

# Sustainability Strategy and Environmental Performance at Private Universities in East Java

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**Abstract.** This study investigates the relationship between sustainability strategies and environmental performance in private universities in East Java, with a particular focus on their contribution to the Sustainable Development Goals (SDGs). Three strategies are examined: green curriculum, Environmental Management Systems (EMS), and sustainable research programs. A quantitative research design using Partial Least Squares–Structural Equation Modeling (SEM-PLS) was applied to data collected from 40 accredited private universities. The findings reveal that only sustainable research programs have a positive and significant effect on institutional and environmental performance ( $T = 6.7$ ;  $p < 0.001$ ), while green curriculum and EMS show no statistically significant direct effects. However, all three strategies collectively explain 91.6% of the variance in university performance ( $R^2 = 0.916$ ). Environmental performance indicators such as energy efficiency, waste management, carbon footprint reduction, and resource conservation illustrate how universities operationalize sustainability commitments. These strategies align with SDG 4 (Quality Education), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action). The results highlight the strategic role of private universities as drivers of environmental sustainability and emphasize the need for stronger integration of education, management, and research to maximize sustainability outcomes.

**Keywords:** *Sustainability strategies, green curriculum, EMS, sustainable research, environmental performance, SDGs.*

## 1 Introduction

Sustainability concerns have emerged as a key issue within the higher education sector. The shift toward sustainable development places pressure on educational organizations, especially universities, to act not only as education and research centers but also as agents of social and environmental action. Within this framework, universities are expected to actively engage in environmental sustainability initiatives and contribute strategically to the realization of the United Nations SDGs. Amid pressing global issues including climate change, environmental deterioration, and energy and food crises, universities are endowed

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with a global responsibility to develop action plans and strategies that support SDG realization.

The new demand is for a higher standard of graduates: people who are not only academically competent but also demonstrate strong environmental awareness and active community engagement through volunteerism. Quality education is the result of good governance, effective learning processes, and institutional commitment to repair and sustain [1]. This has marked the introduction of sustainability initiatives into the education curriculum, the establishment of local Environmental Management Systems (EMS), and the enhancement of universities' research profiles in the fields of sustainability and corporate responsibility. The concept of the "green university" has emerged as a new paradigm, emphasizing efficient resource utilization, waste minimization, and active participation in generating and developing sustainability knowledge [2].

The adoption of sustainable principles in Indonesian higher education remains limited. In private universities, in particular, institutional capacity and resource disparities influence the pace and responsiveness of sustainability strategy implementation. Nevertheless, several private Indonesian universities have demonstrated promising and progressive practices related to greening the curriculum, adopting EMS, and fostering research cultures directed at sustainable solutions. This indicates the significant potential of private higher education institutions to contribute to the national sustainable development agenda.

Sustainability initiatives in higher education are multifaceted. However, three key dimensions have been consistently emphasized in the literature: greening the curriculum, establishing environmental management systems, and delivering sustainable research programs [3], [4]. Green education as part of the curriculum is a crucial medium that shapes students' ecological awareness and behavior. Integrating environmental ethics, ecology, and renewable energy topics into the learning process equips students with the knowledge and tools needed to address real sustainability challenges [5].

EMS, such as ISO 14001, enables institutions to effectively control the environmental impacts of campus operations. EMS helps universities measure key aspects of environmental performance, define sustainability objectives, and regularly review their achievements [6]. EMS has been proven successful in many countries in saving energy, minimizing waste generation, and reducing campus operating expenses [7].

Additionally, research programs are strategically positioned to produce knowledge and innovations related to sustainability. These programs are often interdisciplinary, bringing together social sciences, engineering, and environmental studies to generate practical solutions to global challenges [8]. Universities that successfully develop a sustainable research culture tend to excel not only in academic reputation but also in societal engagement and environmental leadership.

More than 300 private universities are operating in East Java, according to the Higher Education Service Institute (LLDIKTI) Region VII. Research on sustainability strategies in this context is therefore highly relevant. However, there is still a lack of empirical studies examining the scope of sustainability strategy adoption and its impact on institutional performance, particularly in relation to environmental outcomes and SDGs. University performance in this research refers to academic, managerial, social, environmental, and financial aspects. These performance dimensions correspond to the Triple Bottom Line (TBL) framework, which emphasizes people, planet, and profit in assessing organizational success [9]. Universities that continuously embrace sustainability strategies are believed to enhance operational performance, competitive advantage, and stakeholder value [10].

To date, research on university sustainability has predominantly focused on developed countries [10], [11], with very limited studies from developing contexts such as Indonesia. Furthermore, most existing studies examine isolated aspects of sustainability, without considering an integrated approach that incorporates education, operations, and research

dimensions [12]. This study aims to fill this gap by analyzing the link between multidimensional sustainability strategies, environmental performance, and contributions to SDGs in private universities in East Java.

With rising ecological awareness and increasing pressure to implement sustainable principles at all levels, universities are expected to lead by example. For institutions concerned about graduate quality, innovation, and social commitment, adopting sustainability strategies is no longer optional but essential to ensure that universities not only produce excellent graduates but also serve as models of environmental stewardship for current and future generations.

## 2 Research Method

### 2.1 Green Curriculum Establishment, Environmental Performance, and University Performance

The incorporation of the green curriculum has been identified as a crucial approach in higher education to enable the realization of the Sustainable Development Goals (SDGs) and to enhance universities' contributions to environmental performance. Shephard et al. [13] categorize sustainability education into three levels: education *about* sustainability, education *for* sustainability, and education *as* sustainability. This model is supported by Figueiró et al. [14], who emphasize that transformative learning can shape students' critical awareness of environmental issues, which in turn can influence their sustainable behavior.

Shawe et al. found that integrating interdisciplinary practice in the green curriculum is necessary to address complex sustainability challenges. In Asia, Chan et al. reported significant barriers to curriculum reform, such as limited cross-faculty collaboration and pedagogical adaptation. Sousa et al. showed that teaching sustainability has a positive impact on an institution's reputation and encourages students to take greater initiative in sustainability classes.

The theoretical foundation of the green curriculum is rooted in transformative learning theory, which emphasizes deep shifts in perspectives rather than the simple acquisition of knowledge. The green curriculum also contributes to environmental performance by raising awareness and encouraging behavioral changes that support energy conservation, waste reduction, and responsible resource use among students and staff.

Several studies have examined the link between green curriculum and university performance. Sousa et al. found that institutions offering sustainability-focused curricula attract environmentally conscious students. Findler et al. discovered that participatory and sustainability-oriented teaching improves teaching quality and student satisfaction. Romero et al. found that universities featuring green curriculum innovations gain advantages in recruitment and partnership development. In Indonesia, Dian et al. identified significant diversity among universities in terms of methods and content used in sustainability education, indicating uneven but growing adoption.

These findings suggest that green curriculum initiatives not only enhance educational quality but also support environmental performance through awareness-building and behavioral transformation, aligning universities with SDG 4 (Quality Education) and SDG 13 (Climate Action).

**H1:** Green Curriculum has a positive influence on University Environmental Performance and Institutional Performance.

## **2.2 Environmental Management Systems (EMS) and University Environmental Performance**

An Environmental Management System (EMS) is a systematic organizational framework for addressing environmental impacts through planning, implementation, monitoring, and continuous improvement. Within the higher education context, EMS provides a structured approach for managing campus environmental issues, including energy consumption, waste disposal, water conservation, transportation, and sustainable procurement practices.

The theoretical foundation for EMS adoption in universities lies in environmental governance and organizational change theory [15]. Empirical studies highlight successful EMS implementation in higher education institutions across different regions. Drahein et al. (2005) examined ISO 14001 adoption in Latin American universities and found that standardized processes are most effective when supported by top management and key stakeholders. Findler [16] emphasized the need for broad-based governance to achieve sustainable environmental improvements through EMS.

In Indonesia, Putrantomo noted that despite increasing environmental awareness, systematic environmental management remains limited, particularly among private universities with constrained funding. However, EMS adoption is crucial because it enables universities to measure key environmental performance indicators such as carbon emissions, energy use, and waste reduction all of which are essential components in aligning with SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action).

**H2:** Environmental Management Systems (EMS) positively influence University Environmental Performance and Institutional Performance.

## **2.3 Sustainable Research Programs, Institutional Innovation, and SDGs**

Sustainable research programs represent deliberate institutional efforts to align research agendas with sustainability goals, addressing both human and environmental needs. These programs involve research governance systems, funding mechanisms, methodological innovations, and dissemination strategies that support the production of knowledge for sustainable development.

Lange [17] emphasizes the role of universities in producing solution-oriented research that addresses pressing environmental and social challenges. Findler et al. highlight that universities with strong sustainable research programs tend to demonstrate higher organizational innovation capacities, including in environmental management. Moreira et al. [18] argue that research-based innovation provides universities with strategic advantages in driving regional sustainability transitions, thereby enhancing their environmental and institutional performance.

In Indonesia, sustainable research initiatives are still emerging. Nurbaiti et al. report that while momentum is growing, significant challenges remain, including limited funding, weak R&D linkages, and uneven implementation. Setiawan et al. highlight disparities in research focus, methodology, and impact pathways across universities, indicating a need for stronger alignment with SDGs and environmental priorities.

Sustainable research programs directly contribute to SDG 4 by advancing knowledge and education, SDG 13 by supporting climate action research, and SDG 11 by generating context-specific solutions for sustainable communities.

**H3:** Sustainable Research Programs positively influence University Environmental Performance and Institutional Performance.

## **2.4 Sustainability Strategies and Institutional Performance**

The Triple Bottom Line (TBL) framework is widely adopted in universities to assess sustainability performance. TBL emphasizes the integration of *people*, *planet*, and *profit*

dimensions in evaluating organizational success [10]. The institutions implementing TBL principles tend to achieve superior social, environmental, and financial performance.

Romero et al. demonstrate that universities with well-developed sustainability strategies benefit from stronger institutional profiles and more effective collaboration networks. Basta and Liyanage suggest that in developing countries, effective sustainability strategies often combine internal efficiency improvements with responses to external social and environmental demands.

In the context of private universities in East Java, sustainability strategies including green curriculum, EMS, and sustainable research programs are expected to influence not only institutional performance but also environmental outcomes and alignment with SDGs. By linking these strategies with measurable environmental performance indicators, universities can play a pivotal role in advancing sustainability agendas at both institutional and societal levels.

### 3 Research Method

This study employs a quantitative research design aimed at examining the causal relationships between sustainability strategies namely green curriculum, Environmental Management Systems (EMS), and sustainable research programs and both environmental and institutional performance in private universities across East Java. A quantitative approach is appropriate for deductively testing hypotheses and objectively assessing measurable relationships between latent variables. Structural Equation Modeling (SEM) is used as the analytical technique, as it allows for the simultaneous testing of multiple constructs and their observed indicators while accommodating complex models that include both direct and indirect effects. This approach enables the investigation of how sustainability strategies contribute to environmental performance and the achievement of Sustainable Development Goals (SDGs) within higher education institutions.

The study population comprises all private universities in East Java Province listed in the database of the Higher Education Service Institute (LLDIKTI) Region VII. As of 2023, there are 310 active private universities, including 13 institutions accredited as Excellent (Grade A) and 100 as Very Good (Grade B). Cluster sampling was applied using two inclusion criteria: 1) universities must hold either Excellent or Very Good institutional accreditation, and 2) they must have been operating for at least ten years. Following Roscoe's recommendation of a minimum of 30 samples per category, a total of 40 samples were selected, representing both Grade A and Grade B institutions. The respondents consist primarily of university administrators (such as rectors, vice-rectors, and heads of academic bureaus) and permanent academic staff who are directly involved in strategic planning, curriculum development, campus environmental management, and research initiatives. This sampling ensures that the data reflect informed perspectives on institutional sustainability strategies and their implementation.

Data were collected using structured questionnaires distributed electronically via Google Forms to official university email addresses. The instrument consists of closed-ended questions measured on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). It covers four core dimensions: green curriculum, Environmental Management Systems (EMS), sustainable research programs, and environmental and institutional performance. These dimensions reflect the three strategic pillars of sustainability in universities and their expected outcomes in relation to SDG 4 (Quality Education), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action). Content validity was assessed through Confirmatory Factor Analysis (CFA), and reliability was tested using Cronbach's Alpha, with a minimum acceptable value of 0.70. Prior to analysis, the data were coded and cleaned to ensure accuracy and completeness.

For data analysis, Partial Least Squares–Structural Equation Modeling (SEM-PLS) was employed using SmartPLS 4.0 software. SEM-PLS is particularly suitable for complex models and does not rely on the assumption of data normality [19]. The analysis consisted of two stages. The first stage involved evaluating the measurement model (outer model) by examining convergent validity, discriminant validity, and construct reliability to ensure that the indicators accurately represented their respective constructs. The second stage involved testing the structural model (inner model) to assess causal relationships between the independent variables (green curriculum, EMS, and sustainable research programs) and the dependent variables (environmental performance and institutional performance).  $R^2$  values were calculated to determine the model's explanatory power, and bootstrapping procedures were conducted to assess the statistical significance of the hypothesized paths. This analytical framework provides a robust basis for understanding how sustainability strategies influence both environmental and institutional performance and how these relationships align with SDGs within the context of private universities in East Java.

## 4 Results and Discussion

The purpose of this study is to examine the effects of sustainability strategies on both environmental and institutional performance of private universities in East Java. The sustainability strategies considered include three key components: green curriculum, Environmental Management Systems (EMS), and sustainable research programs. These three components are believed to significantly enhance university contributions toward sustainable development, environmental performance, and the achievement of relevant Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action).

The model was tested using Structural Equation Modeling with Partial Least Squares (SEM-PLS) through the SmartPLS 4.0 software. SEM-PLS was chosen because it can accommodate complex conceptual models with relatively small to medium sample sizes and does not require normally distributed data.

The research data were collected through online questionnaires distributed to 40 respondents from private universities in East Java with Excellent (Grade A) and Very Good (Grade B) accreditation that have been operating for more than ten years. The respondents include university administrators (rectors, vice-rectors), heads of academic bureaus, and permanent lecturers responsible for strategic planning, curriculum development, environmental management, and institutional research.

### 4.1. Assessment of Construct Validity and Reliability (Outer Model)

The assessment of the outer model aimed to evaluate the validity and reliability of the constructs in the proposed model. Convergent validity was determined by examining the outer loading values for each indicator. Indicators with factor loadings greater than 0.60 are considered acceptable. Additionally, the Average Variance Extracted (AVE) should exceed 0.50, indicating that the construct explains more than 50% of the variance of its indicators. Internal consistency was assessed using Cronbach's Alpha and Composite Reliability (CR), with recommended values above 0.70.

All indicators show loading values above 0.60, indicating good convergent validity. The highest loading is found in EMS1 (0.883) and the lowest in SR2 (0.631), both of which meet the minimum threshold. This confirms that the indicators are sufficiently representative of their respective constructs.

**Table 1. Outer Loadings of Constructs and Indicator**

Variable	Indicator	Factor Loadings	Description
Green Curriculum (X1)	GC 1	0.756	Valid
	GC 2	0.680	Valid
	GC 3	0.742	Valid
	GC 4	0.663	Valid
	GC 5	0.697	Valid
Environmental Management System (X2)	EMS 1	0.883	Valid
	EMS 2	0.765	Valid
	EMS 3	0.668	Valid
	EMS 4	0.744	Valid
Sustainable Research (X3)	SR1	0.740	Valid
	SR 2	0.631	Valid
	SR 3	0.891	Valid
	SR 4	0.777	Valid
	SR 5	0.780	Valid
	SR 6	0.822	Valid
Environmental & Institutional Performance (Y)	EIP 1	0.766	Valid
	EIP 2	0.735	Valid
	EIP 3	0.653	Valid
	EIP 4	0.689	Valid
	EIP 5	0.698	Valid
	EIP 6	0.879	Valid
	EIP 7	0.675	Valid
	EIP 8	0.692	Valid
	EIP 9	0.795	Valid

**Table 2. Validity & Reliability**

Construct	Cronbach's Alpha	Composite Reliability (Rho_A)	Composite Reliability (Rho_C)	AVE
Environmental & Institutional Performance (Y)	0,992	0,926	0,992	0.545
Green Curriculum (X1)	0,837	0,836	0,834	0.502
Environmental Management System (X2)	0,898	0,907	0,901	0.605
Sustainable Research (X3)	0,854	0,860	0,851	0.591

The results indicate that all constructs meet the criteria for convergent validity and internal consistency. All AVE values are above 0.50, and all CR values exceed 0.80, signifying strong internal reliability for all variables.

**4.2. Assessment of Construct Validity and Reliability (Outer Model)**

Interpretation of inner model The interpretation of the inner model is to measure how the influence between latent variables are strong. Here, we compare the t-statistics and p-values

of the bootstrapping results. Furthermore, Predictive power of the model on dependent the variable is measured by R-squared ( $R^2$ ).

**Table 3. Results of Structural Model Assessment**

Sustainable Research → Environmental & Institutional Performance	6.7	0,000	Significant
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**Table 4. R Square Value**

R_square table		
	R-square	R-square adjusted
Environmental & Institutional Performance	0.916	0.909

### 4.3. Discussion

#### 4.3.1. The Role of Green Curriculum in Enhancing Environmental and Institutional Performance

The findings indicate that the green curriculum does not have a statistically significant effect on environmental and institutional performance, with a T-statistic of 0.759 and a P-value of 0.448 ( $p > 0.05$ ). This suggests that the implementation of green curriculum in private universities in East Java has not yet reached a level that produces measurable impacts on institutional effectiveness or environmental outcomes.

These results differ from a number of previous studies, which reported that incorporating sustainability elements into the curriculum can enhance academic reputation, increase students' environmental awareness, and strengthen institutions' competitive advantage. Two key explanations may account for this discrepancy. First, the adoption of green curricula in many private universities remains partial and inconsistent, often limited to isolated courses rather than embedded systematically across programs. Second, there is currently no standardized national evaluation framework linking green curriculum implementation to measurable institutional and environmental performance indicators.

Transforming curricula to be sustainability-oriented is a complex and long-term process that requires alignment of academic content, teaching methods, evaluation mechanisms, and stakeholder involvement. A prescriptive curriculum that lacks practical implementation strategies and measurable outputs will likely fail to yield significant results. For this reason, universities should develop more practically oriented and outcome-based green curriculum guidelines, focusing not only on knowledge transfer but also on behavioral change, environmental problem-solving, and alignment with SDG 4 (Quality Education) and SDG 13 (Climate Action).

#### 4.3.2 The Impact of Environmental Management Systems on Environmental and Institutional Performance

Similarly, the results show that Environmental Management Systems (EMS) do not exert a statistically significant impact on environmental and institutional performance, with a T-statistic of 0.936 and a P-value of 0.349 ( $p > 0.05$ ). This finding contrasts with earlier studies such as Iraldo et al., which found positive associations between EMS adoption, operational efficiency, and institutional performance. However, it is consistent with Putrantomo's [20] observation that despite growing environmental awareness, the implementation of systematic

environmental management in Indonesian private universities remains limited, mainly due to resource constraints.

The lack of significant impact may be attributed to the fragmented and underdeveloped EMS implementation in many private universities. EMS practices, if they exist, are often not fully integrated into organizational culture or strategic decision-making processes. Consequently, their effects on environmental performance such as waste reduction, energy efficiency, or carbon footprint mitigation are not yet substantial.

This suggests that for EMS to contribute meaningfully to performance, universities need to move beyond compliance-based approaches and adopt strategic, organization-wide environmental management systems. When properly implemented, EMS can become a crucial tool for advancing SDG 11 (Sustainable Cities and Communities) by fostering sustainable campus operations and environmental governance.

### **4.3.3 The Impact of Sustainable Research on Environmental and Institutional Performance**

The SEM-PLS analysis reveals that sustainable research programs are the only sustainability strategy with a statistically significant effect on environmental and institutional performance, with a T-statistic of 6.7 and a P-value of 0.000 ( $p < 0.05$ ). This finding is consistent with Rampasso et al. [4] and Sari, who highlighted the central role of research in driving innovation and advancing sustainability practices in higher education institutions.

Sustainable research generates new knowledge, innovative solutions, and best practices that can be directly applied to campus operations such as renewable energy projects, waste reduction initiatives, and climate adaptation strategies or disseminated to external stakeholders. These research-driven innovations produce positive externalities beyond university boundaries, contributing both to institutional excellence and environmental improvements.

Moreover, strong research programs enable universities to play a leadership role in addressing local and global sustainability challenges, reinforcing their contribution to SDG 4 (through knowledge creation), SDG 11 (through sustainable community development), and SDG 13 (through climate action research).

#### **4.3.3.1. Integrating Sustainability Indicators and SDGs**

These indicators are not merely technical measures; they represent concrete steps through which universities can operationalize sustainability commitments and contribute to broader environmental goals. By integrating green curriculum, EMS, and sustainable research, universities can influence these indicators directly and indirectly.

From a theoretical perspective, the results highlight that research programs play a pivotal role in driving both environmental and institutional performance. This aligns with previous studies indicating that universities with strong sustainability-oriented research tend to develop innovative practices and exert broader societal impact. In contrast, green curriculum and EMS appear to have weaker direct effects, which may be due to uneven implementation, limited institutional resources, or the time lag between educational initiatives and measurable performance outcomes.

The discussion becomes more meaningful when interpreted through the lens of the Sustainable Development Goals (SDGs). The adoption of sustainability strategies in private universities contributes to SDG 4 (Quality Education) by embedding sustainability principles into teaching, thereby producing environmentally literate graduates. It supports SDG 11 (Sustainable Cities and Communities) through waste reduction, energy efficiency, and sustainable infrastructure practices that influence surrounding communities. Moreover, through research and EMS initiatives, universities advance SDG 13 (Climate Action) by

contributing to carbon reduction, climate adaptation strategies, and environmental governance.

These findings underscore the strategic role of private universities in East Java as drivers of environmental sustainability and SDG achievement. While sustainable research currently shows the most significant measurable impact, the combined implementation of all three strategies education, management, and research holds the potential to amplify environmental outcomes and enhance institutional resilience. The results also indicate a need for stronger policy support, capacity building, and integrative planning to ensure that green curriculum and EMS can produce measurable impacts comparable to research initiatives.

**Table 5. Environmental Performance Indicators**

Indicator	Description	Implementation
Energy efficiency	Reduction of electricity consumption per capita	Smart lighting systems, solar panels
Waste management	Percentage of total waste recycled or composted	Campus recycling programs, waste segregation
Carbon footprint	Annual CO <sub>2</sub> emissions reduction from campus operations	Green transportation, renewable energy
Resource conservation	Efficient use of water and paper	Paperless systems, grey water reuse

These indicators are not merely technical measures; they represent concrete steps through which universities can operationalize sustainability commitments and contribute to broader environmental goals. By integrating green curriculum, EMS, and sustainable research, universities can influence these indicators both directly and indirectly.

From a theoretical perspective, the results highlight that sustainable research programs play a pivotal role in driving both environmental and institutional performance. This aligns with previous studies indicating that universities with strong sustainability-oriented research tend to develop innovative practices and exert broader societal impact [17], [18]. In contrast, green curriculum and EMS appear to have weaker direct effects, which may be attributed to uneven implementation, limited institutional resources, or the time lag between educational initiatives and measurable performance outcomes.

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These findings underscore the strategic role of private universities in East Java as drivers of environmental sustainability and SDG achievement. While sustainable research currently shows the most significant measurable impact, the combined implementation of all three strategies education, management, and research has the potential to amplify environmental outcomes and strengthen institutional resilience. The results also point to the need for stronger policy support, capacity building, and integrative planning to ensure that green curriculum and EMS can deliver measurable impacts comparable to research initiatives.

#### **4.3.4 Implications for Practice and Research**

This research offers several practical and academic implications:

- a. Universities should prioritize the development of sustainable research programs by allocating adequate budgets, incentives, and facilities. This includes fostering interdisciplinary research and encouraging collaborations focused on sustainability challenges.

- b. Sustainable research should be integrated into institutional strategic planning, ensuring alignment with long-term visions and environmental performance goals.

- c. Collaboration with industry, government, and civil society should be strengthened to enhance the relevance, impact, and applicability of sustainability research outcomes.

- d. For green curriculum and EMS, institutions need clearer implementation roadmaps and performance indicators to ensure these strategies produce measurable environmental outcomes.

#### **4.3.5 Research Limitations**

This study has several limitations. The research sample is geographically limited to private universities in East Java, and the number of respondents is relatively small. Future research should expand the geographical scope to include other regions and potentially adopt a mixed-methods design to capture qualitative insights into sustainability strategies. Additionally, longitudinal studies could provide valuable information on how the impact of green curriculum, EMS, and sustainable research evolves over time, particularly in relation to environmental performance and SDG achievements.

## **5 Conclusion**

This study examined the relationship between three key sustainability strategies green curriculum, Environmental Management Systems (EMS), and sustainable research programs and both institutional and environmental performance in private universities in East Java. Using a quantitative approach and SEM-PLS analysis, the findings reveal that among these three strategies, only sustainable research programs have a positive and statistically significant effect on university performance. Green curriculum and EMS, while conceptually and strategically important, did not show significant direct effects in this sample, indicating that their implementation and measurable impact may still be at an early stage.

The results also emphasize that sustainability strategies contribute not only to institutional performance but also to environmental outcomes. Through curriculum initiatives, universities foster environmental literacy and behavioral change. EMS adoption provides structured environmental management mechanisms, while sustainable research generates innovative solutions to pressing environmental challenges. Collectively, these strategies align with and support the achievement of SDG 4 (Quality Education), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action).

From a practical perspective, the study highlights the strategic role of private universities as active contributors to environmental sustainability and SDG implementation. Strengthening sustainable research programs should remain a priority, as they currently drive the most significant measurable impact. However, the integration of green curriculum and EMS is equally essential to build a comprehensive sustainability framework. This requires stronger institutional commitment, policy support, and capacity building to ensure that all three strategies operate synergistically. For future research, broader geographic coverage and longitudinal designs are recommended to capture changes over time and differences across regions. Incorporating additional variables such as green leadership, sustainability culture, or stakeholder engagement could provide deeper insights into the mechanisms through which universities can enhance their environmental and institutional performance.

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