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Green university as seeds of change: A strategic digital humanities framework for sustainability transformation in Saudi higher education

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ABSTRACT

This conceptual article proposes a strategic digital humanities framework for advancing green university transformation in Saudi higher education. It begins from a simple but often neglected argument: universities cannot become sustainable by greening infrastructure alone. Energy efficiency, waste management, water conservation, transport planning, and environmental reporting are necessary, yet they do not by themselves transform how academic communities imagine their responsibilities toward land, resources, culture, knowledge, and future generations. In Saudi Arabia, where higher education reform, digital transformation, and sustainability ambitions are closely connected to Vision 2030 and the Saudi Green Initiative, the green university can function as a seed of change when it becomes a cultural and intellectual project as well as an operational one. The article develops a Strategic Digital Humanities for Green University Transformation framework organized around seven interrelated dimensions: digital sustainability curriculum, green digital archives, data storytelling and visualization, the campus as a living laboratory, community and cultural engagement, digital ethics and environmental responsibility, and policy and institutional governance. Drawing on scholarship in sustainability in higher education, digital humanities, education for sustainable development, and Saudi campus sustainability studies, the article argues that digital humanities can humanize sustainability by linking environmental issues with memory, language, place, identity, ethics, narrative, and public participation. The contribution is a context-sensitive framework that Saudi universities can adapt for teaching, research, institutional culture, community engagement, and national development priorities.

KEYWORDS: green university, digital humanities, sustainability transformation, Saudi higher education, Vision 2030, environmental culture, institutional change

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1. Introduction

Universities occupy a distinctive position in the global search for sustainable futures. They produce research, educate professionals, shape public values, convene communities, and model institutional behavior. For that reason, higher education is increasingly expected to do more than reduce the ecological footprint of its buildings. It is expected to cultivate new habits of thought, new forms of responsibility, and new relationships between knowledge and action. The idea of the green university has emerged from this expectation. At its most limited, it may refer to energy-efficient facilities, recycling systems, low-carbon transport, water management, or sustainability rankings. At its most transformative, however, it names a university that reorganizes its teaching, research, governance, partnerships, and cultural life around a long-term commitment to ecological and social well-being.

This distinction matters because sustainability problems are never only technical. Climate change, water scarcity, biodiversity loss, waste, pollution, and unsustainable consumption are material problems, but they are also problems of imagination, memory, language, policy, economic behavior, social meaning, and public trust. A university that installs solar panels but leaves its curriculum untouched may reduce emissions without changing the intellectual culture that normalizes unsustainable development. A university that enters a green ranking but fails to invite students, faculty, and communities into meaningful participation may treat sustainability as institutional branding. Conversely, a university that connects environmental science with history, literature, geography, ethics, Arabic language, Islamic environmental values, urban studies, media, design, and digital culture can make sustainability visible and personally meaningful to learners who will carry those values beyond campus.

Saudi higher education offers a significant context for such a shift. The Kingdom has invested heavily in universities, research capacity, digital infrastructure, and human capability development. Vision 2030 identifies education, innovation, quality of life, environmental protection, and economic diversification as central national priorities (Kingdom of Saudi Arabia, 2016). The Human Capability Development Program further links education with future skills, values, lifelong learning, and global competitiveness (Human Capability Development Program, n.d.). At the same time, the Saudi Green Initiative frames climate action through emissions reduction, land restoration, afforestation, and protection of land and sea, with stated national targets for 2030 and net-zero ambition for 2060 (Saudi Green Initiative, n.d.). These policy directions create a favorable environment for universities to become active agents of sustainability transformation rather than passive recipients of reform.

Yet the path from policy ambition to institutional transformation is not automatic. Saudi universities vary in their readiness, governance capacity, curriculum flexibility, digital literacy, and experience with sustainability integration. Studies of Saudi campus sustainability have reported persistent gaps in teaching, research, operations, management, and community engagement (Alshuwaikhat et al., 2016; Alsharif et al., 2020; AlAli & Aboud, 2024; Alshammari, 2025). These gaps do not imply failure; they indicate that green transformation requires a deeper framework than isolated environmental projects. It requires the ability to connect national priorities with institutional culture, student agency, public communication, and local ecological realities.

This article argues that digital humanities can help provide such a framework. Digital humanities is not simply the use of technology in humanities disciplines. It is a critical, interdisciplinary field that combines digital tools with humanistic questions about interpretation, culture, evidence, memory, language, ethics, access, and power (Burdick et al., 2012; Gold & Klein, 2016; Kirschenbaum, 2010). It includes practices such as digital archives, mapping, data visualization, text mining, digital storytelling, public history, cultural analytics, and online exhibitions. More importantly for sustainability, it asks how digital technologies shape what societies remember, value, visualize, and choose to act upon. When applied strategically, digital humanities can translate sustainability from an administrative target into a shared cultural project.

The central thesis of this article is that Saudi universities can become seeds of change when green university transformation is understood as a digital, cultural, educational, ethical, and institutional process. The proposed framework does not replace engineering, environmental science, facilities management, or policy reform. Rather, it complements them by addressing the human dimensions that often determine whether sustainability becomes a living practice or remains a formal aspiration. In this sense, the green university is not merely a greener campus; it is a seedbed of sustainable citizenship, ecological memory, responsible innovation, and public learning.

2. Problem Statement

Many university sustainability initiatives begin with what is most measurable: electricity consumption, water use, waste volume, transport patterns, carbon emissions, building standards, and the number of sustainability courses or projects. These indicators are important and should not be dismissed. They create accountability, enable comparison, and help leaders identify areas of improvement. Global initiatives such as UI GreenMetric, which benchmarks universities through indicators related to setting and infrastructure, energy and climate change, waste, water, transportation, education, and research, have helped normalize the expectation that universities should report and improve their environmental performance (UI GreenMetric, n.d.). Still, indicators can become narrow if they are treated as the whole meaning of sustainability.

The problem addressed in this article is the tendency to separate green university work from the cultural, narrative, ethical, historical, and digital dimensions of sustainability. A campus may recycle paper while students remain disconnected from the environmental histories of their own cities. A university may host a climate awareness day while curricula continue to present sustainability as a specialized scientific issue rather than a concern that belongs across disciplines. Institutional reports may display data without enabling communities to understand how those data relate to everyday choices, local memory, or national development. In such cases, sustainability becomes visible as administration but not necessarily as transformation.

This gap is especially relevant in Saudi higher education. The Kingdom's environmental challenges are deeply linked to place: desert ecosystems, aridity, coastal environments, rapid urban growth, energy transitions, food and water security, heritage landscapes, and the relation between traditional ecological knowledge and modern development. If sustainability education remains confined to technical departments, universities risk missing the interpretive and civic work required to make ecological responsibility culturally rooted. Students in literature, language, history, media, social sciences, design, business, law, and education also need to understand sustainability as part of their professional and social futures.

The second part of the problem concerns digital transformation itself. Digital tools are often presented as solutions: online learning reduces paper, sensors optimize energy use, dashboards track consumption, and artificial intelligence supports decision-making. These possibilities are valuable, but they are incomplete without critical reflection on digital ethics. Digital systems have environmental costs, including energy-intensive computing, hardware replacement, e-waste, and the resource demands of data centers and AI models (Crawford, 2021; Strubell et al., 2019; UNESCO, 2022). A strategic framework for green universities therefore cannot celebrate digitalization uncritically. It must ask how digital technologies can support sustainability while also being governed responsibly.

The article responds to these problems by proposing a conceptual framework in which digital humanities becomes a bridge between green campus operations, sustainability education, cultural memory, public engagement, and digital responsibility. The framework is designed for Saudi higher education but can be adapted elsewhere, particularly in contexts where national development agendas, environmental transitions, and digital transformation are unfolding simultaneously.

3. Research Aim and Questions

The aim of this article is to develop a strategic digital humanities framework that can support sustainability transformation in Saudi higher education by expanding the meaning of the green university beyond operational efficiency toward cultural, educational, ethical, and participatory change. The article is conceptual and integrative rather than empirical. It draws on literature in sustainability in higher education, education for sustainable development, digital humanities, campus sustainability assessment, digital ethics, and Saudi higher education reform. Its purpose is not to measure the current performance of a particular institution, but to clarify how universities could organize green transformation more holistically.

Three research questions guide the discussion. First, how can Saudi universities move from isolated green initiatives toward deeper sustainability transformation across teaching, research, governance, culture, and community engagement? Second, in what ways can digital humanities support environmental awareness, cultural memory, public communication, sustainability education, and participatory learning? Third, what strategic framework can help Saudi higher education institutions become green universities and seeds of change in alignment with national development priorities while remaining critical of superficial or purely symbolic

sustainability practices?

These questions assume that sustainability transformation requires institutional coherence. It is not enough for one department to offer a sustainability elective, one office to publish an environmental report, or one student club to organize awareness events. Transformation occurs when such efforts begin to reinforce one another: when courses generate digital archives, archives support community projects, campus data becomes the basis for student research, dashboards become storytelling platforms, and governance structures turn participation into policy. The framework proposed in this article is therefore organized around interdependence. Each dimension has practical value on its own, but its full force appears when connected to the others.

4. Literature Review

The literature on sustainability in higher education has long emphasized that universities should act as change agents rather than neutral knowledge providers. The Brundtland definition of sustainable development established the intergenerational responsibility of meeting present needs without compromising future generations (World Commission on Environment and Development, 1987). In higher education, this responsibility has been interpreted through teaching, research, operations, governance, and outreach. Velazquez et al. (2006) define the sustainable university as one that minimizes environmental, economic, societal, and health impacts while fulfilling teaching, research, outreach, and stewardship functions. This definition is useful because it treats the university as an integrated system, not a collection of disconnected activities.

Subsequent research has strengthened this systems perspective. Alshuwaikhat and Abubakar (2008) propose an integrated approach to campus sustainability that combines environmental management, public participation, and social responsibility. Stephens et al. (2008) argue that higher education can act as a change agent by producing knowledge, training leaders, and developing institutional models for sustainability transitions. Lozano et al. (2015) show that commitment and implementation vary widely across institutions, with sustainability often advancing unevenly across curriculum, research, operations, and reporting. Fissi et al. (2021) similarly describe the green university as a complex institution involving campus operations, teaching, research, community engagement, institutional frameworks, and accountability. Across these studies, a consistent message emerges: sustainability cannot be reduced to green buildings or environmental management systems; it requires institutional learning.

The literature on education for sustainable development adds a pedagogical dimension to this argument. UNESCO's ESD for 2030 roadmap identifies education as a key enabler of sustainable development and emphasizes policy, learning environments, educator capacity, youth action, and local community engagement (UNESCO, 2020). Sustainability education is therefore not only about transferring environmental information. It involves competencies such as systems thinking, anticipatory thinking, normative reflection, strategic action, collaboration, and self-awareness (Wiek et al., 2011; Brundiers et al., 2021). Barth et al. (2007) argue that higher education must develop competencies that enable learners to deal with uncertainty and complexity. These competencies align closely with the goals of digital humanities when digital tools are used not only to display information but to interpret relationships, tell stories, invite participation, and critique assumptions.

Saudi-focused studies show both opportunity and challenge. Alshuwaikhat et al. (2016) assessed public universities in Saudi Arabia across teaching and curriculum, research and scholarship, campus operations, management and community, and financial management, finding that sustainability integration remained uneven and that sustainability-related courses, research structures, and campus practices needed stronger institutional support. Abubakar et al. (2016) examined student assessments of campus sustainability and demonstrated the relevance of student perception as a source of institutional learning. Alsharif et al. (2020) identified barriers in Saudi universities, including limited sustainability knowledge among decision makers, lack of supportive leadership, cost concerns, and absence of clear legislation or strategic direction. AlAli and Aboud (2024) and Alshammari (2025) continue this line of inquiry, highlighting the need for faculty participation, stronger sustainability culture, and more systematic institutional practices.

This body of work provides a strong foundation, but it also reveals a gap. The Saudi literature has tended to focus on assessment, barriers, drivers, operations, management, and stakeholder perception. These are essential. However, less attention has been given to how humanities-based digital practices could shape sustainability culture: for example, through environmental storytelling, digital archives of local ecological heritage, geospatial

narratives of urban change, bilingual public platforms, student-created exhibitions, or critical inquiry into the material costs of digital systems. This gap is significant because sustainability transformation depends not only on policy and facilities management but on how people understand place, responsibility, and the future.

Digital humanities scholarship offers tools for addressing this gap. Kirschenbaum (2010) describes digital humanities as a field concerned with the intersection of computing and the humanities, involving research, teaching, invention, analysis, and presentation in electronic form. Burdick et al. (2012) emphasize design, collaboration, public scholarship, and new forms of knowledge production. Drucker (2011) cautions that visualization in the humanities should not simply borrow scientific assumptions of objectivity; humanistic visualization must acknowledge interpretation, ambiguity, and situated knowledge. Liu (2012) calls for stronger cultural criticism within digital humanities, warning that technical tool use without critical reflection can become intellectually thin. Risam (2019) adds that digital humanities must attend to postcolonial, linguistic, and cultural inequities in knowledge production. These arguments matter for green universities because sustainability data also requires interpretation. Numbers about carbon, water, waste, and mobility become socially meaningful when connected to values, histories, and communities.

A further strand of scholarship links digital humanities with the environmental humanities and the Anthropocene. Nowviskie (2015) argues that digital work must reckon with preservation, ephemerality, infrastructure, minimal computing, and the ecological implications of scholarly technologies. Crawford (2021) examines AI as a material and extractive system involving minerals, labor, energy, and data. Strubell et al. (2019) draw attention to the financial and environmental costs of large-scale computational models. These perspectives complicate the assumption that digital transformation is automatically sustainable. For Saudi green universities, this is particularly important: digital humanities should not be a decorative layer of technology added to sustainability work, but a critical approach that asks which digital tools are necessary, who benefits from them, what resources they consume, and how they can be designed responsibly.

Taken together, the literature supports the need for a strategic framework that connects green university scholarship with digital humanities. Sustainability research tells us that institutions must transform comprehensively. Education for sustainable development tells us that learners need competencies and participation. Digital humanities tells us that digital culture can reshape interpretation, access, memory, and public communication. Saudi campus sustainability studies tell us that national ambition must be translated into institutional capacity. The proposed framework emerges at the intersection of these four literatures.

5. Conceptual Background

The term green university is often used in ways that are both productive and limiting. It is productive because it gives universities a recognizable identity around sustainability, encouraging environmental planning, reporting, and benchmarking. It is limiting when green is interpreted as a narrow operational label. A campus may be visually green, technologically efficient, and well-ranked, yet still leave sustainability at the margins of curriculum, research culture, and community relationships. For the purposes of this article, a green university is defined as a higher education institution that embeds sustainability into its physical operations, academic mission, institutional governance, cultural life, digital practices, and social responsibilities. This definition treats sustainability as a transformation of values and systems, not merely a set of projects.

The image of seeds of change is useful because it suggests growth, patience, local adaptation, and multiplication. A seed does not transform a landscape immediately. It needs soil, water, care, and time. Similarly, a sustainability initiative becomes transformative only when it is planted in curriculum, supported by leadership, cultivated by faculty, taken up by students, connected to communities, and protected from being reduced to temporary publicity. Saudi universities can be seeds of change when they prepare graduates who carry sustainability values into schools, municipalities, companies, cultural institutions, media, policymaking, family life, and entrepreneurship. The university's influence then extends beyond the campus boundary.

Digital humanities provides a conceptual bridge between the green university and this wider social role. It connects technology with culture, language, history, interpretation, ethics, archives, mapping, visualization, and public knowledge. Unlike purely technical approaches to digital transformation, digital humanities asks what digital tools do to meaning. It asks whose stories are preserved, whose data are missing, how maps shape perception, how algorithms classify culture, how archives include and exclude, and how publics can

participate in knowledge creation. These questions are central to sustainability because environmental crises are also crises of visibility and voice. Some forms of damage are counted; others are forgotten. Some communities are represented in data; others are absent. Some landscapes are preserved in national memory; others disappear without documentation.

A digital humanities approach to sustainability therefore includes both creative and critical functions. Creatively, it can produce digital exhibitions on Saudi environmental heritage, interactive maps of urban growth and water systems, oral history archives about changing landscapes, student podcasts on sustainability practices, multilingual climate glossaries, and dashboards that transform campus data into accessible narratives. Critically, it can examine the environmental impact of digital infrastructure, the ethics of AI in sustainability governance, unequal access to digital tools, and the risk of reducing complex cultural environments to simplified metrics. The strength of digital humanities lies in holding these functions together: it uses digital tools while also questioning them.

This article uses the phrase Strategic Digital Humanities for Green University Transformation to describe an institutional approach in which digital humanities is not a single course, project, or platform, but an organizing logic for sustainability transformation. Strategy here means alignment: curriculum with research, data with storytelling, archives with community engagement, digital innovation with environmental ethics, and institutional governance with national priorities. The framework is not intended to be a rigid model imposed uniformly on all Saudi universities. A research-intensive university, a regional university, a women's university, a health sciences institution, and a technical university may adopt it differently. What matters is that each institution interprets the framework in relation to its mission, local environment, student population, disciplinary strengths, and community needs.

6. The Saudi Higher Education Context

Saudi higher education has expanded and diversified substantially over recent decades. Universities are central to national goals related to human capital, research productivity, digital transformation, economic diversification, cultural development, and quality of life. Vision 2030 gives this transformation a broad policy frame by linking education with future labor markets, innovation, national identity, and sustainable development (Kingdom of Saudi Arabia, 2016). The Human Capability Development Program reinforces the importance of skills, values, knowledge, and lifelong learning (Human Capability Development Program, n.d.). These priorities create a strong rationale for embedding sustainability across higher education, because future-ready capability increasingly requires climate literacy, systems thinking, digital responsibility, and ethical decision-making.

The Saudi Green Initiative adds an environmental frame that universities can translate into research, teaching, and public engagement. Its priorities - emissions reduction, land restoration and afforestation, and protection of land and sea - are not remote from university life. They connect to engineering, architecture, environmental science, medicine, agriculture, geography, law, business, Islamic studies, language, history, arts, media, and education. Universities can support these priorities through research on renewable energy and water systems, but also through public communication, cultural documentation, environmental education, and community partnerships. In this sense, green university transformation can serve Vision 2030 not only by improving campus performance but by cultivating environmental citizenship.

The Saudi context also requires attention to place. Sustainability in an arid country cannot simply import models from temperate regions. Water scarcity, heat, desertification, coastal ecosystems, biodiversity, pilgrimage cities, rapid urbanization, and energy-intensive lifestyles produce distinctive challenges. Digital humanities can help universities avoid abstract sustainability language by rooting environmental education in local narratives and landscapes. Students might map urban heat islands in their city, create oral histories of agricultural change, document traditional water practices, analyze media discourse on consumption, design bilingual public exhibitions on marine protection, or visualize campus energy use in relation to daily behavior. Such projects make sustainability less distant and more situated.

At the same time, Saudi universities face real institutional constraints. The literature reports gaps in sustainability curriculum, limited faculty participation in policy-making, uneven sustainability governance, lack of strategic direction in some institutions, cost concerns, and limited integration of sustainability into research and campus culture (Alshuwaikhat et al., 2016; Alsharif et al., 2020; Alshammari, 2025). These challenges

should be understood structurally rather than as individual shortcomings. Faculty may support sustainability but lack incentives, training, time, or cross-disciplinary spaces. Students may be interested but see few pathways to participate beyond events. Facilities offices may collect data but not have mechanisms for educational use. Libraries may hold valuable local materials but lack sustainability-oriented digital humanities partnerships. Community engagement offices may organize outreach but not integrate it into research and curriculum.

Digital transformation provides both an opportunity and a risk. Saudi universities have increasingly adopted learning management systems, digital services, online platforms, data systems, and AI-enabled tools. These resources can support sustainability education through open educational resources, virtual exhibitions, data dashboards, and collaborative platforms. However, digital transformation can become fragmented if it remains primarily administrative. It can also reproduce unsustainable practices if hardware procurement, energy use, data storage, and e-waste are not governed carefully. A green university should therefore ask not only how digital tools can make education more efficient, but how digital culture can become ethically and environmentally responsible.

Another contextual issue is language. Sustainability discourse in universities may move between Arabic and English, especially in scientific and technical fields. Digital humanities can support bilingual and culturally responsive sustainability education by developing Arabic sustainability vocabularies, translating key concepts, documenting local ecological terms, and enabling public-facing platforms that reach families, schools, municipalities, and non-specialist audiences. This linguistic work is not secondary. Concepts become actionable when people can speak about them in ways that connect with their lived experience, values, and communities. The Saudi higher education context therefore calls for a framework that is nationally aligned but locally grounded, digitally enabled but ethically critical, and academically rigorous but publicly accessible. The proposed framework responds to this need by treating the university as a living cultural institution capable of connecting environmental policy, student learning, digital innovation, and community transformation.

7. Proposed Strategic Digital Humanities Framework

The Strategic Digital Humanities for Green University Transformation framework consists of seven dimensions. They are not sequential stages; rather, they are mutually reinforcing areas of institutional action. A university might begin with a pilot archive, a general education course, or a campus data project, but the long-term goal is to connect all dimensions into a coherent ecosystem. Table 1 summarizes the framework, followed by a detailed discussion of each dimension.

Table 1: Strategic Digital Humanities for Green University Transformation Framework

Dimension	Core question	Strategic action	Expected transformation
Digital sustainability curriculum	How can sustainability become meaningful across disciplines?	Embed sustainability themes in humanities, social sciences, language, media, education, business, design, and science courses through digital projects.	Students develop sustainability literacy, systems thinking, and public communication skills.
Green digital archives	What environmental memories and local knowledge need preservation?	Create curated digital collections of environmental heritage, oral histories, traditional ecological knowledge, climate memory, and urban change.	Sustainability becomes rooted in cultural memory and local identity.
Data storytelling and visualization	How can environmental data become understandable and actionable?	Use maps, dashboards, timelines, exhibitions, and narrative visualizations to communicate campus and community sustainability challenges.	Data moves from reporting to public learning and participation.
Campus as living laboratory	How can the campus become a site of inquiry and change?	Turn energy, water, waste, mobility, biodiversity, and food systems into student research and digital humanities projects.	Operations, teaching, and research become mutually reinforcing.

Community and cultural engagement	How can universities extend sustainability beyond campus?	Develop partnerships with schools, municipalities, museums, libraries, NGOs, and local communities through bilingual digital platforms.	The university becomes a civic seedbed for environmental awareness.
Digital ethics and environmental responsibility	How can digital transformation avoid reproducing ecological harm?	Adopt principles for minimal computing, responsible AI, green procurement, e-waste reduction, data governance, and inclusive access.	Digital innovation becomes accountable to ecological and social values.
Policy and institutional governance	How can sustainability become durable rather than symbolic?	Integrate the framework into strategy, incentives, assessment, leadership structures, quality assurance, and annual reporting.	Green transformation becomes institutionally embedded.

Note. The framework is intended as a flexible strategic model rather than a fixed checklist. Institutions should adapt the dimensions to their mission, location, resources, and community relationships.

7.1 Digital Sustainability Curriculum

The first dimension calls for sustainability to be embedded across curricula through digital humanities methods. This does not mean adding a single environmental lecture to every course. It means designing assignments and learning outcomes that connect disciplinary knowledge with sustainability questions. In literature courses, students might analyze representations of desert, sea, city, consumption, or intergenerational responsibility. In Arabic language courses, they might build a bilingual lexicon of sustainability terms and public communication materials. In history courses, they might create digital timelines of environmental change. In media courses, they might analyze climate communication on social media. In business courses, they might examine narratives of green entrepreneurship and responsible consumption. In education courses, they might design digital learning resources for schools.

Such curricular work develops competencies identified in sustainability education: systems thinking, collaboration, anticipatory thinking, normative reflection, and strategic action (Wiek et al., 2011; Brundiers et al., 2021). It also gives humanities and social science students an active role in sustainability transformation. A digital sustainability curriculum can be organized through general education requirements, interdisciplinary minors, course-based undergraduate research, capstone projects, and graduate seminars. The key is to make digital production meaningful. Students should not simply make websites or presentations; they should learn how evidence becomes public knowledge, how stories shape behavior, and how local environmental issues connect to national and global futures.

7.2 Green Digital Archives

The second dimension proposes green digital archives that preserve and interpret environmental memory. Saudi Arabia contains diverse ecological and cultural landscapes: deserts, oases, coasts, mountains, farms, historical trade routes, pilgrimage cities, protected areas, and rapidly changing urban zones. Much environmental knowledge exists in personal memory, local terminology, photographs, maps, community practices, poetry, architecture, and everyday stories. Without digital preservation and interpretation, this knowledge may remain scattered or disappear.

University libraries, humanities departments, geography programs, environmental research centers, and community partners can collaborate to create curated digital collections. These archives might include oral histories of water use, photographs of urban expansion, maps of changing coastlines, accounts of traditional agriculture, local names for plants and animals, environmental policy documents, student fieldwork, and artistic representations of place. The archive should not be a passive storage site. It should be pedagogically active, searchable, ethically governed, bilingual where appropriate, and connected to exhibitions, courses, and community events. By doing so, the green university links sustainability to identity and memory rather than presenting it as an imported policy vocabulary.

7.3 Data Storytelling and Visualization

The third dimension addresses the problem that sustainability data often remains locked inside institutional reports. Universities collect information about electricity, water, waste, transport, green spaces, research outputs, and participation. Yet data rarely changes behavior unless people can understand it, trust it, and see themselves in relation to it. Digital humanities can transform data into stories without sacrificing accuracy. It can use interactive maps, timelines, narrative dashboards, short videos, digital exhibitions, and public-facing reports to make environmental conditions visible.

Drucker's (2011) warning about visualization is important here. Green dashboards should not imply that data is neutral or complete. A responsible visualization explains sources, uncertainties, assumptions, and limits. It allows comparison, but it also invites interpretation. For example, a campus water dashboard could show usage patterns while linking them to stories about aridity, Islamic ethics of moderation, local water history, and student conservation initiatives. A waste visualization could connect cafeteria waste to consumption habits, procurement, and food culture. In this way, data storytelling helps the university move from compliance reporting toward public learning.

7.4 Campus as Living Laboratory

The fourth dimension treats the campus as a living laboratory. This idea is well established in sustainability education, but digital humanities can extend it by connecting observation, interpretation, and communication. The campus contains energy systems, water systems, buildings, landscapes, food services, transport routes, laboratories, libraries, classrooms, prayer spaces, residence halls, and digital networks. Each can become an object of inquiry. Students can investigate how people move, consume, gather, waste, conserve, and imagine campus life.

A living laboratory approach should not be limited to engineering measurements. It can include ethnographic observation of recycling behavior, narrative mapping of shaded walking routes, digital exhibitions about native plants, student podcasts on sustainable commuting, visual essays on campus heat, or archival projects on the history of campus planning. Facilities staff, faculty, students, and administrators should work together so that operational data becomes educational material and student research informs institutional decisions. This collaboration can also reduce the distance between academic learning and university governance.

7.5 Community and Cultural Engagement

The fifth dimension extends green university work beyond the campus. A university becomes a seed of change only when its sustainability knowledge circulates through communities. Digital humanities is particularly suited to this role because it produces public-facing forms of knowledge: exhibitions, podcasts, maps, story platforms, online archives, teaching resources, and multilingual materials. Saudi universities can partner with schools, municipalities, cultural centers, libraries, museums, environmental organizations, and local businesses to co-create sustainability projects.

Community engagement should be reciprocal. Universities should not simply broadcast expert knowledge to the public. They should invite community members to contribute memories, concerns, practices, and questions. For instance, an archive on coastal change could include fishermen's stories, municipal data, student photography, and scientific research. A project on urban heat could combine satellite maps with residents' experiences of mobility and public space. A school partnership could involve university students mentoring younger pupils in digital storytelling about environmental responsibility. Such projects build trust and make sustainability socially situated.

7.6 Digital Ethics and Environmental Responsibility

The sixth dimension insists that digital sustainability work must be environmentally responsible. Digital humanities projects can be resource-intensive if they rely on unnecessary platforms, excessive storage, rapid hardware cycles, or opaque AI tools. The environmental costs of computation, including energy use and carbon emissions from model training, have been documented in machine learning research (Strubell et al., 2019). Broader critical work on AI also shows that digital systems depend on material infrastructures, mineral extraction, labor, and waste streams (Crawford, 2021). UNESCO's recommendation on AI ethics includes

environmental and ecosystem flourishing as a principle (UNESCO, 2022). A green university should therefore model responsible digital practice.

Practical principles may include minimal computing where appropriate, preference for durable and open formats, lifecycle planning for digital projects, green procurement, e-waste collection, server energy awareness, accessibility standards, data privacy, transparent AI use, and evaluation of whether a high-tech solution is necessary. Digital humanities can help here because it is comfortable with critique. It reminds universities that innovation is not automatically good; it becomes good when governed by human and ecological values.

7.7 Policy and Institutional Governance

The seventh dimension concerns durability. Many sustainability initiatives fail because they depend on individual enthusiasm rather than institutional structures. A green digital humanities framework should be embedded in university strategy, quality assurance, promotion criteria, funding schemes, curriculum review, community engagement plans, library strategy, and digital transformation policy. Without governance, archives may disappear when a grant ends, dashboards may become outdated, and student projects may remain invisible to decision makers.

Governance does not mean excessive bureaucracy. It means creating clear responsibility, incentives, and accountability. Universities can establish cross-disciplinary sustainability and digital humanities committees, seed grants for course redesign, student fellowships, public scholarship awards, faculty development programs, partnerships between libraries and sustainability offices, and annual reporting that includes cultural and educational indicators alongside operational metrics. This dimension also helps align university efforts with national goals while allowing local adaptation.

8. Discussion

The proposed framework advances three arguments about green university transformation. First, sustainability becomes durable when it is made culturally meaningful. Technical improvements can reduce environmental impacts, but they do not automatically change the stories people tell about prosperity, convenience, responsibility, or the future. Digital humanities can help universities work at this deeper level by connecting sustainability to memory, language, identity, faith-informed ethics, local landscapes, and public narrative. In Saudi Arabia, where national transformation is accompanied by renewed attention to heritage, culture, tourism, and quality of life, this cultural dimension is especially important.

Second, the framework challenges the division between sciences and humanities. Sustainability is sometimes framed as the responsibility of environmental science, engineering, architecture, or facilities management. These fields are indispensable, but they cannot alone address the social meanings and behaviors that shape sustainability outcomes. Humanities and social sciences are needed to interpret values, histories, policies, communication, behavior, ethics, and imagination. Digital humanities adds a practical methodology for turning interpretation into public-facing projects. It allows students to create, not only consume, sustainability knowledge.

Third, the framework treats digital transformation with both hope and caution. Digital tools can make environmental patterns visible, widen participation, preserve cultural memory, and support new forms of collaboration. Yet digitalization also carries environmental and ethical costs. A university that uses AI to optimize energy but ignores e-waste, data privacy, or the energy footprint of computation has not fully embraced sustainability. The framework therefore invites a mature digital culture: one that is innovative, critical, inclusive, and ecologically aware.

The framework also helps Saudi universities move beyond symbolic sustainability. Symbolic sustainability appears when institutions highlight isolated projects without changing structures. Examples may include one-time events, publicity-driven tree planting, reports without participation, dashboards without pedagogy, or rankings pursued without cultural transformation. The framework reduces this risk by requiring connections among curriculum, archives, data storytelling, living laboratories, community engagement, digital ethics, and governance. No single project can satisfy the whole framework. Transformation is measured by the quality of relationships among activities.

However, several barriers must be acknowledged. Interdisciplinary collaboration is difficult in universities organized by departments, budgets, and disciplinary identities. Faculty may lack training in digital humanities

or sustainability education. Digital literacy may be uneven among students and staff. Institutional data may be inaccessible, inconsistent, or sensitive. Libraries and IT units may not have resources to support long-term public digital projects. Some leaders may prefer highly visible infrastructure projects over slower cultural work. There is also a risk that digital humanities itself becomes another fashionable label unless linked to rigorous methods, ethical standards, and assessment.

Another challenge is evaluation. Operational indicators are easier to measure than cultural change. It is easier to count solar panels or recycling bins than to assess whether students have developed ecological responsibility or whether communities feel represented in university archives. Nevertheless, qualitative and mixed methods can help. Universities can evaluate student learning through portfolios, reflective writing, project rubrics, community feedback, digital analytics, participation rates, interviews, and longitudinal alumni studies. The goal is not to replace quantitative indicators but to complement them with evidence of meaning, participation, and institutional learning.

The framework's strength lies in its adaptability. A university with strong environmental science programs might begin by turning campus data into public humanities projects. A university with strong Arabic, history, or media departments might begin with environmental archives and storytelling. A technical university might focus on responsible digital infrastructure and living laboratory projects. A regional university might document local ecological heritage and connect with municipalities. What matters is not uniform adoption but strategic coherence. Each university should ask: What environmental issues are most urgent in our place? What cultural resources do we hold? What digital capacities do we have? Who needs to be included? How will this work survive beyond a single event or grant?

9. Practical Implications

For university leaders, the framework suggests that sustainability should be placed at the center of institutional strategy rather than assigned only to facilities departments or temporary committees. Leaders can begin by mapping existing sustainability-related courses, research centers, digital resources, library collections, community partnerships, and operational data. This mapping should identify not only strengths but also missed connections. For example, a university may have energy data, a media department, and student clubs, yet no mechanism that allows students to transform energy data into public communication projects. Strategic leadership means creating those bridges.

For policymakers and quality assurance bodies, the framework suggests that sustainability indicators should include cultural and educational dimensions. National ranking systems and institutional evaluations can encourage universities to document not only environmental performance but also sustainability curriculum, public scholarship, community engagement, digital accessibility, responsible AI policies, and faculty development. Such indicators should be carefully designed to avoid superficial compliance. They should reward evidence of integration, participation, and learning rather than mere statements of intention.

For faculty members, the framework offers practical entry points. Not every instructor needs to become an environmental scientist or programmer. A literature instructor can assign a digital storytelling project on place and environmental memory. A history instructor can guide students in building timelines of urban or agricultural change. A media instructor can analyze sustainability campaigns. A business instructor can examine green branding critically. A computer science instructor can collaborate with humanities faculty on ethical dashboards. Faculty development workshops can help instructors design assignments that combine disciplinary outcomes with sustainability and digital literacy.

For libraries, archives, and IT units, the framework highlights a strategic role that is often underrecognized. Libraries can curate green digital archives, support metadata standards, preserve student projects, teach information ethics, and host public exhibitions. IT units can support sustainable platforms, accessibility, cybersecurity, data governance, and responsible procurement. Together, libraries and IT offices can ensure that digital humanities projects are not fragile experiments but durable institutional resources.

For students, the framework creates pathways from awareness to agency. Students should be invited to collect data, tell stories, build archives, interview communities, design campaigns, create visualizations, and propose policy changes. Their work should be visible to decision makers and communities. Student participation is especially important because universities educate future teachers, administrators, entrepreneurs, engineers, media producers, researchers, and parents. When students experience sustainability as participatory and creative,

they are more likely to carry it beyond the classroom.

For community partners, the framework offers a model of collaboration that respects local knowledge. Municipalities, schools, museums, environmental groups, and cultural organizations can work with universities to co-create resources that are useful beyond academic publication. A digital archive, map, or exhibition can become a public learning tool. Such partnerships also help universities avoid treating sustainability as an internal campus matter. Environmental transformation requires public trust, and public trust grows when communities see their knowledge and concerns represented.

10. Limitations and Future Research

This article is conceptual. It proposes a framework but does not test it empirically in a specific Saudi university. The framework should therefore be understood as a strategic model for adaptation rather than a validated instrument. Its practical usefulness depends on institutional context, leadership support, resources, faculty readiness, student interest, digital infrastructure, and community partnerships. Some universities may find certain dimensions easier to implement than others. For example, institutions with strong libraries may begin with archives, while institutions with strong facilities data may begin with living laboratories and dashboards.

Future research should test the framework through case studies, interviews, action research, curriculum analysis, institutional audits, and design-based research. Comparative studies could examine how different Saudi universities adapt the framework in relation to location, mission, size, gender composition, disciplinary strengths, and governance structures. Researchers could also develop assessment rubrics for each dimension and examine how digital humanities projects influence sustainability literacy, student agency, faculty collaboration, and community engagement.

Another area for future research concerns Arabic digital sustainability resources. Scholars could examine how sustainability concepts are translated, taught, and circulated in Arabic and bilingual university contexts. Research might also investigate how Saudi environmental heritage, Islamic environmental ethics, local ecological terminology, and community narratives can support sustainability education. Finally, more work is needed on the environmental impact of digital transformation in universities, including data centers, AI use, e-waste, procurement, and minimal computing practices. A truly green university must examine not only what digital tools make possible, but what they consume and what responsibilities they create.

11. Conclusion

The green university should not be imagined as a finished object, a ranking position, or a campus aesthetic. It is better understood as a seed of change: a living institutional possibility that grows through teaching, research, culture, governance, and public engagement. In Saudi higher education, this possibility is especially timely because national priorities around Vision 2030, human capability development, digital transformation, and environmental action create a broad policy environment for sustainability transformation. Yet policy ambition must be translated into institutional meaning. That translation is where digital humanities can make a distinctive contribution.

By linking technology with culture, data with interpretation, archives with memory, dashboards with storytelling, and innovation with ethics, digital humanities can humanize sustainability. It can help students see environmental issues not as distant scientific abstractions but as questions about place, language, heritage, behavior, justice, and the future. It can help universities preserve local ecological knowledge, communicate campus data, engage communities, and critique the environmental costs of digital systems. It can also bring humanities and social sciences into sustainability work not as decorative additions, but as essential partners in transformation.

The Strategic Digital Humanities for Green University Transformation framework proposed in this article offers one way to organize that work. Its seven dimensions - curriculum, archives, data storytelling, living laboratories, community engagement, digital ethics, and governance - invite Saudi universities to move from isolated initiatives to integrated change. The framework is ambitious but practical: it can begin with a course, a library project, a dashboard, a student archive, or a community partnership. What matters is that each seed is cultivated within a larger institutional ecology. When universities teach sustainability, preserve environmental memory, visualize data responsibly, involve students, engage communities, and govern digital transformation ethically, they become more than green campuses. They become seeds of cultural and national change.

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