

Research Article

Embedding the SDGs in higher education institutions: A hierarchical regression analysis of governance factors and university sustainability

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Sustainability in higher education increasingly depends on governance and institutional strategies aligned with the sustainable development goals. Examining how leadership commitment, policy alignment, institutional adaptability, stakeholder engagement, and organizational culture shape university sustainability is essential for promoting sustainable academic environments. This study explores the individual and combined impacts of these factors on university sustainability across social, economic, and environmental dimensions using hierarchical regression analysis. A cross-sectional survey was conducted with 2,167 participants. Data were gathered using the researcher-developed Governance Variables and University Sustainability Scale, validated to ensure sound psychometric properties. Hierarchical regression analyses assessed the relative and combined effects of the predictors. The results reveal that policy alignment is the most influential factor for social and overall sustainability, while institutional adaptability and stakeholder engagement predominantly drive economic sustainability. Stakeholder engagement emerged as the key determinant of environmental sustainability. Leadership commitment served as a foundational influence but diminished in significance when other variables were considered. Organizational culture made incremental contributions and, in some cases, exhibited negative effects depending on the sustainability dimension. Universities should focus on coherent policy implementation, adaptable governance structures, stakeholder engagement, and a sustainability-oriented organizational culture to achieve multidimensional sustainability. The study offers new insights by conceptualizing these factors as interrelated drivers of university sustainability and highlighting the importance of systemic strategies.

Keywords: Higher education governance; Policy alignment; Stakeholder engagement; Sustainable development goals; University sustainability

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1. Introduction

The 2030 Agenda for Sustainable Development positions higher education institutions [HEIs] as pivotal actors in advancing global sustainability. As centres of knowledge production, innovation, and societal engagement, universities are uniquely situated to generate research, cultivate future

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leaders, and model sustainable practices capable of addressing complex environmental, social, and economic challenges (UNESCO, 2020). In the twenty-first century, sustainability has therefore become a strategic priority in global higher education, underscoring the heightened expectations placed on universities to contribute meaningfully to both local and global development agendas. Through their core mandates of teaching, research, and community service, universities influence societal values, expand knowledge on sustainability issues, and create pathways for long-term transformation (Findler et al., 2019; Lozano, 2018).

University sustainability goes beyond symbolic declarations or isolated green initiatives. It reflects the capacity of HEIs to embed sustainable development principles into their governance processes, curriculum design, research agendas, operational practices, and stakeholder interactions (Chankseliani & McCowan, 2021). This holistic orientation links internal institutional reforms with broader societal responsibilities, enabling universities not only to advance the Sustainable Development Goals [SDGs] but also to strengthen institutional resilience in contexts marked by political instability, economic shocks, and environmental uncertainties (Leal Filho et al., 2019). Such integration equips universities to respond effectively to emerging global disruptions, including climate change, pandemics, technological transitions, and widening inequalities.

Evidence across global higher education systems demonstrates that sustainability integration yields substantial academic, social, and operational benefits. Academically, universities that embed sustainability into teaching and learning foster interdisciplinary thinking, creativity, and problem-solving skills, preparing students to engage with real-world sustainability challenges (Hesselbarth & Schaltegger, 2014). Research contributions on sustainable technologies, environmental governance, and community-based innovations guide policymaking and promote equitable development (Findler et al., 2019). Operationally, institutions that adopt sustainable practices often experience reduced energy consumption, minimized waste, improved water management, and enhanced campus efficiency (Disterheft et al., 2015). These practices strengthen institutional stability while improving reputation and legitimacy, which in turn attract partnerships, funding, and international recognition (Lozano et al., 2015). Moreover, through community engagement and stakeholder partnerships, universities co-create locally relevant solutions that promote social inclusion and accelerate sustainable development (Leal Filho et al., 2019).

Despite this global progress, the transition toward sustainability in the Global South—particularly within Nigeria—remains constrained by persistent structural and systemic challenges. Nigerian universities continue to face chronic underfunding, which undermines efforts to improve infrastructure, strengthen research capacity, and support innovative teaching approaches required for sustainability-oriented transformation (Ofoegbu & Alonge, 2016). Weak governance structures and inconsistent leadership further constrain the implementation of sustainability initiatives, resulting in fragmented efforts and limited institutional coherence (Abubakar et al., 2019). Infrastructure deficits such as unstable electricity supply, inadequate classroom and laboratory facilities, and outdated digital technologies hinder the adoption of sustainable operational practices and the development of smart campus systems (UNESCO, 2021). Policy misalignments between national frameworks and institutional mandates also impede curriculum reform and organizational transformation, particularly where research priorities, funding mechanisms, and institutional responsibilities remain poorly coordinated (Fosci et al., 2019). In addition, human resource challenges—including staff shortages, limited professional development opportunities, and ongoing brain drain—reduce universities' capacity to champion sustainability reforms (Awe et al., 2022). Equally, insufficient stakeholder collaboration restricts opportunities for co-creating contextually relevant solutions that address local sustainability needs (Leal Filho et al., 2019). These constraints highlight the need for governance mechanisms tailored to Nigeria's unique higher education landscape.

A review of existing scholarship reveals that although sustainability in higher education has received considerable attention, significant gaps remain in understanding how governance factors shape sustainability outcomes in developing countries. Research by Lozano et al. (2015) and

Lozano (2018) demonstrates that many universities adopt sustainability rhetorically without achieving meaningful institutional integration, largely due to entrenched organizational cultures and slow change processes. Conceptual frameworks developed by Findler et al. (2019) provide valuable guidance but focus mainly on theoretical constructs rather than empirical validation in resource-constrained environments. Other studies have examined participatory approaches (Disterheft et al., 2015), leadership and grassroots dynamics (Brinkhurst et al., 2011), curriculum reform (Figueiró & Raufflet, 2015), and business school initiatives (Hesselbarth & Schaltegger, 2014), yet these investigations predominantly reflect well-resourced settings with governance systems that differ considerably from those found in Nigeria. Studies from other developing contexts, such as Saudi Arabia (Abubakar et al., 2019), offer useful insights but cannot be directly applied to the Nigerian system due to differences in governance culture, funding patterns, and national priorities. Overall, the literature highlights the importance of leadership, participation, and curriculum reform but offers inadequate explanation of how governance variables interact to determine sustainability performance.

These limitations underscore a critical empirical gap: the combined influence of leadership commitment, policy coherence, institutional adaptability, stakeholder engagement, and organizational culture on university sustainability remains underexplored, particularly within Nigeria. While most studies isolate one or two governance variables, few have examined how these dimensions collectively contribute to or hinder sustainability transformations (Findler et al., 2019; Leal Filho et al., 2019). Addressing this gap is essential for developing integrative strategies that move beyond symbolic compliance toward meaningful institutional transformation.

Accordingly, the aim of this study is to examine the influence of governance factors—leadership commitment, policy alignment, institutional adaptability, stakeholder engagement, and organizational culture—on university sustainability, with the goal of informing policy and institutional practices in Nigerian higher education. The aim is to develop a comprehensive governance model capable of guiding evidence-based reforms that strengthen the sustainability performance of HEIs in resource-constrained contexts. The research is guided by the following questions:

RQ 1) What is the percentage contribution of leadership commitment, policy alignment, institutional adaptability, stakeholder engagement, and organizational culture to university sustainability?

RQ 2) What is the combined effect of these governance factors on university sustainability outcomes?

RQ 3) What is the relative impact of each governance factor on university sustainability, and what are the implications for policy and institutional practice?

2. Literature Review

2.1. Leadership Commitment and University Sustainability

Leadership commitment in higher education refers to the sustained dedication of university leaders to embedding sustainability across governance, operations, and academic culture. This commitment is expressed through a clearly articulated long-term vision, the allocation of financial and human resources, policy reforms, and the creation of institutional incentives that convert sustainability discourse into tangible outcomes (Lozano et al., 2015). Within universities, leadership commitment is regarded as indispensable for advancing environmental, social, and governance [ESG] dimensions of sustainability. These dimensions include minimizing ecological footprints, fostering equity and inclusion, ensuring financial resilience, and aligning institutional strategies with the Sustainable Development Goals (Findler et al., 2019). In the absence of genuine leadership commitment, sustainability initiatives risk becoming largely symbolic—confined to declarations, charters, and mission statements without meaningful implementation (Leal Filho et al., 2019). This raises important concerns about the gap between rhetoric and action, especially in institutions where leadership renewal is frequent and visions shift with administrative changes.

A growing body of empirical evidence underscores the decisive role of leadership in shaping sustainability outcomes in higher education. For instance, Lozano et al. (2015), in a global survey, found that visible and consistent support from senior leadership strongly predicted the extent to which sustainability was integrated into research, teaching, and campus operations. Similarly, Disterheft et al. (2015) demonstrated through case studies that participatory sustainability programs achieved greater success when leaders provided enabling conditions such as adequate funding, time allowances, and interdepartmental coordination. Extending this argument, Brinkhurst et al. (2011) emphasized the importance of distributed leadership, showing that sustainability gains were maximized when responsibilities were shared among faculty, administrators, and middle managers rather than concentrated at the top. Taken together, these studies suggest that leadership effectiveness is not merely a function of positional authority but also of the relational and collaborative processes that allow sustainability values to permeate institutional culture. However, they offer limited insight into how leaders navigate conflicting priorities—such as balancing revenue generation with sustainability investments—or the political dynamics that may constrain decision-making.

Subsequent studies in different contexts have reinforced these observations. Leal Filho et al. (2019) reported that leadership vision and perseverance were strongly associated with progress on sustainability initiatives in international universities, though their impact was often moderated by resource availability. Abubakar et al. (2019), in the case of Saudi universities, found that well-structured governance frameworks enhanced sustainability outcomes, suggesting that leadership operates most effectively within supportive institutional systems. In Nigeria, Habeeb and Eyupoglu (2024) demonstrated that transformational leadership improved organizational performance through effective strategic planning, while Nnaji and Unamba (2024) showed that transformational leadership practices positively influenced sustainability across research, teaching, and community engagement. However, most of these studies stop short of examining whether leadership commitments translate into long-term structural transformation or remain dependent on individual leaders whose initiatives may not survive administrative turnover. This raises questions about sustainability continuity in fragile higher education ecosystems, particularly in Africa, where leadership instability, political interference, and erratic funding cycles often disrupt institutional reforms.

Moreover, African universities operate in contexts characterized by weak infrastructure, fluctuating budgets, and vulnerability to ecological and socio-political shocks—including flooding, heat stress, institutional strikes, and policy inconsistencies. These fragile ecosystems heighten the importance of leadership commitment, because sustainability initiatives depend on resilient governance, long-term commitment, and strategically coordinated action, especially where fragility complicates implementation (Maccioni et al., 2024). In such environments, leadership must negotiate not only resource scarcity but also cultural resistance, limited autonomy, bureaucratic delays, and inadequate government support. This makes leadership commitment more complex and more consequential in Africa than in well-resourced contexts.

Despite this evidence, important gaps persist in the literature. Many studies equate leadership commitment with rhetorical or symbolic support—such as public statements—while neglecting more substantive indicators like budgetary allocations, structural reforms, or policy innovations. In addition, much of the research has been conducted in well-resourced settings, while empirical studies in resource-constrained contexts, particularly in the Global South, remain limited. Furthermore, few investigations comprehensively evaluate sustainability outcomes across ecological, social, and economic dimensions, instead using narrow or generalized measures of institutional performance. More critically, the literature rarely explores how leadership interacts with other governance variables—such as policy coherence, institutional adaptability, stakeholder engagement, and organizational culture—to produce sustainability outcomes. This fragmentation limits understanding of the collective dynamics that shape sustainable transformation.

Addressing these shortcomings requires research that not only conceptualizes leadership

commitment more rigorously but also analyses it within the realities of African higher education systems, where institutional fragility complicates sustainability implementation. Such analysis must account for interdependencies among governance factors and adopt multidimensional measures that reflect the complexity of sustainability in contexts like Nigeria.

2.2. Policy Alignment and University Sustainability

Policy alignment in higher education refers to the degree of coherence between an institution's strategic plans, governance structures, and operational practices in advancing sustainability. Rather than viewing sustainability as a set of discrete activities, alignment emphasizes holistic integration across teaching, research, infrastructure development, and community engagement. When policies reinforce one another, institutions can institutionalize sustainability values and avoid the fragmentation that often undermines long-term progress. Conversely, misaligned policies frequently result in symbolic commitments that lack operational depth, a pattern noted in several higher education systems (Wright, 2010).

Empirical studies consistently show that policy coherence is central to transforming sustainability aspirations into measurable outcomes. Velázquez et al. (2005), for example, demonstrated that Mexican universities with integrated sustainability policies embedded environmental principles more effectively into teaching and campus operations than institutions with disconnected frameworks. Similarly, Stephens et al. (2008) found that American universities with aligned policies strengthened institutional innovation and stakeholder participation, illustrating how coherent policy environments can serve as catalysts for change. These studies collectively suggest that sustainability becomes transformative only when it is supported by interconnected and mutually reinforcing institutional policies, highlighting the importance of examining alignment not in isolation but in relation to leadership, culture, and stakeholder engagement.

However, a more critical reading of the literature reveals gaps. Much of the existing work assumes that policy coherence naturally leads to sustainability success, yet the mechanisms through which alignment shapes institutional behaviour remain underexplored. For instance, several studies do not fully interrogate how policy alignment interacts with leadership commitment—even though leaders are responsible for interpreting policies, allocating resources, and motivating compliance. Barth and Rieckmann (2012) acknowledge that sustainability policies provide legitimacy for leadership action, but they do not evaluate how misalignment can constrain leaders or create contradictory expectations for staff and students. Likewise, Kapitulčinová et al. (2018) show that aligned European university policies improve teaching and research outcomes, but the broader governance and cultural conditions that make such alignment possible are not always addressed, which limits understanding of the contextual factors that mediate policy effectiveness.

A second gap concerns the limited attention to African universities, where institutional fragility deeply affects policy implementation. In many African contexts, higher education institutions operate within fragile ecosystems marked by inadequate infrastructure, fluctuating government funding, weak regulatory enforcement, and exposure to climate-related stressors such as flooding, heatwaves, and erosion. These conditions exacerbate policy fragmentation because policies often shift with political changes, donor priorities, or emergency responses. As recent research on African higher education shows, limited funding, political instability, and weak infrastructure make it difficult for universities to sustain coherent long-term sustainability and climate-related policies (Leal Filho et al., 2026). This suggests that policy alignment cannot be understood in isolation from the broader institutional and environmental constraints that shape implementation realities.

The literature on policy alignment remains largely descriptive, focusing more on policy content than on its practical interactions with leadership, organizational culture, or stakeholder engagement. A more integrated and context-sensitive analysis is needed, especially in African

higher education systems where sustainability is urgent yet governance frameworks remain uneven. Addressing these gaps will provide a more complete understanding of how aligned policies can support genuine institutional transformation.

2.3. Institutional Adaptability and University Sustainability

Institutional adaptability in higher education describes a university's ability to remain flexible in the face of internal and external challenges while pursuing long-term sustainability goals. Adaptability is particularly critical because higher education institutions must respond to evolving stakeholder expectations, technological advancements, financial constraints, and unpredictable global crises. A truly adaptive university not only embeds sustainability into existing operations but also modifies curricula, policies, and practices to meet new environmental, social, and governance demands (Amaral et al., 2015). When universities fail to adapt, their sustainability efforts risk stagnation, leaving institutions ill-equipped to manage disruptions such as pandemics, climate crises, or socio-political instability.

Scholars consistently emphasize the importance of adaptability in achieving sustainability outcomes. Shriberg and Harris (2012) observed that U.S. universities with flexible decision-making structures implemented sustainability programs more effectively than those constrained by rigid bureaucracies. Similarly, Ferrer-Balas et al. (2008) showed that European HEIs with adaptable frameworks better mainstreamed sustainability into curricula and campus life. These findings suggest that institutional flexibility not only strengthens operational innovation and resilience but also interacts with leadership commitment and policy alignment, creating conditions for sustainability initiatives to succeed. However, much of this literature remains descriptive, focusing on organizational structures without examining the mechanisms through which adaptability influences outcomes or its interdependencies with governance and stakeholder engagement.

Research also highlights the role of external pressures in shaping adaptability. Leal Filho et al. (2019) demonstrated that universities across continents adjusted sustainability agendas in response to policy changes, funding realities, and cultural conditions, which directly impacted initiative effectiveness. Kioupi and Voulvoulis (2019) emphasized that adaptability extends to pedagogy, as institutions incorporating flexible teaching methods better equip students with sustainability-related skills. This underscores that adaptability is both an organizational and educational strategy, linking administrative practices to human capital development and long-term institutional sustainability.

Despite its recognized importance, gaps remain in the literature, particularly regarding African universities operating within fragile ecosystems. These institutions often face weak infrastructure, resource scarcity, political interference, and environmental vulnerabilities such as flooding and heat stress. In such contexts, adaptability is constrained not only by limited financial and technological resources but also by governance instability and fragmented policy frameworks (Agyeman, 2005). Few studies examine how African universities integrate adaptability with leadership, policy alignment, and stakeholder engagement to produce measurable sustainability outcomes, highlighting a critical area for future research.

In sum, institutional adaptability is widely acknowledged as essential for sustainable higher education, yet evidence largely reflects well-resourced Western contexts. Understanding how adaptability operates in resource-constrained and fragile African higher education ecosystems, and how it interacts with other governance dimensions, is crucial for developing practical strategies that ensure long-term institutional resilience and sustainability.

2.4. Stakeholders' Engagement and University Sustainability

Stakeholder engagement in higher education refers to the deliberate inclusion of both internal groups—such as faculty, students, and administrators—and external partners like alumni, industry, government, and local communities in shaping institutional sustainability efforts. At its core, this approach recognizes that sustainability cannot be achieved through isolated actions but requires shared ownership, dialogue, and joint knowledge production. Universities are more likely

to embed sustainability comprehensively when stakeholder perspectives are integrated into institutional policy, teaching practices, and community-oriented learning environments. Participation can strengthen responsiveness to diverse social and institutional expectations by connecting sustainability initiatives with local communities, external agents, interdisciplinary collaboration, and the practical contexts in which sustainability challenges are experienced (Rekalde-Rodríguez, 2026). However, stakeholder engagement should not be treated as an isolated driver; it becomes more meaningful when aligned with leadership commitment, coherent policy frameworks, institutional resources, and adaptive strategies that support sustained implementation (Ajani, 2024; Rekalde-Rodríguez, 2026).

Empirical findings highlight the tangible benefits of broad-based stakeholder participation. Stephens et al. (2008) showed that U.S. universities involving multiple actors in governance processes designed stronger sustainability policies and adopted more innovative solutions than those relying solely on top-down directives. Mochizuki and Fadeeva (2010) similarly demonstrated that Asian universities collaborating closely with community partners translated abstract global sustainability agendas into meaningful local action. Critically, these studies indicate that stakeholder engagement functions not only as an operational mechanism but also as a bridge linking institutional policies, leadership vision, and adaptive practices, enabling more resilient and context-sensitive sustainability outcomes.

Stakeholder involvement also strengthens interdisciplinary learning and knowledge integration. Lukman et al. (2010) observed that sustainability challenges are inherently complex and require cross-disciplinary collaboration, facilitated by active stakeholder participation in curriculum reform and research. Barth and Rieckmann (2012) emphasized that stakeholder dialogue develops competencies for sustainability, equipping students with practical skills while simultaneously fostering systemic institutional change. This dual role underscores that engagement operates as both a governance tool and an educational strategy, enhancing the long-term sustainability of universities when effectively coordinated with leadership and adaptable institutional structures.

Despite these advantages, limitations persist. Wright and Wilton (2012) caution that participation is often tokenistic, with stakeholders consulted superficially rather than engaged as equal partners, reproducing existing hierarchies. Lozano et al. (2013) similarly noted that universities often reference stakeholder inclusion in documents without establishing sustained collaborative platforms. These challenges are particularly pronounced in African and other Global South contexts, where fragile ecosystems – including weak institutional capacity, resource scarcity, political interference, and environmental vulnerabilities – complicate meaningful engagement (Agyeman, 2005). In such settings, the effectiveness of stakeholder participation is heavily dependent on leadership support, coherent policies, and adaptive institutional practices.

Overall, the literature positions stakeholder engagement as a critical driver of sustainability in universities, yet its application remains uneven and under-theorized. Future research should focus on how African and resource-constrained universities can cultivate meaningful, sustained engagement, considering the interplay between governance structures, leadership, policy alignment, and institutional adaptability. Understanding these dynamics is essential for designing sustainability initiatives that are both equitable and contextually relevant.

2.5. Organizational Culture and University Sustainability

Organizational culture is increasingly recognized as a pivotal factor in advancing sustainability within higher education institutions. It encompasses shared assumptions, values, and practices that shape collective behavior and institutional decision-making. In universities, culture determines how sustainability is framed, prioritized, and operationalized across teaching, research, and administrative functions (Bertels et al., 2010). A culture that fosters collaboration, ethical responsibility, and environmental stewardship provides the conditions for systemic change, while rigid, hierarchical, or compliance-oriented cultures can constrain the translation of

sustainability policies into tangible outcomes. In this sense, culture functions as the foundation upon which leadership, policy alignment, and stakeholder engagement either succeed or fail in promoting sustainability (Schein & Schein, 2017).

Empirical studies demonstrate culture's significant influence on sustainability outcomes. Velázquez et al. (2005) found that universities where environmental values were deeply embedded in organizational culture successfully mainstreamed sustainability into governance, curricula, and outreach. Kreber (2010) similarly noted that integrating sustainability principles into daily practices of students and staff allows sustainability to transcend formal policies and become part of the institutional identity. Conversely, Dagiliūtė et al. (2018) showed that fragmented cultures tied to disciplinary silos or isolated initiatives limit universities' ability to implement holistic sustainability programs, highlighting how culture interacts with leadership commitment and institutional adaptability to either amplify or weaken outcomes.

Comparative studies further reveal the role of culture in different contexts. Jones et al. (2010) observed that UK universities with inclusive, participatory cultures achieved deeper sustainability integration than those with compliance-driven environments. In contrast, Filho et al. (2015) highlighted challenges in Global South institutions, where entrenched governance traditions, bureaucratic inertia, and resource limitations often obstruct cultural shifts. These examples illustrate that organizational culture does not operate in isolation; its effectiveness depends on supportive leadership, coherent policy frameworks, engaged stakeholders, and adaptive institutional structures.

Despite its importance, organizational culture remains underexplored and inconsistently measured. Wals (2014) noted that most research relies on qualitative perceptions, limiting comparability across institutions. Moreover, the majority of studies focus on Europe and North America, leaving cultural dynamics in African and other Global South contexts underrepresented. In Africa, universities often operate within fragile ecosystems characterized by limited resources, political instability, and infrastructural weaknesses, making cultural alignment both more challenging and more critical for sustaining change.

Future research should examine how specific cultural attributes—such as innovation, inclusiveness, and accountability—can be deliberately cultivated to institutionalize sustainability, and how these cultural factors interact with leadership, policy alignment, adaptability, and stakeholder engagement in resource-constrained contexts. Understanding these interdependencies is essential for moving beyond symbolic commitments toward systemic transformation in higher education.

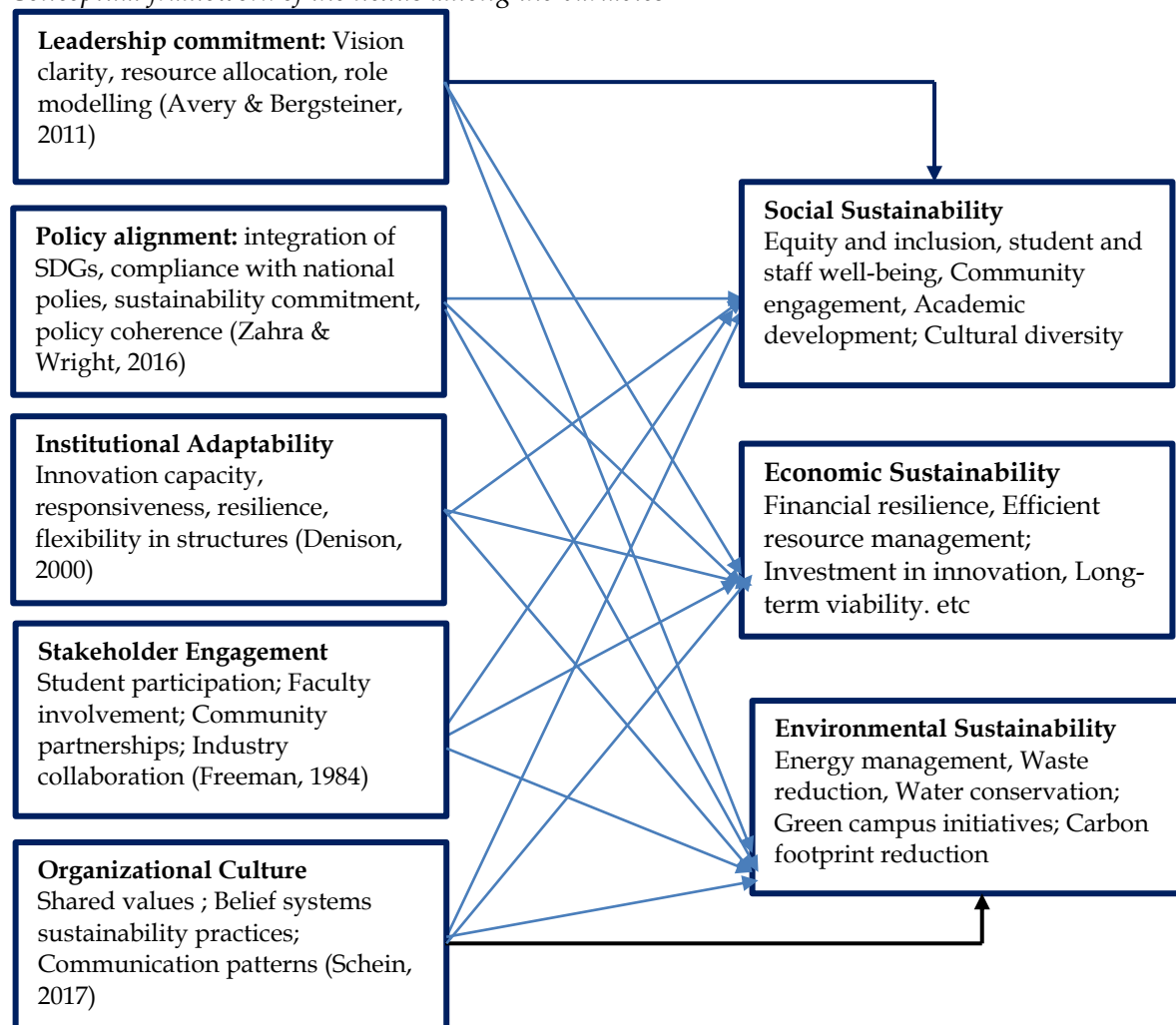
2.6. Conceptual / Theoretical Framework

This study conceptualizes university sustainability as a multidimensional construct encompassing ecological, social, economic, and institutional resilience dimensions that shapes the long-term effectiveness and adaptability of higher education institutions (Lozano, 2011). Its outcomes are influenced by key governance factors: leadership commitment, policy alignment, institutional adaptability, stakeholder engagement, and organizational culture. This conceptualization is grounded in Institutional Theory (DiMaggio & Powell, 1983; Meyer & Rowan, 1977), which theorizes that organizations adopt structures, practices, and behaviors in response to both external pressures—such as regulatory demands, societal expectations, accreditation requirements, and global sustainability agendas—and internal imperatives, including legitimacy, operational coherence, and institutional norms. The assumptions of the theory posit that organizations seek legitimacy by conforming to institutionalized rules and that formal structures often reflect normative expectations rather than purely technical efficiency. The theory also assumes that internal governance mechanisms and organizational practices interact dynamically with external pressures, shaping both short-term performance and long-term resilience. The implication is that sustainability outcomes in universities are contingent upon the alignment between internal governance practices, institutional culture, and external legitimacy pressures.

Within this theoretical lens, leadership commitment shapes sustainability by signaling organizational priorities, allocating resources, and modeling behaviors that institutionalize environmentally and socially responsible practices. Policy alignment ensures that institutional strategies, curricula, and operational systems are coherent with national policies, accreditation standards, and global sustainability frameworks, transforming rhetoric into actionable initiatives. Institutional adaptability enables universities to respond flexibly to changing ecological, technological, social, and financial conditions, sustaining progress despite resource constraints or environmental shocks. Stakeholder engagement operationalizes legitimacy by incorporating the perspectives of faculty, students, communities, industry partners, and government actors, ensuring that sustainability efforts are inclusive, contextually relevant, and accountable. Finally, organizational culture embeds sustainability values into shared assumptions, norms, and daily practices, reinforcing the effectiveness of leadership, policy, adaptability, and engagement mechanisms. Collectively, these linkages illustrate the multidimensional pathways through which governance factors drive university sustainability, providing a coherent framework to guide both analysis and interpretation of findings.

Figure 1

Conceptual framework of the nexus among the variables



3. Methodology

3.1. Research Design

The study was grounded in the positivist paradigm, which stresses objectivity, quantification, and generalizability. Within this framework, a cross-sectional survey design was employed because it

allowed quantitative data to be gathered from a large population at a single point in time. This design was suitable for identifying relationships among leadership commitment, policy alignment, institutional adaptability, stakeholder engagement, organizational culture, and university sustainability. It further enabled reliable inference from the sampled institutions while ensuring cost-effectiveness and time efficiency.

3.2. Area of the Study

The research was carried out in Nigeria's South-South geopolitical zone, which comprises Akwa Ibom, Bayelsa, Cross River, Delta, Edo, and Rivers states. This region is economically vital due to its oil resources, cultural diversity, and growing higher education sector. It hosts federal, state, and private universities serving diverse student populations, making it an appropriate setting for examining sustainability practices. Altogether, 31 accredited public and private universities were included in the study scope.

3.3. Participants

The target population consisted of 43,331 individuals across the 31 universities: 78 administrators, 19,821 academic staff, and 23,432 non-academic staff. These groups were chosen because of their direct or indirect roles in decision-making, teaching, and support services influencing sustainability. A multistage sampling method was adopted. First, universities were stratified by type (federal, state, and private). From each stratum, a 5% proportional sample was drawn, resulting in 2,167 respondents. Finally, purposive sampling identified participants actively engaged in sustainability-related processes such as policy development, implementation, and monitoring. Of the 2,167 respondents, 1,302 (60.1%) were male and 865 (39.9%) females. By age, 497 (22.9%) were under 30, 1,193 (55.1%) between 30–50, and 477 (22.0%) above 50. In terms of work experience, 687 (31.7%) had less than 10 years, 982 (45.3%) between 10–20 years, and 498 (23.0%) more than 20 years. These characteristics ensured perspectives from both younger and older staff with varied institutional experience and are presented in Table 1.

Table 1
Demographic Characteristics of Respondents (n = 2,167)

<i>Characteristics and categories</i>	<i>Frequency</i>	<i>Percentage</i>
Staff Category		
Administrators	4	0.2%
Academic Staff	991	45.7%
Non-Academic Staff	1,172	54.1%
Gender		
Male	1,302	60.1%
Female	865	39.9%
Age (years)		
Under 30	497	22.9%
30–50	1,193	55.1%
Above 50	477	22.0%
Work Experience		
Less than 10 years	687	31.7%
10–20 years	982	45.3%
More than 20 years	498	23.0%

3.4. Instrumentation

The instrument for the study was a researcher-developed questionnaire titled the *Governance Variables and University Sustainability Scale* [GVUSS], designed to capture demographic details, governance variables, and sustainability outcomes. The first section gathered background information such as gender, age, marital status, and work experience. These demographic items were structured on categorical scales with exclusive response options, and the section also

included a consent form where respondents affirmed their voluntary participation before proceeding with the questionnaire.

The second section consisted of 25 items measuring the independent variables of the study, grouped into five constructs. Leadership commitment was operationalized as the extent to which university leaders demonstrate dedication to sustainability through vision, resource allocation, and accountability. This was measured with items such as, "University leaders provide resources to support sustainability programs." Policy alignment captured the degree to which institutional policies correspond with global, national, and internal sustainability frameworks, with items like, "University policies are aligned with national sustainability goals." Institutional adaptability was defined as the university's capacity to respond to emerging sustainability challenges through innovation and learning, illustrated by items such as, "Our university adjusts quickly to new sustainability demands." Stakeholder engagement reflected the involvement of students, staff, and external partners in sustainability initiatives, with sample items like, "Students are encouraged to take part in sustainability activities." Organizational culture represented the shared values and practices that shape institutional commitment to sustainability and was measured with items such as, "Sustainability is part of the values shared in this university." All items in this section were rated on a four-point Likert scale ranging from *Strongly Agree* to *Strongly Disagree*.

The third section comprised 15 items measuring university sustainability across three dimensions: social, economic, and environmental. Social sustainability referred to practices promoting equity, inclusiveness, and well-being, measured with items like, "The university promotes fairness and inclusiveness." Economic sustainability assessed resource efficiency and financial stability, with items such as, "The university uses resources in a cost-effective way." Environmental sustainability focused on ecological responsibility, illustrated by items like, "The university encourages recycling and waste reduction." These items were also rated on a four-point Likert scale from *Strongly Agree* to *Strongly Disagree*.

3.5. Validity of the Instrument

The *Governance Variables and University Sustainability Scale* underwent rigorous content validation by a panel of six experts specializing in higher education, sustainability, and educational measurement. Each expert independently assessed the relevance of the items to their corresponding constructs using a four-point scale (1 = not relevant to 4 = highly relevant). Results indicated strong precision, with Item-level Content Validity Index [I-CVI] values ranging from .83 to 1.00 and a Scale-level Content Validity Index [S-CVI] of .91, demonstrating clarity and lack of ambiguity in the items. Accuracy was also established, with I-CVI values between .80 and .95 and an S-CVI of .89, confirming that the items were consistent with their conceptual definitions. Representativeness was validated as well, with I-CVI scores ranging from .82 to .96 and an overall S-CVI of .90, indicating comprehensive coverage of all constructs. In addition to expert evaluation, the instrument was subjected to a pilot test with 150 respondents drawn from universities outside the main study sample. Findings from this pre-test are presented in Table 1.

3.6. Procedure for Data Collection

Before commencing data collection, ethical clearance was secured from the Institutional Review Board of Alex Ekwueme Federal University, Ndufu-Alike (Approval No. IRB/FUNAI/2025/01928). All procedures adhered to established ethical standards, including voluntary participation, informed consent, confidentiality, and the assurance of respondent anonymity. To support the administration of the instrument, ten research assistants were recruited from both academic and non-academic staff across the universities in the South-South geopolitical zone. Their selection ensured institutional familiarity and representativeness. A comprehensive training session was organized and coordinated through a dedicated Telegram group, which facilitated real-time communication and engagement. The training focused on the objectives of the study, ethical considerations, administration procedures, and approaches for clarifying respondents' queries.

The *Governance Variables and University Sustainability Scale* was administered electronically using a secure survey link. Questionnaires were distributed through official WhatsApp groups of academic and non-academic staff to safeguard access and ensure participation only from eligible respondents. Out of 2,167 questionnaires disseminated, 2,010 were returned, and following data screening, 1,998 were retained for analysis, with incomplete or inconsistent responses excluded. These valid responses formed the basis for subsequent model specification and statistical analysis.

3.7. Models' Specification

The hierarchical models of this study were specified as follows:

Model 1: SS = β LC + ε (R^2).	(1)
Model 2: SS = β LC + β PA + $\varepsilon R^2(R^2, \Delta R^2)$.	(2)
Model 3: SS = β LC + β PA + β IA + ε ($R^2, \Delta R^2$).	(3)
Model 4: SS = β LC + β PA + β IA + β SE + ε ($R^2, \Delta R^2$).	(4)
Model 5: SS = β LC + β PA + β IA + β SE + β OC + ε ($R^2, \Delta R^2$).	(5)
Model 6: ES = β LC + ε (R^2).	(6)
Model 7: ES = β LC + β PA + $\varepsilon R^2(R^2, \Delta R^2)$.	(7)
Model 8: ES = β LC + β PA + β IA + ε ($R^2, \Delta R^2$).	(8)
Model 9: ES = β LC + β PA + β IA + β SE + ε ($R^2, \Delta R^2$).	(9)
Model 10: ES = β LC + β PA + β IA + β SE + β OC + ε ($R^2, \Delta R^2$).	(10)
Model 11: ENS = β LC + ε (R^2).	(11)
Model 12: ENS = β LC + β PA + $\varepsilon R^2(R^2, \Delta R^2)$.	(12)
Model 13: ENS = β LC + β PA + β IA + ε ($R^2, \Delta R^2$).	(13)
Model 14: ENS = β LC + β PA + β IA + β SE + ε ($R^2, \Delta R^2$).	(14)
Model 15: ENS = β LC + β PA + β IA + β SE + β OC + ε ($R^2, \Delta R^2$).	(15)
Model 16: USS = β LC + ε (R^2).	(16)
Model 17: USS = β LC + β PA + $\varepsilon R^2(R^2, \Delta R^2)$.	(17)
Model 18: USS = β LC + β PA + β IA + ε ($R^2, \Delta R^2$).	(18)
Model 19: USS = β LC + β PA + β IA + β SE + ε ($R^2, \Delta R^2$).	(19)
Model 20: USS = β LC + β PA + β IA + β SE + β OC + ε ($R^2, \Delta R^2$).	(20)

Source. (Field work, Ofem et al., 2025).

The following are the notes from equations (1)– (12). SS= social sustainability; ES= economic sustainability; ENS = Environmental sustainability; LC= Leadership commitment, PA = policy alignment, IA=Institutional adaptability, SE = Structural engagement, OC=Organizational culture. USS= University sustainability, R^2 = Coefficient of determination from each regression of analysis; ΔR^2 = The change in the coefficient of determination due to the inclusion of new variables at various levels and ε = the error

3.7. Data Analysis

The data collected from the Governance Variables and University Sustainability Scale were analyzed using hierarchical regression analysis to address the study's research questions. Hierarchical regression was selected because it allows the examination of both the individual contributions of predictors and their incremental influence on the dependent variable, university sustainability, across its social, economic, and environmental dimensions. This method aligns with the stepwise conceptual approach of the study, where independent variables were entered sequentially to assess their cumulative and relative effects. At each step, changes in R^2 (ΔR^2) were calculated to quantify the additional variance explained by each successive predictor, thus highlighting both individual and composite effects. The standardized regression coefficients (β) were examined to determine the relative strength and direction of each predictor's effect on the dependent variable. Hierarchical regression also facilitated testing of all three research questions: (i) the percentage contribution of each predictor, (ii) the composite effect of all predictors together, and (iii) the relative influence of each predictor in the presence of others. All analyses were conducted using SPSS Version 28, and assumptions of normality, linearity, multicollinearity, and homoscedasticity were confirmed prior to analysis.

4. Result

4.1. Exploratory Factor Analysis of Governance Variables

Exploratory Factor Analysis [EFA] was conducted to examine the dimensional structure of the five independent variables—Leadership Commitment, Policy Alignment, Institutional Adaptability, Stakeholder Engagement, and Organizational Structure—using principal axis factoring with oblimin rotation. This analysis was performed to validate the measurement model and ensure that each construct appropriately reflected its theoretical dimension as proposed in the study framework. The EFA yielded a clear five-factor solution explaining 82.5% of the total variance: Leadership Commitment (13.5%), Policy Alignment (16.2%), Institutional Adaptability (17.1%), Stakeholder Engagement (18.4%), and Organizational Structure (17.3%). Sampling adequacy was verified with a Kaiser-Meyer-Olkin (KMO) value of 0.87, while Bartlett's test of sphericity was significant, $\chi^2(300) = 1265.42$, $p < .001$, confirming the suitability of the data for factor analysis. These results indicate that the governance variables map accurately onto the theoretical dimensions, consistent with Institutional Theory, where internal structures and practices reflect the institutionalized expectations of universities (DiMaggio & Powell, 1983; Meyer & Rowan, 1977). Descriptive statistics (see Table 2) further demonstrated approximate normality across items, supporting the use of parametric analyses.

Table 2

Exploratory factor analysis of the governance construct

Variable / Item Code	Mean	SD	Skewness	Kurtosis	λ	λ^2	δ
Leadership Commitment							
LC1	3.45	0.78	-0.12	0.34	0.81	0.656	0.344
LC2	3.67	0.85	0.22	-0.28	0.86	0.740	0.260
LC3	3.29	0.79	-0.09	0.12	0.80	0.640	0.360
LC4	3.55	0.83	0.15	-0.05	0.78	0.608	0.392
LC5	3.62	0.81	-0.18	0.09	0.84	0.706	0.294
Policy Alignments							
PA1	4.12	0.88	0.10	0.21	0.87	0.757	0.243
PA2	4.05	0.91	-0.14	-0.32	0.83	0.689	0.311
PA3	3.98	0.86	0.07	0.18	0.80	0.640	0.360
PA4	4.20	0.89	-0.08	0.12	0.81	0.656	0.344
PA5	4.03	0.87	0.16	-0.11	0.85	0.723	0.277
Institutional Adaptability							
IA1	3.88	0.82	-0.05	0.09	0.79	0.624	0.376
IA2	3.92	0.84	0.12	-0.14	0.80	0.640	0.360
IA3	3.75	0.79	-0.11	0.05	0.78	0.608	0.392
IA4	3.83	0.81	0.08	0.22	0.82	0.672	0.328
IA5	3.89	0.80	-0.16	-0.09	0.84	0.706	0.294
Stakeholders Engagement							
SE1	4.05	0.86	0.09	-0.12	0.85	0.723	0.277
SE2	4.11	0.89	-0.07	0.18	0.87	0.757	0.243
SE3	3.98	0.83	0.14	-0.09	0.79	0.624	0.376
SE4	4.02	0.85	-0.11	0.11	0.80	0.640	0.360
SE5	4.07	0.87	0.06	-0.05	0.82	0.672	0.328
Organizational Structure							
OS1	3.95	0.88	0.13	-0.18	0.82	0.672	0.328
OS2	4.00	0.85	-0.09	0.22	0.84	0.706	0.294
OS3	3.88	0.82	0.05	-0.07	0.78	0.608	0.392
OS4	3.92	0.84	-0.12	0.15	0.81	0.656	0.344
OS5	3.97	0.86	0.10	-0.11	0.83	0.689	0.311

Note. λ =factor loadings , λ^2 = square of factor loadings, δ =unexplained variance.

4.2. Exploratory Factor Analysis of University Sustainability

For the dependent variable, EFA identified a three-factor structure explaining 76.8% of the total variance: Social Sustainability (25.4%), Economic Sustainability (26.1%), and Environmental Sustainability (25.3%). Sampling adequacy was confirmed by a KMO value of 0.85, and Bartlett's test was significant, $\chi^2(120) = 842.36$, $p < .001$. The factor structure aligns with the multidimensional conceptualization of university sustainability in this study, linking leadership, policy, adaptability, stakeholder engagement, and culture to tangible outcomes across social, economic, and environmental domains. Item distributions demonstrated approximate normality (skewness: -0.17 to 0.21 ; kurtosis: -0.30 to 0.32), validating the appropriateness of parametric analysis. As presented in Table 3, the three sustainability dimensions provide a robust representation of the dependent variable, allowing subsequent regression and structural analyses to assess the relative and composite effects of governance factors.

4.3. Linking EFA to the Model

Together, the governance and sustainability EFA results provide empirical support for the study model. Each governance factor demonstrated coherent loadings that correspond to the hypothesized dimensions, while the three sustainability outcomes confirm the dependent variable structure. This connection allows for a clear narrative: governance mechanisms (leadership, policy, adaptability, stakeholder engagement, and organizational culture) serve as predictors of multidimensional university sustainability, providing the foundation for subsequent analyses (RQ1-RQ3). By reporting factor loadings, communalities, and variance explained, Tables 2 and 3 illustrate the alignment between the conceptual framework and observed data, ensuring theoretical coherence and transparency in the model specification.

Table 3

Exploratory factor analysis of the university sustainability construct

Variable / Item Code	Mean	SD	Skewness	Kurtosis	λ	λ^2	δ
Social Sustainability							
SS1	3.75	0.81	0.12	-0.08	0.80	0.640	0.360
SS2	3.82	0.84	-0.10	0.15	0.82	0.672	0.328
SS3	3.68	0.79	0.07	0.09	0.78	0.608	0.392
SS4	3.90	0.86	-0.05	-0.12	0.85	0.723	0.277
SS5	3.77	0.80	0.15	0.11	0.81	0.656	0.344
Economic Sustainability							
ES1	3.88	0.83	-0.08	0.18	0.84	0.706	0.294
ES2	3.92	0.85	0.09	-0.05	0.86	0.740	0.260
ES3	3.81	0.82	-0.11	0.12	0.80	0.640	0.360
ES4	3.95	0.87	0.06	-0.09	0.83	0.689	0.311
ES5	3.89	0.84	-0.14	0.05	0.81	0.656	0.344
Environmental Sustainability							
ENS1	3.78	0.80	0.10	0.07	0.79	0.624	0.376
ENS2	3.85	0.82	-0.12	0.09	0.81	0.656	0.344
ENS3	3.80	0.79	0.07	-0.11	0.78	0.608	0.392
ENS4	3.88	0.83	-0.06	0.14	0.82	0.672	0.328
ENS5	3.84	0.81	0.11	-0.08	0.80	0.640	0.360

Note. λ = factor loadings, λ^2 = square of factor loadings, δ = unexplained variance.

4.4. Convergent and Divergent Validation

Convergent validity of the instrument was evaluated using the Average Variance Extracted [AVE] for each construct. Following the guidelines of Fornell and Larcker (1981) and Hair et al. (2019), an AVE of 0.50 or higher indicates adequate convergence, meaning that a construct explains at least half of the variance in its indicators. In this study, all constructs as presented in Table 4 recorded AVE values between 0.61 and 0.74, surpassing the recommended benchmark and confirming that the items strongly captured their respective latent variables. Discriminant validity was assessed

through the Fornell-Larcker criterion, which requires that the square root of each construct's AVE exceeds its correlations with other constructs. The results confirmed that leadership commitment, policy alignment, institutional adaptability, stakeholder engagement, organizational structure, and the three dimensions of university sustainability satisfied this condition, supporting their conceptual distinctiveness.

Reliability was further examined using Cronbach's alpha and Composite Reliability [CR]. As shown in Table 4, Cronbach's alpha values ranged from .81 to .89, while CR values ranged from .83 to .90. Both exceed the minimum threshold of 0.70 recommended by Nunnally and Bernstein (1994) and Hair et al. (2019), indicating strong internal consistency. These results provide evidence that the scale is both valid and reliable for research and practical applications.

Table 4

Convergent and discriminate validities of the factors

Construct	AVE	α	CR	LC	PA	IA	SE	OS	SS	ES	ENS
Leadership Commitment [LC]	.65	.85	.87	.81							
Policy Alignments [PA]	.68	.86	.88	.43	.82						
Institutional Adaptability [IA]	.63	.84	.86	.37	.41	.79					
Stakeholders Engagement [SE]	.67	.85	.88	.45	.49	.46	.82				
Organizational Structure [OS]	.64	.84	.87	.42	.44	.41	.48	.80			
Social Sustainability [SS]	.66	.85	.87	.30	.32	.28	.31	.29	.81		
Economic Sustainability [ES]	.68	.86	.88	.28	.34	.29	.33	.30	.44	.82	
Environmental Sustainability [ENS]	.65	.84	.86	.26	.30	.27	.29	.28	.41	.43	.81

4.5. Confirmatory Factor Analysis

Confirmatory Factor Analysis [CFA] was performed using Maximum Likelihood estimation in AMOS v.23 to validate the structure derived from the EFA. The results, presented in Tables 1 and 2 and illustrated in Figures 2 and 3, confirmed strong factor loadings that aligned with the theoretical framework. Items with weak performance were removed from the final scales to enhance construct validity.

Model fit was assessed using eight indices: Chi-square, GFI, NFI, RFI, IFI, TLI, CFI, and RMSEA. Although Chi-square was significant, which is expected with large sample sizes, all other indices for both the Governance Variables Scale [GVS] and University Sustainability Scale [USS] exceeded the 0.90 benchmark, demonstrating good to excellent model fit. The RMSEA values of 0.04 and 0.07 also fell within the recommended range, further confirming the adequacy of the model.

4.6. Test of Hypothesis

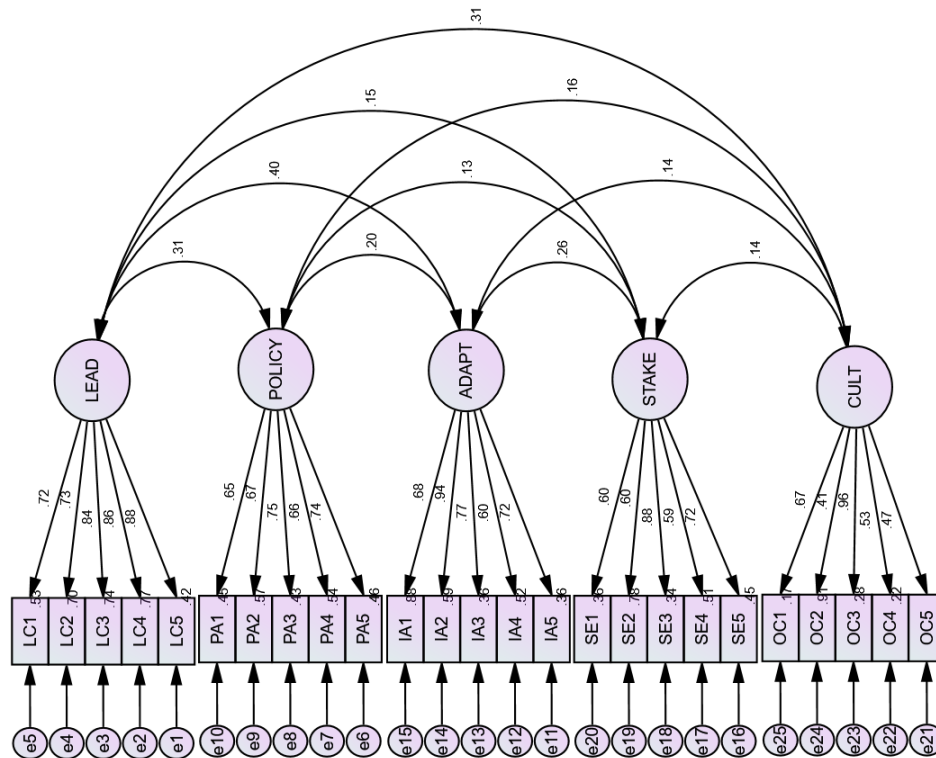
4.6.1. Research question one

What is the percentage contribution of leadership commitment, policy alignment, institutional adaptability, stakeholder engagement, and organizational culture to university sustainability? The hierarchical regression results in Table 5 show the stepwise contributions of the five governance factors to university sustainability across social, economic, and environmental dimensions, as well as overall sustainability.

For social sustainability, leadership commitment alone explained 4.6% of the variance ($R^2 = .047$), indicating that top-level prioritization and resource allocation set the foundational tone for sustainability practices, consistent with the institutional theory assumption that organizations conform to institutionalized expectations to gain legitimacy. Adding policy alignment increased the variance explained to 61.8% ($\Delta R^2 = 57.1\%$), highlighting the pivotal role of coherent institutional policies in transforming sustainability intentions into operational outcomes. Institutional adaptability, stakeholder engagement, and organizational culture contributed 1.5%, 3.5%, and 3.2%, respectively, producing a cumulative variance of 70.0%. These incremental contributions suggest that responsiveness to emerging challenges, active stakeholder participation,

Figure 2

Confirmatory factor analysis of governance factor scale



and embedding sustainability values in organizational culture complement the structural and leadership foundations, reinforcing social sustainability outcomes. Thus, policy alignment emerged as the strongest predictor for social sustainability.

In economic sustainability, leadership commitment accounted for 1.8% of the variance, with policy alignment adding 0.7% (total $R^2 = 2.5\%$). Institutional adaptability contributed 13.1%, raising the explained variance to 15.6%, while stakeholder engagement added 8.5%, reaching 24.1%. Organizational culture added 0.9%, producing a total of 25.0%. Here, adaptability and stakeholder engagement were the most influential predictors, suggesting that economic sustainability relies more heavily on the university's capacity to innovate and involve key actors in resource efficiency and financial practices.

For environmental sustainability, leadership commitment explained 2.5%, and policy alignment added 4.2% ($R^2 = 6.7\%$). Institutional adaptability contributed 1.7%, but stakeholder engagement explained an additional 56.4%, with organizational culture adding 0.1%, bringing the total variance explained to 64.9%. This indicates that active engagement of internal and external stakeholders is central to environmental sustainability, as universities rely on participatory practices to achieve ecological responsibility, consistent with the institutional theory emphasis on legitimacy through social and external alignment.

Finally, for overall university sustainability, the result in Table 5, leadership commitment explained 4.4%, with policy alignment increasing the variance explained to 57.5% ($\Delta R^2 = 53.1\%$). Institutional adaptability, stakeholder engagement, and organizational culture added 0.4%, 1.2%, and 2.6%, respectively, producing a total R^2 of 61.7%. These results demonstrate that while all governance factors contribute to overall sustainability, policy alignment remains the primary driver, supported by leadership, culture, adaptability, and stakeholder engagement.

In summary, hierarchical regression analysis reveals that governance factors collectively account for substantial variance in university sustainability, with policy alignment and stakeholder engagement emerging as the most critical predictors across dimensions. This analysis directly answers Research Question 1 by quantifying the percentage contributions of each factor and illustrating their theoretical and practical significance.

Figure 3

Confirmatory factor analysis of the university sustainability scale

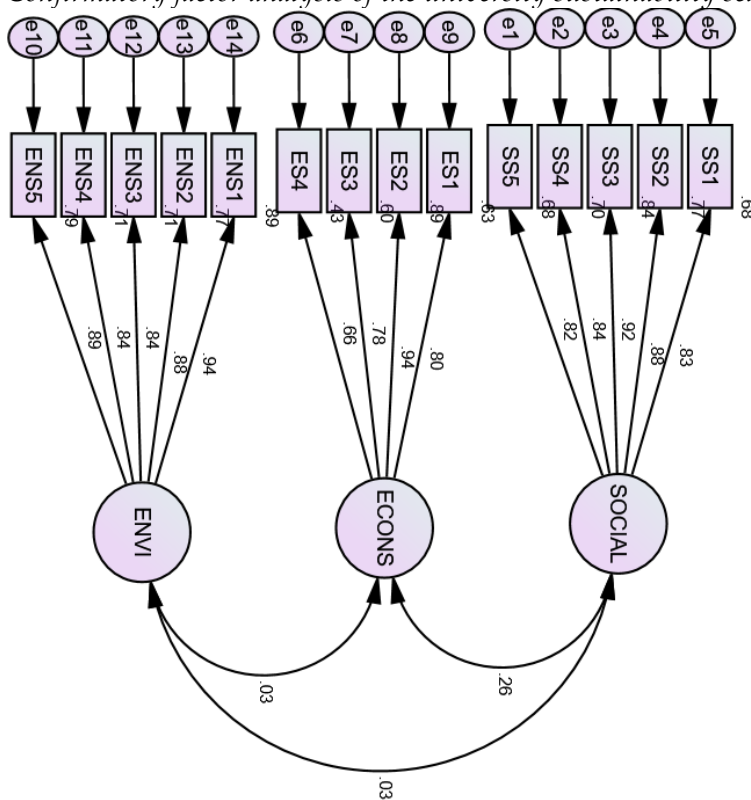


Table 5

Percentage contribution of predictors on university sustainability from three dimensions

Variable and Model	R	R ²	Adj. R ²	S.E	Δ R ²
Social sustainability					
Leadership commitment	.216 ^a	.047	.046	2.70	.046
Policy alignment	.786 ^b	.618	.617	1.71	.571
Institutional adaptability	.795 ^c	.633	.632	1.67	.015
Stakeholders engagement	.817 ^d	.667	.667	1.59	.035
Organizational culture	.837 ^e	.700	.699	1.51	.032
Economic sustainability					
Leadership commitment	.135 ^a	.018	.018	0.89	.018
Policy alignment	.159 ^b	.025	.024	0.88	.007
Institutional adaptability	.395 ^c	.156	.155	0.88	.131
Stakeholders engagement	.491 ^d	.241	.239	0.78	.085
Organizational culture	.500 ^e	.250	.248	0.78	.009
Environmental sustainability					
Leadership commitment	.158 ^a	.025	.024	1.50	.025
Policy alignment	.258 ^b	.067	.066	1.47	.042
Institutional adaptability	.290 ^c	.084	.083	1.46	.017
Stakeholders engagement	.805 ^d	.648	.647	0.91	.564
Organizational culture	.805 ^e	.649	.648	0.90	.001
University sustainability					
Leadership commitment	.211 ^a	.044	.044	3.32	.211
Policy alignment	.758 ^b	.575	.575	2.21	.044
Institutional adaptability	.761 ^c	.579	.578	2.20	.004
Stakeholders engagement	.769 ^d	.591	.590	2.17	.012
Organizational culture	.786 ^e	.617	.616	2.10	.026

4.6.2. Research question 2

What is the composite effect of leadership commitment, policy alignment, institutional adaptability, stakeholders' engagement, and organizational culture on university sustainability? The composite effect of the five governance variables on university sustainability was examined using hierarchical regression models. This approach allowed for the stepwise evaluation of each predictor's contribution while accounting for their combined influence, aligning with the study's theoretical framework of Institutional Theory (DiMaggio & Powell, 1983; Meyer & Rowan, 1977), which posits that organizational outcomes emerge from the interplay of internal structures and external pressures.

For social sustainability, the results in Table 6 and 7 showed that leadership commitment significantly predicted outcomes in the baseline model, $F(1, 1996) = 97.96, p < .001$. Inclusion of policy alignment in Model 2 sharply increased explanatory power, $F(2, 1995) = 1612.12, p < .001$, highlighting the critical role of coherent institutional policies in transforming leadership intent into collective action. Institutional adaptability, stakeholders' engagement, and organizational culture maintained significance in subsequent models, with the final model yielding $F(5, 1992) = 929.09, p < .001$, demonstrating that these predictors jointly explain a substantial proportion of variance in social sustainability.

Table 6

Composite contribution of the predictors on university sustainability

Variable	Model	Source of variation	SS	df	MS	F	p
Social sustainability	1	Regression	714.504	1	714.504	97.959	<.001 ^b
		Residual	14558.658	1996	7.294		
		Total	15273.162	1997			
	2	Regression	9435.156	2	4717.578	1612.120	<.001 ^c
		Residual	5838.006	1995	2.926		
		Total	15273.162	1997			
	3	Regression	9661.795	3	3220.598	1144.440	<.001 ^d
		Residual	5611.367	1994	2.814		
		Total	15273.162	1997			
	4	Regression	10191.525	4	2547.881	999.270	<.001 ^e
		Residual	5081.636	1993	2.550		
		Total	15273.162	1997			
	5	Regression	10689.452	5	2137.890	929.090	<.001 ^f
		Residual	4583.710	1992	2.301		
		Total	15273.162	1997			
Economic sustainability	1	Regression	29.420	1	29.420	36.905	<.001 ^b
		Residual	1591.177	1996	.797		
		Total	1620.597	1997			
	2	Regression	41.189	2	20.594	26.013	<.001 ^c
		Residual	1579.409	1995	.792		
		Total	1620.597	1997			
	3	Regression	252.454	3	84.151	122.646	<.001 ^d
		Residual	1368.143	1994	.686		
		Total	1620.597	1997			
	4	Regression	390.267	4	97.567	158.048	<.001 ^e
		Residual	1230.330	1993	.617		
		Total	1620.597	1997			
	5	Regression	405.131	5	81.026	132.792	<.001 ^f
		Residual	1215.466	1992	.610		
		Total	1620.597	1997			

Note. SS: Sum of squares; MS: Mean Squares

For economic sustainability, leadership commitment initially contributed modestly, $F(1, 1996) = 36.91, p < .001$. Policy alignment added minimal improvement, $F(2, 1995) = 26.01, p < .001$, but

institutional adaptability (Model 3) markedly enhanced explanatory power, $F(3, 1994) = 122.65, p < .001$. Stakeholders' engagement and organizational culture sustained significance, with the final model producing $F(5, 1992) = 132.79, p < .001$, indicating that economic sustainability is primarily driven by adaptive capacity and active stakeholder involvement, consistent with the institutional theory perspective on organizational responsiveness.

For environmental sustainability, the result in Table 7 revealed that leadership commitment had a small but significant effect, $F(1, 1996) = 50.78, p < .001$. Policy alignment and institutional adaptability gradually improved the model, but stakeholders' engagement in Model 4 produced a dramatic effect, $F(4, 1993) = 917.83, p < .001$, which remained significant in the full model, $F(5, 1992) = 735.51, p < .001$. This underscores the centrality of broad-based engagement in driving ecological outcomes, demonstrating that sustainability success requires active participation beyond leadership mandates.

For overall university sustainability, leadership commitment contributed significantly at baseline, $F(1, 1996) = 92.84, p < .001$. Policy alignment markedly improved the model, $F(2, 1995) = 1350.68, p < .001$, while institutional adaptability, stakeholders' engagement, and organizational culture-maintained significance in subsequent models. The final model, $F(5, 1992) = 642.22, p < .001$, confirms that policy alignment is the strongest determinant of overall sustainability, supported by organizational culture and stakeholder engagement, emphasizing the importance of integrated governance strategies.

Table 7

Composite contribution of the predictors on university sustainability

Variable	Model	Source of variation	SS	df	MS	F	p
Environmental sustainability	1	Regression	115.545	1	115.545	50.780	<.001 ^b
		Residual	4541.755	1996	2.275		
		Total	4657.300	1997			
	2	Regression	310.391	2	155.195	71.226	<.001 ^c
		Residual	4346.909	1995	2.179		
		Total	4657.300	1997			
	3	Regression	390.945	3	130.315	60.906	<.001 ^d
		Residual	4266.355	1994	2.140		
		Total	4657.300	1997			
	4	Regression	3018.622	4	754.655	917.830	<.001 ^e
		Residual	1638.678	1993	.822		
		Total	4657.300	1997			
	5	Regression	3020.953	5	604.191	735.509	<.001 ^f
		Residual	1636.347	1992	.821		
		Total	4657.300	1997			
University sustainability	1	Regression	1027.546	1	1027.546	92.839	<.001 ^b
		Residual	22091.882	1996	11.068		
		Total	23119.428	1997			
	2	Regression	13298.340	2	6649.170	1350.675	<.001 ^c
		Residual	9821.088	1995	4.923		
		Total	23119.428	1997			
	3	Regression	13388.491	3	4462.830	914.494	<.001 ^d
		Residual	9730.937	1994	4.880		
		Total	23119.428	1997			
	4	Regression	13660.925	4	3415.231	719.623	<.001 ^e
		Residual	9458.503	1993	4.746		
		Total	23119.428	1997			
	5	Regression	14268.198	5	2853.640	642.221	<.001 ^f
		Residual	8851.230	1992	4.443		
		Total	23119.428	1997			

Note. SS: Sum of squares; MS: Mean Squares

In conclusion, the hierarchical regression analysis shows that while leadership commitment establishes a foundation, the combined influence of policy alignment, institutional adaptability, stakeholder engagement, and organizational culture produces the greatest explanatory strength. This directly answers Research Question 2, demonstrating that a holistic approach to governance is essential for advancing university sustainability across social, economic, and environmental dimensions.

4.6.3. Research question 3

What is the relative effect of leadership commitment, policy alignment, institutional adaptability, stakeholders' engagement, and organizational culture on university sustainability? The relative effects of the governance variables on university sustainability were assessed using hierarchical regression analysis (Tables 8 and 9). This approach enables a nuanced understanding of which predictors exert the strongest influence on social, economic, environmental, and overall sustainability, in line with Institutional Theory (DiMaggio & Powell, 1983; Meyer & Rowan, 1977), which emphasizes that organizational outcomes depend on both internal practices and external pressures.

Table 8

Relative contribution of each predictor on university sustainability

<i>Dependent variable</i>	<i>Model</i>	<i>Predictors</i>	<i>B</i>	<i>t</i>	<i>p</i>
Social sustainability	1	leadership	-.216	-9.897	<.001
	2	leadership	-.317	-22.681	<.001
		policy	.762	54.590	<.001
	3	leadership	-.279	-19.424	<.001
		policy	.776	56.321	<.001
		institutional	-.129	-8.974	<.001
	4	leadership	-.249	-18.054	<.001
		policy	.829	60.863	<.001
		institutional	-.145	-10.593	<.001
		stakeholders	-.196	-14.414	<.001
	5	leadership	.029	1.269	.205
		policy	.833	64.360	<.001
		institutional	-.073	-5.240	<.001
		stakeholders	-.182	-14.006	<.001
		organizational	-.360	-14.710	<.001
Economic sustainability	1	leadership	.135	6.075	<.001
	2	leadership	.123	5.535	<.001
		policy	.086	3.855	<.001
	3	leadership	.010	.471	.638
		policy	.045	2.160	.031
		institutional	.382	17.547	<.001
	4	leadership	.056	2.697	.007
		policy	.128	6.231	<.001
		institutional	.356	17.194	<.001
		stakeholders	-.307	-14.941	<.001
	5	leadership	.204	5.602	<.001
		policy	.130	6.369	<.001
		institutional	.395	17.924	<.001
		stakeholders	-.299	-14.608	<.001
		organizational	-.191	-4.936	<.001

Table 9

Relative contribution of each predictor on university sustainability

<i>Dependent variable</i>	<i>Model</i>	<i>Predictors</i>	<i>B</i>	<i>t</i>	<i>p</i>
Environmental sustainability	1	leadership	-.158	-7.126	<.001
	2	leadership	-.185	-8.464	<.001
		policy	.206	9.456	<.001
	3	leadership	-.143	-6.336	<.001
		policy	.221	10.167	<.001
		institutional	-.139	-6.136	<.001
	4	leadership	-.262	-18.458	<.001
		policy	.007	.510	.610
		institutional	-.073	-5.168	<.001
		stakeholders	.791	56.532	<.001
	5	leadership	-.296	-11.901	<.001
		policy	.007	.475	.635
		institutional	-.082	-5.432	<.001
		stakeholders	.789	56.264	<.001
		organizational	.045	1.684	.092
University sustainability	1	leadership	-.211	-9.635	<.001
	2	leadership	-.308	-20.899	<.001
		policy	.735	49.926	<.001
	3	leadership	-.288	-18.769	<.001
		policy	.742	50.311	<.001
		institutional	-.066	-4.298	<.001
	4	leadership	-.305	-19.943	<.001
		policy	.711	47.071	<.001
		institutional	-.057	-3.714	<.001
		stakeholders	.114	7.577	<.001
	5	leadership	-.055	-2.128	.033
		policy	.715	48.880	<.001
		institutional	.008	.536	.592
		stakeholders	.127	8.700	<.001
		organizational	-.323	-11.691	<.001

For social sustainability, leadership commitment initially exhibited a significant negative effect ($\beta = -.216$, $t = -9.90$, $p < .001$), but its influence became non-significant in the full model ($\beta = .029$, $t = 1.27$, $p = .205$) after additional predictors were included. Policy alignment consistently demonstrated the strongest positive effect across all models, peaking in the final model ($\beta = .833$, $t = 64.36$, $p < .001$), indicating that coherent institutional policies dominate social sustainability outcomes. Institutional adaptability ($\beta = -.073$, $t = -5.24$, $p < .001$), stakeholders' engagement ($\beta = -.182$, $t = -14.01$, $p < .001$), and organizational culture ($\beta = -.360$, $t = -14.71$, $p < .001$) had negative effects, suggesting that misalignment or weak integration of these factors may reduce their positive influence.

For economic sustainability, leadership commitment maintained a small positive effect in the baseline model ($\beta = .135$, $t = 6.08$, $p < .001$), but institutional adaptability emerged as the strongest predictor in the full model ($\beta = .395$, $t = 17.92$, $p < .001$). Policy alignment remained significant ($\beta = .130$, $t = 6.37$, $p < .001$), whereas stakeholders' engagement ($\beta = -.299$, $t = -14.61$, $p < .001$) and organizational culture ($\beta = -.191$, $t = -4.94$, $p < .001$) contributed negatively. This pattern highlights the central role of adaptive capacity in driving economic sustainability, reflecting the need for universities to respond flexibly to financial and operational pressures.

For environmental sustainability, leadership commitment consistently showed negative effects ($\beta = -.296$, $t = -11.90$, $p < .001$), and policy alignment lost significance in the final model ($\beta = .007$, $t = .475$, $p = .635$). Institutional adaptability remained slightly negative ($\beta = -.082$, $t = -5.43$, $p < .001$), while stakeholders' engagement overwhelmingly dominated the model ($\beta = .789$, $t = 56.26$, $p < .001$).

.001), confirming its role as the principal driver of ecological outcomes, consistent with the theory's emphasis on legitimacy and collective action. Organizational culture had a small, non-significant effect ($\beta = .045$, $t = 1.68$, $p = .092$).

For overall university sustainability, leadership commitment's negative effect weakened in the full model ($\beta = -.055$, $t = -2.13$, $p = .033$), while policy alignment emerged as the dominant predictor ($\beta = .715$, $t = 48.88$, $p < .001$), complemented by a positive contribution from stakeholders' engagement ($\beta = .127$, $t = 8.70$, $p < .001$). Organizational culture had a significant negative effect ($\beta = -.323$, $t = -11.69$, $p < .001$), and institutional adaptability was no longer significant ($\beta = .008$, $t = .536$, $p = .592$). These results indicate that overall university sustainability depends primarily on aligned policies and effective stakeholder engagement, while misaligned organizational culture can act as a barrier, reinforcing the importance of holistic governance strategies.

In summary, the hierarchical regression analysis clearly shows the relative strengths of each governance factor across sustainability dimensions. Policy alignment consistently emerges as the most influential predictor, stakeholders' engagement supports its effects, institutional adaptability drives economic sustainability, and organizational culture can either enhance or impede outcomes depending on alignment, directly answering Research Question 3.

5. Discussion

The findings reveal distinct patterns in how institutional factors influence the three dimensions of university sustainability. Policy alignment emerged as the most influential predictor of both social and overall sustainability, emphasizing the importance of well-structured, coherent policies in fostering sustainable academic environments. Consistent with prior studies, such policies guide decision-making, prioritize resource allocation, and support long-term planning that enhances inclusivity, welfare, and student engagement (Leal Filho et al., 2019; Leal Filho et al., 2020). Recent research confirms that policy coherence is a critical determinant of sustainable development integration in higher education institutions (Mo & Wang, 2023). When aligned with broader sustainability frameworks, policies facilitate the integration of sustainability into teaching, research, and community engagement. However, Velazquez et al. (2005) caution that policies without effective implementation may remain symbolic rather than transformative, highlighting the need for monitoring and accountability to achieve meaningful outcomes. Furthermore, related educational research suggests that translating policy intentions into actionable institutional practices requires mechanisms for organizational learning, self-evaluation, stakeholder-informed reflection, and continuous assessment of implementation outcomes (Serra et al., 2023).

Economic sustainability was influenced by a combination of institutional adaptability and stakeholder engagement. Institutional adaptability enables universities to respond more effectively to changing funding conditions, regulatory demands, resource constraints, and labor market expectations, while stakeholder engagement can strengthen collaboration with government, industry, alumni, communities, and other external actors. Such collaboration may provide access to resources, contextual legitimacy, and implementation support, particularly when sustainability initiatives are aligned with institutional governance structures, policy frameworks, budgeting processes, and reporting mechanisms (Leal Filho et al., 2021). This combination of internal flexibility and external collaboration can enhance institutional resilience against financial uncertainty by helping universities remain responsive while drawing on diverse networks and forms of support. Recent evidence also indicates that sustainability assessment in higher education requires alignment across governance, environmental, social, economic, and academic pillars, and that economic viability is closely related to funding, grants, government financial assistance, affordability policies, and stakeholder priorities (Basheer et al., 2025). In this sense, adaptive institutional planning and stakeholder engagement should be understood as mutually reinforcing conditions for economic sustainability rather than as isolated predictors (Ajani, 2024; Basheer et al., 2025; Rekalde-Rodríguez, 2026).

Environmental sustainability was primarily driven by stakeholder engagement, reflecting the inherently collaborative nature of ecological initiatives. While leadership and policy provide direction, meaningful environmental progress requires active participation from students, staff, local communities, and external partners, ensuring shared responsibility and ownership (Leal Filho et al., 2020). Recent international studies highlight that participatory governance and community-based engagement in HEIs significantly enhance environmental performance outcomes (Leal Filho et al., 2025; Rekalde-Rodríguez, 2026).

Organizational culture contributed incrementally across all dimensions, acting as a conduit through which policies, leadership decisions, and adaptive strategies are operationalized in daily practice. A supportive culture embeds sustainability into institutional routines, ensuring continuity beyond leadership changes or temporary initiatives. This is supported by recent evidence showing that internal institutional factors and a sustainability-driven culture can either facilitate or hinder the effective operationalization of sustainability initiatives in higher education institutions, while accountability and inclusivity remain important conditions for implementation and stakeholder engagement (Bui et al., 2024; Leal Filho et al., 2025). University sustainability is shaped by the combined influence of policy alignment, adaptability, stakeholder engagement, and organizational culture, highlighting the need for integrated, systemic approaches that harmonize policy, practice, and people.

The results indicate that the examined predictors collectively exert substantial and meaningful effects across the dimensions of university sustainability, highlighting the complex, multidimensional nature of sustainable institutional practices (Basheer et al., 2025; Bayram & Aslan, 2025). While leadership commitment provides an essential foundation, the full explanatory power of the model emerges only when policy alignment, institutional adaptability, stakeholder engagement, and organizational culture are integrated. This aligns with current scholarship emphasizing that long-term sustainability cannot be achieved through a single factor alone; rather, it arises from the interaction of governance structures, adaptive capacities, cultural norms, and participatory mechanisms (Basheer et al., 2025; Leal Filho et al., 2019; Mo & Wang, 2023).

Policy alignment was identified as the most influential predictor of both social and overall sustainability. This finding suggests that coherent institutional policies may provide universities with clearer decision-making frameworks, more consistent priorities for resource allocation, and longer-term goals through which inclusivity, welfare, and student engagement can be embedded into institutional practice. In higher education, sustainability-oriented transformation depends not only on formal commitments but also on the alignment of governance arrangements, institutional objectives, and educational practices; university-level sustainability education similarly requires participatory and systemic approaches that connect policy with teaching, community engagement, and stakeholder involvement (Leal Filho et al., 2019; Rekalde-Rodríguez, 2026). When policies are coherent and aligned with broader sustainability agendas, universities are better positioned to translate social values into institutional practices that promote equity, participation, and inclusive learning opportunities (Adigun et al., 2023; Alemayehu, 2020; Rekalde-Rodríguez, 2026). At the same time, policy alignment should not be treated as sufficient on its own, since sustainable universities require structured implementation processes and movement from strategic intent to concrete practices across institutional functions (Velazquez et al., 2006). Thus, the effect of policy alignment should be interpreted as depending on the extent to which policy is operationalized through actionable initiatives that shape teaching, learning, student welfare, and institutional practices (Leal Filho et al., 2019; Velazquez et al., 2006).

Economic sustainability was most strongly influenced by institutional adaptability and stakeholder engagement. This pattern is plausible given that universities operate in changing financial and regulatory environments in which sustainability work can be constrained by limited funding, fragmented reporting, and uneven organizational capacity (Basheer et al., 2025; Leal Filho et al., 2021). Institutions with adaptable governance and organizational arrangements are better positioned to adjust priorities, reallocate resources, and revise curricula or programs in response to

external pressures and emerging social or economic needs (Moldashev et al., 2026). Stakeholder engagement strengthens this adaptive capacity by expanding universities' access to expertise, partnerships, and collaborative networks, particularly through links with industry, communities, and other external actors (Moldashev et al., 2026; Rekalde-Rodríguez, 2026). In this sense, economic sustainability is less a matter of financial stability alone than of institutional capacity to align resources, partnerships, and educational missions with changing societal expectations. This interpretation is broadly consistent with work showing that sustainability in HEIs depends on governance, resources, stakeholder understanding, and integrated campus-level approaches, while also requiring attention to implementation challenges and context-specific adaptation (Basheer et al., 2025; Leal Filho et al., 2021; Sonetti et al., 2016).

For environmental sustainability, stakeholder engagement emerged as the dominant predictor, far outweighing leadership, policy alignment, and adaptability. Ecological progress requires collective effort, as universities alone lack the resources and reach to address large-scale environmental challenges. Engaged stakeholders—including students, staff, communities, and government actors—provide the knowledge, legitimacy, and collaboration necessary for effective implementation. Lozano et al. (2015) emphasize that participatory governance is essential for sustainable ecological outcomes, since top-down directives alone are insufficient. Current studies similarly argue that universities must foster multilevel stakeholder networks to implement climate action and sustainability programs effectively (Leal Filho et al., 2025).

Organizational culture contributed incrementally across all dimensions, functioning as the mechanism through which leadership, policy, and adaptive strategies are operationalized in daily practice. A supportive culture promotes values such as accountability, transparency, and collaboration, reinforcing and sustaining formal initiatives. Aguado et al. (2015) highlight culture as a cross-cutting enabler, shaping behaviors and institutional norms that integrate sustainability into the fabric of the university. Even with robust leadership and policy frameworks, their effectiveness depends on a culture that internalizes sustainability as a shared institutional value. Recent findings suggest that institutional culture plays a critical role in translating leadership vision and policy frameworks into effective sustainability practices, particularly when these are supported by sustainability education, internal communication, and organizational commitment (Bui et al., 2024).

The analysis of relative effects provides insight into how different institutional factors shape sustainability outcomes in universities. Policy alignment consistently emerged as the most influential predictor of social and overall sustainability. This likely reflects the role of well-articulated policies in establishing frameworks for operationalizing inclusivity, welfare, and engagement initiatives. Policies guide decision-making, resource allocation, and long-term planning, shaping how sustainability goals are integrated into daily academic practices. Leal Filho et al. (2019) emphasize that governance frameworks are essential for anchoring sustainability in higher education, while Velazquez et al. (2005) caution that policies without effective implementation may remain symbolic. Therefore, the strength of policy alignment lies not only in its design but also in its practical execution, enabling universities to harmonize internal practices with national or global sustainability standards and foster resilient, equitable communities. Recent research similarly finds that aligned governance and institutional policies enhance sustainable development performance across global universities (Mo & Wang, 2023).

Economic sustainability, in contrast, was primarily influenced by institutional adaptability. Universities operate in volatile financial contexts where funding, labor markets, and regulatory demands frequently shift. Institutions with adaptive structures—through flexible governance, innovative funding strategies, or curricular adjustments—are better able to maintain stability and seize emerging opportunities. As Leal Filho et al. (2020) note, strong governance enhances adaptive capacity, helping institutions withstand financial and regulatory pressures. Adaptability not only allows universities to survive volatility but also provides the agility to diversify income streams and remain relevant in a complex socio-economic landscape. This is supported by current

studies emphasizing that adaptive capacities are essential for sustaining economic performance under financial and operational uncertainty (Basheer et al., 2025; Ponce de Leon, 2024).

Environmental sustainability was predominantly driven by stakeholder engagement. Effective ecological transformation requires collaborative action beyond the university's internal structures, including partnerships with communities, governments, industries, and civil society. Without broad engagement, universities lack the legitimacy, resources, and collaborative capacity necessary for meaningful environmental initiatives. Lozano et al. (2015) highlight the critical role of participatory governance, ensuring shared ownership of goals and collective responsibility. Leadership commitment, while foundational, became less impactful when other variables were introduced, suggesting that institutional vision alone is insufficient unless it is supported by coherent policy frameworks, adaptive organizational learning mechanisms, adequate resources, and stakeholder engagement. This interpretation is consistent with research indicating that effective institutional transformation requires not only visionary leadership but also strategic planning, resource mobilization, faculty development, stakeholder participation, and policy guidance (Ajani, 2024; Simiyu et al., 2026). Organizational culture exhibited mixed effects, reflecting the complexity of institutional norms. When values such as accountability, transparency, collaboration, shared responsibility, and learning capacity are embedded in institutional practice, culture can support sustainability-oriented change; however, resistant, fragmented, or short-term-focused cultures may weaken formal initiatives by limiting organizational adaptation and reducing the continuity of implementation (Gao et al., 2024). Contemporary research emphasizes that universities need to embed sustainability within institutional culture if environmental and broader sustainability initiatives are to be sustained over time (Mohammadi et al., 2023).

6. Limitations

Although this study offers valuable insights, several limitations should be acknowledged. First, the research was confined to universities in the South-South region, which may restrict the applicability of the findings to institutions in other parts of Nigeria or internationally. Second, data were collected through self-administered questionnaires, which, despite thorough validation, could be influenced by respondent biases such as social desirability or subjective interpretation. Third, the cross-sectional design limits the ability to infer causal relationships among leadership commitment, policy alignment, institutional adaptability, stakeholder engagement, organizational culture, and university sustainability, meaning the results primarily reflect associations rather than definitive cause-and-effect links.

Future studies could overcome these limitations by employing longitudinal or experimental designs to better examine causal relationships over time. Including universities from other regions or countries would improve generalizability and facilitate comparative analyses. Additionally, integrating qualitative approaches, such as interviews or case studies, could provide richer insights into how governance, adaptability, stakeholder engagement, and organizational culture collectively influence sustainability in higher education.

7. Conclusion and Implications

The findings of this study indicate that university sustainability is shaped by an interconnected set of predictors, each exerting distinct effects across social, economic, and environmental dimensions. Policy alignment emerged as the most consistent and influential driver of both social and overall sustainability, highlighting the importance of coherent governance structures in fostering inclusive and resilient academic environments. Economic sustainability was primarily influenced by institutional adaptability and stakeholder engagement, reflecting the need for universities to remain responsive internally while leveraging external collaborations to ensure financial stability and competitiveness. For environmental sustainability, stakeholder engagement was the dominant factor, emphasizing that ecological outcomes depend on participatory approaches that involve actors beyond the university. While leadership commitment offered an initial foundation, its

impact weakened when structural and relational variables were considered, and organizational culture produced incremental, and occasionally adverse, effects depending on the sustainability dimension.

This study reinforces the systemic and multidimensional nature of sustainability in higher education, demonstrating that outcomes are not solely dependent on individual leadership but emerge from the interaction of governance structures, policies, organizational culture, and stakeholder engagement. The findings extend Institutional Theory (DiMaggio & Powell, 1983; Meyer & Rowan, 1977) by illustrating how universities achieve legitimacy and sustainability through coherent alignment between internal governance mechanisms and external pressures, such as regulatory expectations and societal demands. The results also advance Stakeholder Theory (Freeman, 1984) by highlighting that stakeholder engagement is not peripheral but central to sustainability, particularly in driving environmental and economic outcomes. Additionally, the study contributes to theory by showing that the relative influence of governance variables varies across sustainability dimensions, emphasizing the importance of integrated frameworks that account for policy alignment, adaptability, culture, and collective institutional arrangements rather than individual agency alone. These insights fill a critical gap in the African higher education context, where empirical evidence linking governance factors to measurable sustainability outcomes remains limited.

Practically, the findings provide actionable guidance for university leaders and policymakers. Policy alignment emerges as a foundation for social sustainability, suggesting that universities should prioritize coherent, well-resourced, and contextually relevant strategies. Institutional adaptability is critical for navigating financial, technological, and environmental uncertainties, while stakeholder engagement ensures legitimacy, resource mobilization, and practical relevance of sustainability initiatives. The study also underscores the importance of cultivating a sustainability-oriented culture, where shared norms and values translate policies into everyday practice. Importantly, the variable effects of culture reveal potential resistance or misalignment, highlighting the need for deliberate efforts to ensure cultural values reinforce, rather than hinder, institutional sustainability goals. By providing a comprehensive, multidimensional perspective, this study equips African universities with evidence-based strategies to design governance structures, implement policies, and engage stakeholders effectively to achieve enduring sustainability outcomes.

8. Recommendations

Based on the study's findings, several recommendations can be proposed to enhance policy and practice in universities. First, institutions should strengthen policy alignment by ensuring that their strategies are consistent with national and global sustainability frameworks. This requires not only designing coherent policies but also implementing them through operational mechanisms that directly influence teaching, research, and community engagement. Regular monitoring and evaluation are essential to prevent policies from remaining symbolic and to ensure they produce tangible outcomes for inclusivity, welfare, and student development.

Second, to improve economic sustainability, universities should foster institutional adaptability by developing flexible governance systems capable of responding to changing financial, regulatory, and labor market conditions. This may involve diversifying funding sources, adopting innovative financial models, and incorporating entrepreneurial approaches into academic operations. Concurrently, stakeholder engagement should be emphasized as a complementary strategy, with strong partnerships across government, industry, alumni, and local communities mobilizing resources and ensuring that university programs remain relevant to societal needs.

Third, for environmental sustainability, universities should implement participatory governance structures that actively involve students, staff, local communities, and external stakeholders. Such inclusive engagement not only mobilizes diverse knowledge and resources but also legitimizes environmental initiatives, supporting continuity beyond changes in leadership.

Establishing sustainability councils or advisory boards composed of diverse stakeholders can facilitate coordinated ecological actions. Finally, universities must intentionally cultivate a sustainability-oriented organizational culture by embedding values of accountability, transparency, and collaboration into everyday practices. Training, awareness programs, and incentives for sustainable behaviors among staff and students can help bridge the gap between policies and practice, while careful alignment of cultural values with sustainability goals is critical to minimize resistance or inertia that could impede progress.

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Data availability: The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable requests.

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