rajabhat University Presidents of Thailand, 2018). Like Thailand does, Indonesia’s higher education system reflects the typical conditions of a developing country, where rapid expansion is accompanied by uneven institutional quality and performance. In both countries, universities increasingly engage with global frameworks such as THE, although high ranking performance remains concentrated in a limited number of institutions. As seen in regions such as East Java (Ilhami et al., 2025), Indonesia exhibits inequalities in teaching capacity, research output, and internationalization, patterns also observed in Thailand, where regionally focused institutions often face difficulties in translating national policies into measurable ranking outcomes.

In accordance with institutional isomorphism, external pressures influence universities with shared values and missions to demonstrate transparency when they report their SDG initiatives (Kitagawa et al., 2016; De la Poza et al., 2021). However, the extent to which third mission activities are aligned with sustainable development depends largely on institutional leadership and organizational structures, making it difficult to measure outcomes and draw meaningful comparisons (Gharzeddine & Davies, 2025).

The discourse on “greenwashing” in higher education highlights how sustainability reporting becomes, more often than not, performative rather than transformative. Global rankings often prioritize short-term indicators, encouraging administrative, checklist-based approaches rather than whole-system change (Jones, 2012). This reflects a broader tendency to emphasize standardization and benchmarking over meaningful engagement and reflection (Tilbury et al., 2007; Selby and Kagawa, 2010), allowing institutions to adopt “econarratives” as a legitimizing tool without fully embedding sustainability in practice (Crane, 2000). In the context of

Rajabhat universities, where SDG reporting is linked to rankings and international visibility, similar pressures may reinforce standardized ways of presenting performance, resulting in what Jones (2012) describes as a “greenwashing glass cage,” where alignment is demonstrated at the level of reporting but remains uneven in implementation.

Coercive pressures from national higher education policies and an increasing emphasis on SDG engagement and global rankings (Anafinova, 2020) encourage institutions to adopt similar reporting practices and to frame their activities within internationally recognizable sustainability discourses. Moreover, mimetic isomorphism (Dua, 2022) can be observed in the adoption of frameworks such as the SDGs and benchmarking systems such as THE Impact Rankings, as universities seek legitimacy by aligning with perceived best practices. Normative pressures (Zdonek, 2025) further reinforce this convergence through shared professional networks and expectations regarding the role of universities in local development.

With respect to Rajabhat institutions, these dynamics are particularly visible because of the system’s strong policy alignment and shared mandate for community-oriented development. MHESI’s Reinventing University policy has encouraged Rajabhat Universities to participate in impact rankings to increase global visibility and demonstrate their contributions to sustainability and local development (Subcommittee on University Re-invention, 2021). Despite these changes, no systematic study has yet analyzed Rajabhat University’s collective performance in terms of impact rankings. This study addresses this gap by examining trends, engagement levels, and efficiency outcomes across the 5Ps framework and geographic clusters between 2022 and 2025, exploring whether Rajabhats’ impact ranking results align with their people-centered profile or reveal a broader role that includes significant contributions to other pillars.

Materials and methods

This study employs a mixed-methods research design, combining quantitative analysis of secondary data from Rajabhat universities’ submissions to the THE Impact Rankings (2022–2025) with qualitative analysis of institutional strategic plans. The quantitative component includes a cross-sectional analysis of performance across institutions, regions, and sustainability pillars (5P), situated within a longitudinal perspective that tracks performance, participation, and efficiency trends over the four-year period.

1) Data collection

Data were collected from the public database of the THE Impact Rankings for the period 2022–2025. In total, 37 institutions were included in the dataset, as one university did not participate in the rankings during the study period. The unit of analysis was the university-level SDG score reported in the rankings. All 17 SDGs were considered and grouped into five thematic pillars. For regional analysis, the 37 Rajabhat University universities were categorized into six geographic regions (Bangkok, Central, Western, Northern, Northeastern, and Southern) according to the Council of Rajabhat University Presidents of Thailand (2018) to analyze performance patterns across regional groups. In addition, a targeted review of selected institutional strategic plans and the system-level Rajabhat strategic framework was conducted to contextualize observed differences in efficiency performance across thematic pillars.

2) Data analysis

The analysis proceeded in several steps to evaluate Rajabhat University performance across the 5Ps and to examine regional differences. First, descriptive statistics were determined for each university’s SDG scores between 2022 and 2025, providing an overview of engagement and trends across institutions. Because THE Impact Rankings report exact scores only for the top 100 institutions and provide score bands for all others, midpoint estimation was applied to approximate numerical values for comparative analysis. This procedure, which is required by data format rather than by analytical design, may introduce measurement bias when uniform performance is assumed within intervals. Accordingly, the findings reflect relative efficiency patterns rather than exact performance differences. For this study, the score of each university that was not placed among the top 100 was approximated using the midpoint of its score band and then normalized to a 0–1 scale using Eq. 1.

$$\text{Normalized Score} = (\text{Midpoint} - \text{Min}) / (\text{Max} - \text{Min}) \quad (\text{Eq.1})$$

The performance efficiency index (PEI), as shown in Eq.2, was developed to assess the relative efficiency with which Rajabhat universities translate sustainability reporting effort into performance outcomes within the THE Rankings. Drawing on the conceptual logic of data envelopment analysis (DEA), the index treats ranking performance as a performance outcome, while total submissions, engagement breadth, and institutional commitment collectively approximate the inputs reflecting institutional investment in ranking participation.

$$PEI = \frac{\text{Average Score} \times \text{Engagement Breadth} \times \text{Institutional Commitment}}{\ln(1 + \text{Total Submissions})} * 100 \quad (\text{Eq.2})$$

Engagement breadth captures the relative distribution of institutional participation across sustainability pillars and is calculated as the ratio between the system-wide average number of submissions per university and the number of submissions within each pillar. Institutional commitment reflects the proportion of total submissions made relative to the maximum possible submissions within each pillar. A logarithmic transformation was applied to model diminishing returns to reporting effort, preventing high submission volumes from disproportionately influencing efficiency. As the computed values were small, the index was rescaled by multiplying by 100 to improve interpretability. The PEI evaluates sustainability performance relative to reporting effort, complementing conventional score-based ranking interpretations.

The construction of an area efficiency score (AES) addresses structural imbalances in SDG reporting, where institutions differ in both submission consistency and participation across regions. While the University Submission Ratio (USR) corrects year-to-year inconsistencies in reporting, it does not account for uneven institutional representation. The inclusion of area submission coverage (ASC) therefore ensures that regional performance is not disproportionately driven by a small number of universities. Together, these components produce a participation-weighted evaluation of SDG performance and are computed as shown in Eq. 3.

$$AES_{r,p} = \left(\frac{1}{n_r} \sum_{i=1}^{n_r} (\text{Score}_{i,p} \cdot \text{USR}_i) \right) \times \text{ASC}_r \quad (\text{Eq.3})$$

The calculation proceeded in three stages. First, for each region within a selected pillar (p), each university's (i) average SDG score ($\text{Score}_{i,p}$) was adjusted by its University Submission Ratio (USR), defined as the proportion of years in which the institution submitted data relative to the maximum possible submissions. This produced a USR-adjusted average score while accounting for submission consistency. Second, these adjusted scores were regionally aggregated within the same area (r), resulting in a weighted average score (WAS). Third, to account for the breadth of engagement, the WAS was multiplied by the Area Submission Coverage, ASC_r , which ranges between 0 and 1 and reflects the proportion of universities within the region that submitted at least one SDG during the 2022–2025 period. An ASC value of 1 indicates full participation. To assess whether AES does not constitute an artifact of index construction, its results are compared with

the mean SDG scores within each geographical area and pillar. Associations between these measures are further examined using Spearman correlation analysis (see Results).

Results and discussion

In this section, the performance scores of Rajabhat Universities in THE Impact Rankings from 2022 to 2025 are analyzed. The analysis focuses on SDG engagement and progress, covering all 37 Rajabhats that submitted a minimum of four SDGs in any given year, including the mandatory SDG 17, which allows them to participate in the overall ranking. The results are based on normalized SDG scores, allowing for standardized comparisons across institutions and years. The analysis begins with a descriptive overview of participation patterns and performance levels, followed by trend analysis, regional clustering, and performance efficiency across the 5Ps framework.

1) Data collection, normalization, and preliminary indicators

For data collection, the midpoint values of the respective bands were used and normalized to a 0–1 scale. For Rajabhat Universities whose scores were ranked within the top 100 for any of the SDGs, the actual scores were retained. Table 1 reports the average normalized scores for 2022–2025.

These results suggest that sustainability rankings provide insights into the extent to which universities integrate sustainability principles and practices (Leal Filho et al., 2024). Researchers argue that university rankings gain popularity by enabling a direct comparison of diverse institutional characteristics through standardized classification and normalization (Hammarfelt et al., 2017; Buckner & Zhang, 2025), which aligns with the present analysis. The average SDG scores of Rajabhat Universities for 2022 to 2025 are shown in Figure 1, which provides a concrete example of how these comparisons reveal performance differences. On the basis of simple linear regression analysis, SDG 6 and SDG 14 demonstrated the strongest positive trends, whereas SDG 3 and SDG 7 declined over the four-year period. However, only the trends observed for SDG 6 and SDG 16 were statistically significant ($p < 0.05$), indicating consistent directional change over time. The slope coefficients, derived from the best-fit line for each SDG, represent the average annual rate of change and distinguish areas of overall improvement from those where persistent challenges remain.

Table 1 Rajabhat average normalized scores (2022–2025)

SDG	Average score				Average overall
	2022	2023	2024	2025	
SDG 1	0.3462	0.4373	0.4037	0.3849	0.3930
SDG 2	0.2956	0.3530	0.3413	0.3974	0.3468
SDG 3	0.4273	0.3856	0.2943	0.3603	0.3669
SDG 4	0.4002	0.4794	0.5201	0.5225	0.4806
SDG 5	0.5135	0.5727	0.5784	0.5613	0.5565
SDG 6	0.2605	0.3164	0.3983	0.4528	0.3570
SDG 7	0.4696	0.5649	0.5191	0.4335	0.4968
SDG 8	0.4830	0.5574	0.5486	0.5375	0.5316
SDG 9	0.3279	0.2245	0.2728	0.2890	0.2786
SDG 10	0.1675	0.2448	0.2328	0.2367	0.2205
SDG 11	0.3431	0.4164	0.3566	0.3819	0.3745
SDG 12	0.2840	0.4657	0.4451	0.4628	0.4144
SDG 13	0.2901	0.4481	0.2879	0.3401	0.3416
SDG 14	0.2903	0.4901	0.3448	0.5485	0.4184
SDG 15	0.3810	0.5218	0.4376	0.5158	0.4640
SDG 16	0.3295	0.3425	0.3896	0.4180	0.3699
SDG 17	0.3359	0.3732	0.3606	0.4648	0.3836

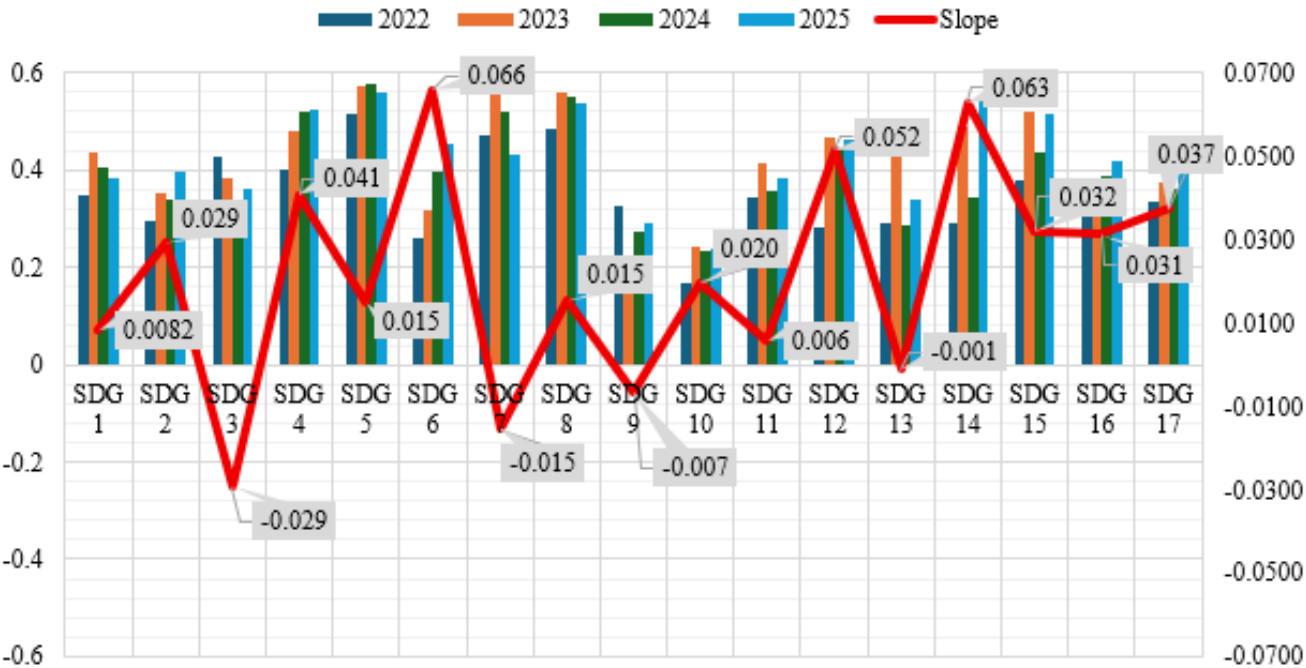


Figure 1 Trends in Rajabhat University SDG scores (2022–2025).

To examine engagement and performance patterns, the number of SDGs submitted annually by Rajabhat Universities was analyzed for institutions with at least one year of participation. For each SDG, total submissions and average normalized scores were calculated. The bars in Figure 2 present these indicators, with the bars indicating submission volume and the line indicating average performance. Engagement is highest for SDGs 1, 4 and 17, which also demonstrate relatively strong performance, while low-participation SDGs (6, 14, and 15) exhibit some of the strongest scores. These findings support prior findings that HEIs prioritize social SDGs over environmental SDGs (Leal Filho et al., 2021; Urbano

et al., 2025; De la Poza et al., 2021) but extend them by showing that less-reported SDGs can achieve comparatively high performance. Normalized SDG scores were aggregated, and universities were grouped by geographic region to enable comparative analysis across different areas. Such comparisons reflect prior studies showing that geographical location influences both institutions' willingness to report and the perceived relevance of specific SDGs (De la Poza et al., 2021; Urbano et al., 2025). Table 2 presents the average performance and standard deviation of Rajabhat university clusters across Thailand's regions in each of the 5Ps, which are based on normalized impact ranking scores.

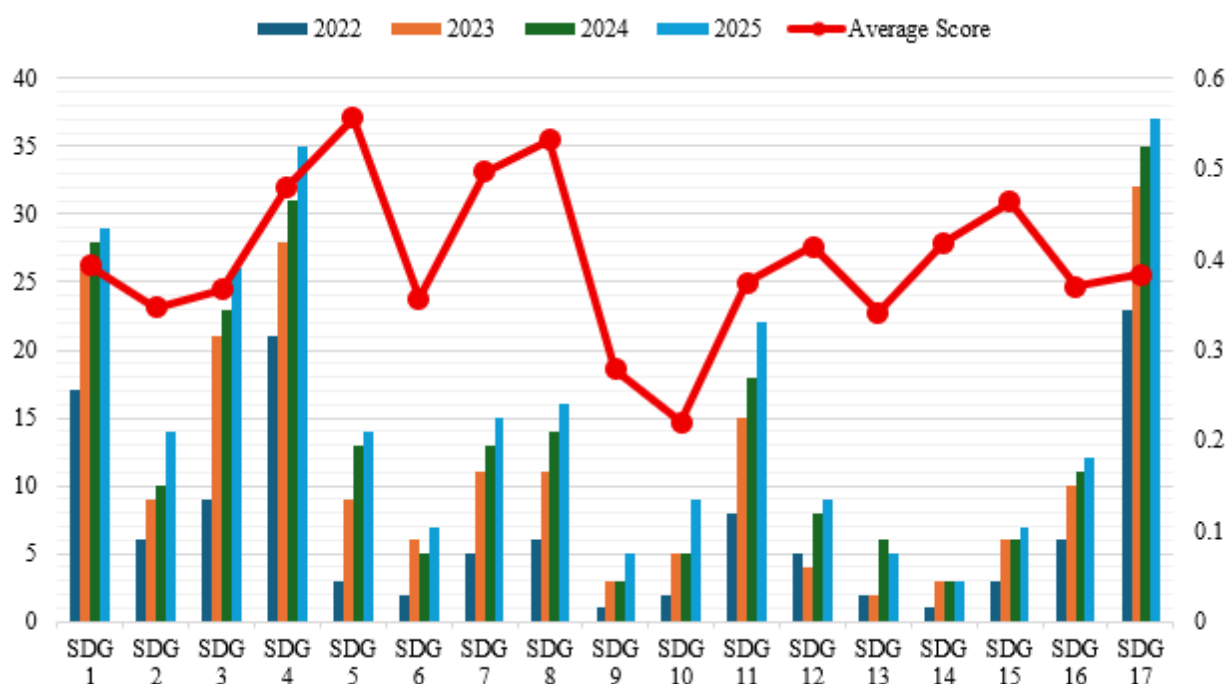


Figure 2 SDG engagement and performance of Rajabhat Universities (2022–2025).

Table 2 Average 5P performance and SD in regional clusters

Pillar	Rajabhat group						SD	CV (%)
	Bangkok	Central	Western	Northern	North-eastern	Southern		
Planet	0.1507	0.4284	0.3564	0.3350	0.3243	0.3532	0.0927	29%
People	0.4147	0.4319	0.4681	0.4217	0.4268	0.4295	0.0187	4%
Prosperity	0.3242	0.3243	0.3390	0.3885	0.3628	0.3616	0.0254	7%
Peace	0.3360	0.4125	0.3679	0.3882	0.1448	0.4650	0.1106	31%
Partnerships	0.4614	0.3714	0.3967	0.4046	0.3138	0.4483	0.0536	13%
Average	0.3374	0.3937	0.3856	0.3876	0.3145	0.4115		

2) Development of efficiency metrics and regional comparative analysis

Using the PEI, which evaluates performance relative to reporting volume, engagement breadth, and institutional commitment, distinct efficiency patterns emerge across the five pillars. A statistically significant moderate positive correlation was observed between average SDG performance scores and PEI values ($r = 0.567$, $p = 0.001$), indicating that efficiency-adjusted performance remains broadly aligned with overall sustainability performance as captured by the impact rankings. Table 3 presents the performance and efficiency of Rajabhat Universities by thematic pillar.

Although the People pillar records the highest participation (372 submissions) and average score (0.4321), its efficiency remains moderate (PEI = 6.41), suggesting diminishing returns to large-scale reporting. This is supported by low regional variability (CV = 4%), indicating the consistent institutionalization of social sustainability. SDG-level correlation analysis reinforces this pattern, with a stronger logarithmic relationship ($r = 0.60$) than linear ($r = 0.46$), implying that increased reporting yields progressively smaller performance gains. This aligns with prior research em-

phasizing the importance of reporting quality over volume in advancing sustainability initiatives (Dungtripop et al., 2025; Pistoni et al., 2018).

In contrast, the partnerships pillar demonstrates the highest efficiency (PEI = 12.93), supported by near-complete engagement breadth (98%) and strong average performance (0.3994), with minimal regional variability (13%). The peace pillar also shows relatively high efficiency (PEI = 5.95) despite limited reporting (39 submissions), suggesting strategically concentrated governance efforts and uneven engagement (CV = 31%). A similar dispersion pattern appears in the planet pillar (CV = 29%), but with substantially lower efficiency (PEI = 1.74), indicating fragmented environmental engagement. These patterns align with prior research suggesting that rankings incentivize differentiated institutional responses to sustainability (Hansen et al., 2021). In contrast, the Prosperity pillar exhibits moderate efficiency (PEI = 3.14) with a more balanced distribution. As sustainability initiatives increasingly contribute to national SDG progress (Smolennikov et al., 2024), identifying such efficiency patterns helps clarify strategic priorities. Figure 3 illustrates the regional variation in the PEI across the five pillars.

To assess regional performance across the five pillars, this study introduces an area efficiency score (AES), which integrates performance quality and engagement breadth. Quality is measured through the weighted average score, with each university's contribution weighted by its UAR, while engagement breadth is captured by ASC, which represents the proportion of participating universities. By combining these components, AES provides an effort-adjusted measure of regional contributions to the five pillars of sustainable development. Table 4 presents AES scores across the 5P framework, disaggregated by geographic region. The last column reports the average AES for each pillar for a cross-pillar comparison.

A statistically significant moderate-to-strong positive correlation was observed between AES and submission-weighted mean scores (Spearman's $\rho = 0.618$, $p < 0.001$), indicating that AES captures similar performance patterns while incorporating additional information on participation consistency and institutional coverage. A Friedman test was performed to assess differences in aggregated PEI scores across SDG pillars. The results

indicated a statistically significant effect of pillar ($\chi^2(4) = 20.90$, $p < .001$). Post hoc Durbin–Conover comparisons revealed that efficiency scores in the planet pillar were significantly lower than those in all other pillars, whereas Partnerships showed significantly higher efficiency than most thematic areas did, a pattern highlighting the presence of thematic differentiation in participation-weighted efficiency performance.

The table shows that partnerships achieve the highest participation-weighted efficiency, driven by strong performance and complete participation, reflecting its basis in SDG 17, the only mandatory SDG for overall ranking inclusion. The People pillar ranks second, with relatively consistent efficiency across regions (average AES = 0.2474), while Planet records the lowest efficiency (average AES = 0.0514). These patterns align with prior findings that HEIs prioritize socially oriented SDGs, whereas environmental dimensions receive less emphasis (Leal Filho et al., 2021; Urbano et al., 2025; De la Poza et al., 2021). Both cross-pillar efficiency variation and regional differences are illustrated in Figure 4.

Table 3 Performance and efficiency of Rajabhat University by thematic pillar

Pillar	Average score	Total Subs.	Max Subs.	Engagement breadth	Institutional commitment	PEI	Coefficient of variation (CV)
Planet	0.3247	89	640	3.8333	14%	1.74	29%
People	0.4321	372	640	1.011	58%	6.41	4%
Prosperity	0.3501	186	640	1.0098	29%	3.14	7%
Peace	0.3524	39	130	0.9060	30%	5.95	31%
Partnerships	0.3994	127	130	1.0003	98%	12.93	13%

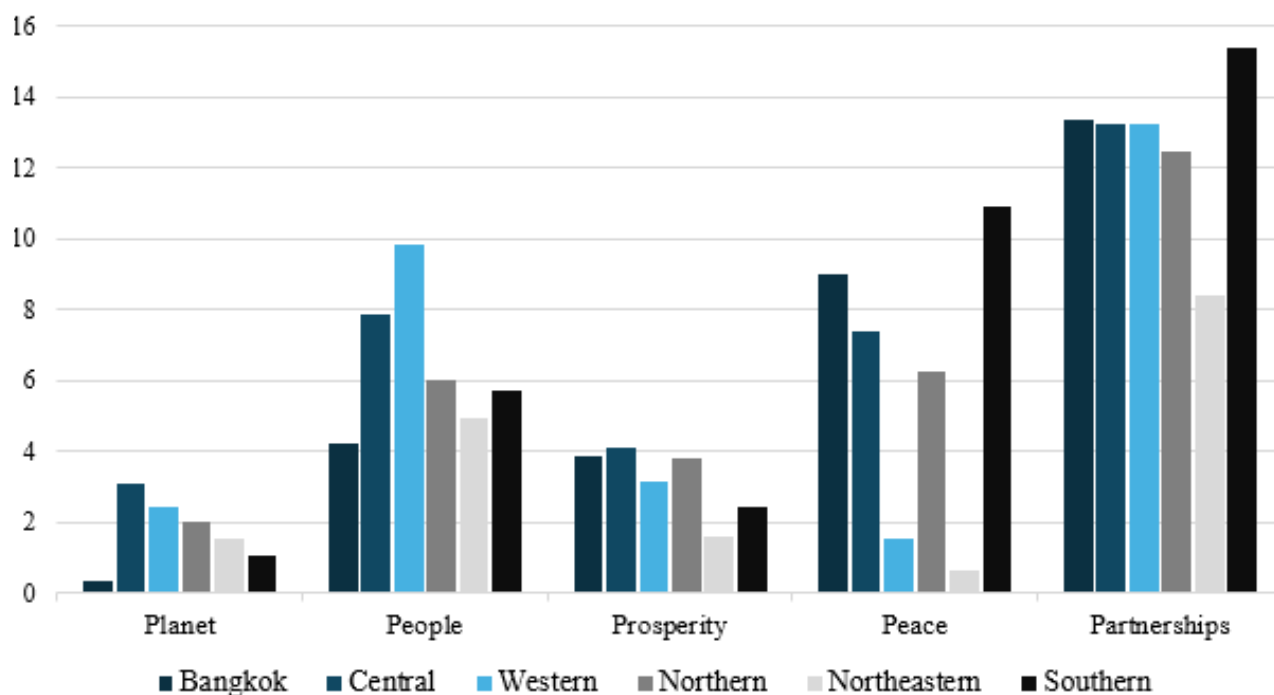


Figure 3 Performance and efficiency of Rajabhat University by geographical area and thematic pillar.

Table 4 Area efficiency scores (AES) of Rajabhat University by geographical area and thematic pillar

Pillar	Region/area	Weighted average score (Area-level)	Area submission coverage (ASC)	Area efficiency score (AES)	Average AES
Planet	Bangkok	0.0558	0.4	0.0223	0.0514
	Central	0.1373	0.6	0.0824	
	Western	0.0691	1.0	0.0691	
	Northern	0.0922	0.63	0.0576	
	North-eastern	0.0849	0.7	0.0594	
	Southern	0.0477	0.6	0.0286	
People	Bangkok	0.2001	1	0.2001	0.2474
	Central	0.2646	1	0.2646	
	Western	0.2931	1	0.2931	
	Northern	0.2449	1	0.2449	
	North-eastern	0.2388	1	0.2388	
	Southern	0.2432	1	0.2432	
Prosperity	Bangkok	0.1521	1	0.1521	0.1236
	Central	0.1562	1	0.1562	
	Western	0.1167	1	0.1167	
	Northern	0.1689	0.87	0.1478	
	North-eastern	0.0920	0.8	0.0736	
	Southern	0.0954	1	0.0954	
Peace	Bangkok	0.2996	0.6	0.1798	0.1216
	Central	0.2648	0.6	0.1589	
	Western	0.0920	0.25	0.0230	
	Northern	0.2700	0.5	0.1350	
	North-eastern	0.1137	0.2	0.0227	
	Southern	0.3500	0.6	0.2100	
Partnerships	Bangkok	0.4463	1	0.4463	0.3776
	Central	0.3712	1	0.3712	
	Western	0.3470	1	0.3470	
	Northern	0.3970	1	0.3970	
	North-eastern	0.3000	1	0.3000	
	Southern	0.4496	1	0.4496	

AES and PEI provide complementary perspectives on Rajabhat universities' participation in sustainability rankings by distinguishing between the breadth of sustainability engagement and outcome efficiency. Considering both dimensions simultaneously allows for a more nuanced interpretation of sustainability performance and highlights differences that may be less visible under a single evaluation approach. Although the Rajabhat mission aims at economic, social, environmental, and educational development, these aspects are deeply interwoven, making clear differentiation analytically complex. Moreover, while they operate under similar policy frameworks and institutional mandates, the ways in which sustainability objectives are manifested in institutional performance may differ across institutions and sustainability domains.

In this context, metric-based evaluation helps identify areas of performance intensity as well as pattern variations in institutional engagement across pillars. The overall structural relationship between these performance indices is illustrated in Figure 5.

The relationship between AES and PEI demonstrates strong structural convergence across Rajabhat areas, as evidenced by a high and statistically significant Pearson correlation ($r = 0.944$, $p < .01$). Although both

indices capture a broadly similar distribution of institutional sustainability performance, important differences emerge when participation breadth and performance efficiency are considered simultaneously. To examine whether these differences produce distinct performance patterns across sustainability pillars, paired Wilcoxon signed-rank tests (Table 5) were conducted on AES and PEI z scores across regional groupings within each sustainability pillar.

A statistically significant shift was found in the prosperity pillar ($p = 0.031$, $r = 1.00$), with a negative ΔZ indicating that economic engagement appears weaker when assessed through the efficiency-adjusted metric (PEI) than through participation-weighted evaluation (AES). This suggests that prosperity-related engagement is widely embedded within the Rajabhat mission, but participation-weighted evaluation may mask differences in how effectively economic development objectives are operationalized and translated into sustainability outcomes across institutions. An oppositely directed significant shift was observed in the peace pillar ($p = 0.031$, $r = -1.00$), where the positive shift suggests that while governance-related engagement may be less widespread across the Rajabhat system, the institutions

that are active in this domain appear more effective in translating participation into measurable outcomes.

The planet pillar showed a large but statistically nonsignificant shift between AES and PEI ($p = 0.063$, $r = -0.91$), with ΔZ indicating relatively lower environmental performance under the efficiency-adjusted assessment. A similarly large but opposite trend was observed for the People pillar ($p = 0.063$, $r = 0.91$), with relatively stronger social sustainability performance.

This pattern suggests that participation-weighted evaluation may mask differences in institutional capacity within both people- and planet-focused performance patterns, although the evidence remains statistically inconclusive. Overall, the efficiency-adjusted measurement does not substantially shift the overall performance hierarchy but highlights pillar-specific variation in how sustainability engagement is distributed across the Rajabhat system.

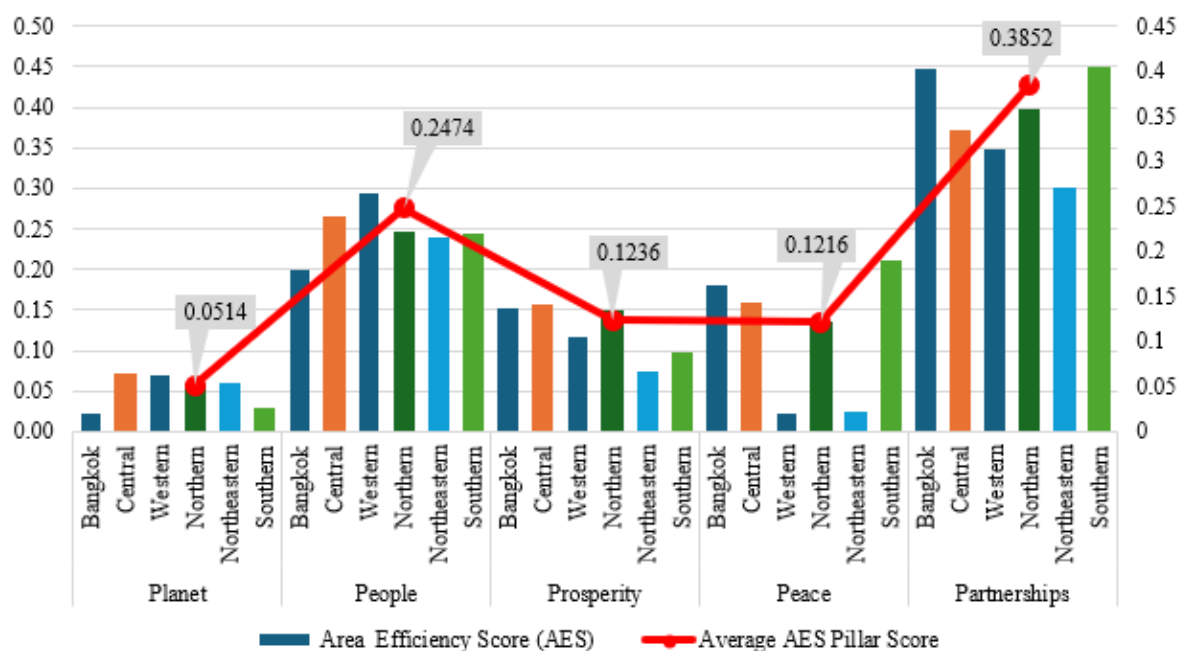


Figure 4 5P geographic area efficiency score (AES).

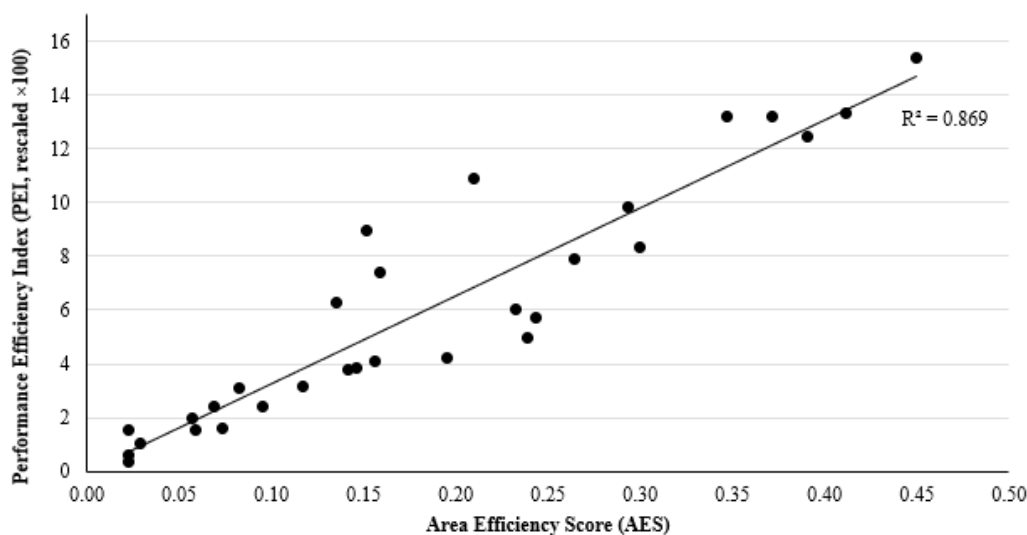


Figure 5 Relationships between AES and PEI across Rajabhat areas.

Table 5 Paired Wilcoxon signed-rank test results comparing AES and PEI across sustainability pillars

Pillar	W	P	Effect size r	Median ΔZ (PEI-AES)	Direction of standardized shift
Planet	3	0.156	-0.714	0.0964	No consistent shift detected
People	20	0.063	0.905	-0.4759	Tendency toward lower standardized PEI values
Prosperity	21	0.031	1	-0.1612	Lower standardized PEI values observed
Peace	0.0	0.031	-1	0.4909	Higher standardized PEI values observed
Partnerships	11	1	0.0467	-0.0547	No observable shift pattern

When interpreted through AES and PEI, sustainability engagement within the Rajabhat system appears to operate through two related dimensions: the breadth of participation and the efficiency with which participation is translated into performance outcomes. Although Rajabhat universities operate under a common strategic orientation and are exposed to similar sustainability frameworks, common external pressures alone may not explain patterns of sustainability performance across institutions. The divergence between participation-weighted and efficiency-adjusted performance indicates that sustainability engagement and sustainability performance are not always aligned to the same degree across institutions. These findings raise questions regarding how sustainability commitments are incorporated into strategic planning, implementation processes, and performance monitoring systems. To explore these differences, the following section examines the strategic plans of selected universities representing distinct AES–PEI performance profiles.

3) Strategic plan case studies

The strategic orientation of the Rajabhat system reflects an area-based, community-driven development model that prioritizes economic growth, human capital development, and local engagement through value-based economic initiatives. Within their 5-year strategic plan, environmental considerations are embedded within economic and social agendas instead of a separate strategic domain. References to sustainability most often appear in connection with local economic value creation, indicating a view of the environment as an external factor that affects community development rather than a focus of ecological governance. Simultaneously, the SDGs are integrated as a broad guiding framework but are referenced in ranking-related terms (THE SDGs) without clear prioritization of specific goals. Such a strategy reflects a logic in which the SDGs serve as a mechanism for institutional visibility, while environmental action is addressed solely through development initiatives rather than targeted ecological strategies (Office of National Higher Education, Science, Research and Innovation Policy Council, 2023). Within this broad strategic framework, the decentralized nature of institutional planning allows universities considerable autonomy in how their individual sustainability agendas are implemented, potentially leading to uneven institutionalization across sustainability domains.

To further explore how differences between AES and PEI are reflected in institutional practice, this study analyses the 5-year strategic plans of four Rajabhat universities selected through a maximum variation approach. Case selection is guided by the

relative alignment and divergence between AES and PEI, capturing four performance configurations: high PEI–high AES, low PEI–low AES, high PEI–low AES, and low PEI–high AES (Table 6). The analysis prioritizes a targeted exploration of how different strategic orientations shape the relationship between AES and PEI and seeks to identify how institutional policy helps explain the divergence between the two lenses.

3.1) Suan Sunandha Rajabhat University

Within the Bangkok region, Suan Sunandha Rajabhat University (SSRU) is one of only two universities submitting Planet-related SDGs, and it has the greatest participation among them (USR = 0.2). This highlights that, while planet-focused engagement is generally low (Institutional commitment = 6%), SSRU stands out, even though overall efficiency remains limited. The institution envisions itself as a niche Guru university, focusing on producing graduates with specialized knowledge, promoting creative research, and generating academic work that addresses social challenges (Suan Sunandha Rajabhat University, 2025). SSRU emphasizes the preservation and promotion of Thai arts and culture and prioritizes community service, research investment, and innovation. Its strategic pillars reflect this focus, while environmental sustainability objectives are mostly absent from the institution's 5-year plan. As a result, SSRU's engagement in Planet-related SDGs has been limited to SDG 12, which contributes to the low AES and PEI observed in this pillar.

The university's development framework emphasizes sustainability as a key driver of development and is further supported by strategic thrusts emphasizing community service in alignment with the efficiency economy philosophy (SEP). In 2022, SSRU formalized a policy on sustainable production and consumption aligned with SDG 12, outlining environmentally friendly practices, resource management, and waste reduction (Suan Sunandha Rajabhat University, 2022). However, the policy does not define specific key performance indicators (KPIs), meaning that efforts cannot be systematically evaluated for efficiency. As a result, planet-focused initiatives remain limited, explaining both the low participation (AES) and the limited efficiency (PEI) in sustainability outcomes. This pattern suggests that environmental sustainability is not a central strategic priority for SSRU. While SDG 12 is reflected in institutional policy, the absence of dedicated environmental objectives and measurable performance indicators suggests a limited institutionalization of planet-related sustainability, explaining both the low participation and low efficiency observed in this pillar.

Table 6 Rajabhat case study selection

Rajabhat university	AES rank	PEI rank	Rank shift (PEI – AES)	Divergence pillar	Performance configuration
Suan Sunandha	24	24	0	Planet	Low PEI – Low AES
Nakhon Pathom	1	2	1	People	High PEI – High AES
Chiang Rai	13	6	-7	Peace	High PEI – Low AES
Nakhon Sawan	3	7	+4	People	Low PEI – High AES

3.2) Nakhon Pathom Rajabhat University

Within the western region, Nakhon Pathom Rajabhat University (NPRU) demonstrates strong engagement in the People pillar, with a high level of participation (USR = 0.6) in a region with high institutional commitment (69%). The NPRU is guided by the philosophy of “education develops people, knowledge creates wisdom, and local development”, focusing on local development and academic service to communities with an emphasis on regional capacity building (Nakhon Pathom Rajabhat University, 2024). The NPRU demonstrates strong policy alignment, linking its strategy with national development frameworks such as the BCG (Bio-Circular-Green) model and the New S-curve industries. This focus is reflected in a selective engagement with SDGs 1, 3, 4, and 17, aligning closely with people-oriented priorities and contributing to the high AES observed in this pillar.

This approach is supported by KPIs targeting community impact and SDG-related activities, indicating a strong alignment between policy and measurable outcomes. The integration of new S-curve industries is operationalized through these KPIs prioritizing programs linked to national workforce demands, such as health and medical services. The university advances a competency-based and lifelong learning orientation through targets for nondegree programs, credit bank systems, and online learning platforms. These targets, including the number of programs and participants, demonstrate a commitment to upskilling and reskilling, directly supporting relevant THE indicators. Overall, the policy structure reflects a system in which strategic priorities, implementation mechanisms, and measurable indicators are closely aligned. The NPRU case illustrates how such alignment can strengthen the institutionalization of people-related sustainability. This may help explain the university's strong performance under both participation-weighted and efficiency-adjusted evaluation.

3.3) Chiang Rai Rajabhat University

Within the Peace pillar, the northern region exhibits the greatest difference between the PEI and AES ($\Delta\text{Rank} = -7$). Chiang Rai Rajabhat University (CRRU) is selected as a case study within this area, reflecting sustained engagement and relatively strong performance in SDG 16. The university's profile is characterized by area-based development that emphasizes participa-

tory governance and multistakeholder collaboration (Chiang Rai Rajabhat University, 2023). For example, CRRU requires full stakeholder involvement (public, private, and community) in the design and implementation of development projects, while academic staff are expected to serve as advisors or committee members to local organizations, embedding the university within local governance. In addition, indicators such as improvements in community well-being (“Gross Happiness”) frame peace-related projects in terms of social cohesion. These features align closely with those of SDG 16 and support localized outcomes that are captured under PEI.

Moreover, several limitations are evident. While SDG priorities are clearly articulated, performance metrics remain underdefined, with limited specification of how outcomes such as participation or well-being are measured. Institutional documents also highlight constraints, including administrative regulations, underdeveloped information systems, and delays in operationalizing collaboration models (e.g., the quadruple helix framework). Overall, the structure of the CRRU reflects a model in which governance-related sustainability is embedded within the local partnerships and participatory practices of the CRRU, enabling localized community outcomes even where formal measurement and implementation mechanisms remain underdeveloped.

3.4) Nakhon Sawan Rajabhat University

The strategic profile of Nakhon Sawan Rajabhat University (NSRU) reflects a model focusing on local development, innovation, and human capital. This is evident in its emphasis on area-based research and innovation, the development of a community-based science park, and the expansion of work-integrated learning (CWIL/MOOC). NSRU promotes lifelong learning systems and tracks indicators such as the percentage of programs codeveloped with communities or enterprises and income generated from nondegree courses, highlighting extensive engagement across sectors (Nakhon Sawan Rajabhat University, 2025). While SDGs are embedded across multiple strategic areas and KPIs, they are framed broadly as “Times Higher Education (THE) SDGs,” without clear prioritization or focus on specific goals, indicating an aspirational orientation toward global standards but without clearly defined mechanisms for achieving them.

This extensive participation helps explain the pattern of high AES but lower PEI. Universities mobilize a wide range of actors through community-linked research (e.g., increasing the proportion of socially engaged researchers) and projects aimed at increasing local income and economic value, but bureaucratic administrative systems and slow coordination processes limit efficiency. As a result, while engagement is highly visible, the lack of specificity and operational coherence may limit the effective institutionalization of sustainability commitments, reducing their translation into efficient outcomes.

Taken together, the study findings suggest that differences in sustainability performance are associated with the extent to which sustainability commitments become embedded across institutional implementation processes and performance monitoring systems. Although Rajabhat universities operate under a common national policy framework, individual institutions differ considerably in how they translate sustainability objectives into practice. The case studies demonstrate that stronger strategic alignment between implementation mechanisms and measurable indicators is related to more consistent performance across both AES and PEI evaluation, whereas sustainability engagement without operational integration appears to generate less efficient outcomes. These findings may indicate that sustainability commitments serve different institutional functions, such as operational frameworks, to broader mechanisms of institutional visibility. From an institutional perspective, the findings demonstrate that the institutionalization of sustainability objectives plays a critical role in shaping sustainability engagement into measurable performance outcomes.

4) Limitations

This study is subject to several limitations. First, the use of midpoint estimation for score bands in the THE impact ranking may introduce measurement bias, as it assumes a uniform distribution within intervals and therefore reflects relative rather than exact performance differences. Second, the analysis relies on self-reported institutional data, which may not fully capture actual sustainability outcomes, highlighting a potential gap between reporting and practice. Third, although the constructed indices (PEI and AES) were theoretically grounded and empirically validated, they remain sensitive to variations in reporting structures and participation patterns. These limitations should be considered when the findings are interpreted.

Conclusions

Viewed through the complementary lenses of AES and PEI, Rajabhat Universities' performance in THE

Impact Rankings across 2022–2025 reflects a more complex profile than their prescribed people-centered role. While social-oriented pillars such as people and partnerships show consistently high levels of engagement across the system, the analysis reveals differentiated performance dynamics across the remaining pillars. The planet pillar is characterized by both low participation and the lowest efficiency, suggesting fragmented and weakly institutionalized environmental engagement. In contrast, the peace pillar demonstrates relatively high efficiency despite limited participation, where governance-related performance is concentrated in a small number of institutions.

By distinguishing between participation-weighted engagement (AES) and efficiency-adjusted performance (PEI), the study shows that sustainability participation does not necessarily translate into equivalent sustainability outcomes. The Rajabhat cases demonstrate how differences in strategic alignment, implementation, and monitoring may help explain this divergence. Moreover, the findings suggest that Rajabhat Universities are increasingly engaging with sustainability agendas beyond their traditional educational and community-development role. However, this transformation is shaped by an instrumental use of sustainability frameworks, where SDG engagement is often aligned with international visibility and ranking performance rather than fully integrated institutional change. Looking forward, the challenge lies in balancing participation across underrepresented pillars such as Planet with the preservation of their community-based identity. Moreover, the transition of THE Impact Rankings into a subscription-based Sustainability Impact Ranking model may reduce incentives for participation, particularly in resource-constrained institutions, potentially limiting both the visibility and strategic integration of sustainability efforts within the Rajabhat system.

Building on these findings, several practical recommendations can be proposed. First, the consistently low performance and efficiency of the planet pillar suggest that Rajabhat Universities need to strengthen their environmental strategies, moving beyond general mentions to SDGs or "international standards". While SDGs appear prominently in institutional five-year plans in relation to partnerships, research internationalization, and showcasing Rajabhat work globally, these mentions rarely translate into actionable KPIs for specific pillars, especially Planet. Second, institutions would benefit from a more focused and coherent roadmap in which SDG engagement is operationalized through measurable targets rather than broad statements, ensuring alignment between philosophy, strategic intent, and implementation. Third, at the policy level, national frameworks could help reduce

pillar disparities by incentivizing underrepresented areas such as environmental sustainability, including targeted funding schemes and performance evaluation criteria. This approach would support a more balanced distribution of sustainability efforts that mitigate the risk of normative isomorphism, where international rankings such as THE may inadvertently function as a form of greenwashing, emphasizing administrative compliance over impactful outcomes.

Data availability statement

Information and data used in the study will be disclosed upon request.

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Author contributions

Konstantinos Balis: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – Original draft, Writing – Review & editing, Visualization, Project administration

Conflicts of interest

The authors declare that there are no conflicts of interest in competing financial or personal relationships that could have appeared to influence the work reported in this work.

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