SUSTAINABILITY ASSESSMENT OF HIGHER EDUCATION INSTITUTIONS: FACULTY MEMBERS PERSPECTIVE IN SAUDI UNIVERSITIES

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Abstract: Sustainability in higher education involves the integration of sustainable principles, practices, and values into the fundamental functions of educational institutions, addressing environmental, social, and economic dimensions. This study aims to evaluate sustainability practices in Saudi higher education institutions, focusing on faculty members' perceptions. The primary objective is to assess the extent of sustainability implementation across academic, research, social, and environmental dimensions in Saudi universities. By leveraging faculty members' insights, the study seeks to identify areas of strength and weakness in current sustainability practices. The research adopts a descriptive and analytical approach, utilizing an electronic questionnaire as the primary data collection tool. A random sample of 275 faculty members from diverse Saudi universities actively participates in the study. Descriptive and inferential statistical methods are applied for data analysis and hypothesis testing. The findings indicate a limited implementation of sustainability practices within Saudi universities across various dimensions, as perceived by faculty members. Weaknesses are identified in academic, research, social, and environmental spheres. The study recommends that universities prioritize sustainability by establishing dedicated committees and drawing inspiration from successful institutions in the field. A clear strategic vision for sustainability is crucial for advancing these practices within higher education institutions in Saudi Arabia.

Key words: Sustainability of universities, Academic sustainability, Research sustainability, Social sustainability, Environmental sustainability

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INTRODUCTION

The increasing global interest in sustainability within higher education institutions reflects a growing recognition of the importance of addressing environmental, social, and economic challenges. This interest is evident through the organization of numerous international conferences and initiatives that emphasize the need to integrate sustainability into the fabric of higher education. These gatherings provide platforms for experts, researchers, and practitioners to share knowledge, exchange ideas, and recommend strategies for embedding sustainability within universities.

The recommendations put forth by these conferences and initiatives highlight the significance of adopting a holistic approach to sustainability or focusing on specific pillars such as environmental stewardship, social equity, and economic viability. This comprehensive and integrated perspective acknowledges that sustainability requires a multidimensional effort that transcends disciplinary boundaries and requires collaboration from various stakeholders within higher education institutions (Griebeler et al., 2022; Grano and Prieto, 2020).

Universities, as key players in the field of sustainability, have a pivotal role to play in shaping a sustainable future. They have the capacity to contribute to societal progress and development by fostering innovation in sustainable practices and solutions. By aligning their efforts with the needs and aspirations of contemporary society, universities can actively participate in spreading the culture of sustainability. This can be achieved by prioritizing sustainability as a core value, integrating it into institutional policies and strategies, and making it a central topic for scientific research and education. To further promote sustainability and effect long-term social changes, the establishment of dedicated centers for peace and education is crucial. These centers serve as hubs for interdisciplinary collaboration, knowledge dissemination, and capacity building in sustainability. They facilitate cross-sector partnerships, engage with local communities, and develop initiatives that address pressing sustainability challenges. By enhancing awareness, education, and research in sustainability, these centers contribute to transforming societies and fostering a more sustainable future.

Despite the progress made in recent years, the higher education sector still faces challenges in fully embracing sustainability. The relative novelty of sustainability within the university context and the complexity of implementing comprehensive and emerging sustainability models contribute to this lag. However, the increasing number of sustainable universities worldwide signifies a growing momentum and commitment toward sustainability in higher education (Leal Filho et al., 2023; Leal Filho et al., 2021; Bauer et al., 2021). Universities are playing a crucial role in driving sustainable

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development by integrating sustainability into their operations, education, research, and community engagement. Sustainable universities prioritize not only reducing negative environmental impacts but also supporting sustainable development locally and globally. They demonstrate key features such as implementing entrepreneurial practices, following regulations and guidelines, and collaborating with local communities to create positive change. Each university may focus on specific aspects of sustainability that align with their unique context, creating a diverse and impactful role for sustainable universities in promoting sustainability across different fields (Abunasser et al., 2022).

The United Nations has recently launched seventeen sustainable development goals that encompass a range of societal challenges. Education has been identified as a crucial component in achieving these goals, with a focus on providing quality, inclusive education and lifelong learning opportunities. Sustainable development education has gained significance as it has the potential to address pressing issues such as environmental degradation, social inequality, and economic instability. By integrating sustainability principles into curricula and educational practices across all levels, education can equip learners with the knowledge, skills, and values needed to tackle these challenges. It promotes an understanding of the interconnectedness of social, economic, and environmental systems, empowering individuals to contribute to sustainable development. Additionally, sustainable development education fosters critical thinking, creativity, and problem-solving abilities by engaging learners in real-world sustainability issues and encouraging innovative solutions. This approach aims to cultivate responsible and active global citizens who can make meaningful contributions towards creating a more sustainable future. Ultimately, the integration of sustainable development in education is vital in preparing learners with the necessary tools to address complex global challenges and shape a sustainable world (AlAli et al., 2023).

STUDY PROBLEM

Certainly! In this study, the aim is to delve deeper into the current state of sustainability practices within Saudi higher education institutions. The focus is to go beyond the traditional emphasis on strengthening sustainability in the fundamental functions of universities, such as education, academic achievement, and community service. Instead, the study seeks to prioritize environmental stewardship as an integral component of sustainability efforts. By examining the key pillars of higher education sustainability, namely academic sustainability, physical sustainability, social sustainability, and environmental sustainability, the research aims to provide a comprehensive assessment of sustainability practices within these institutions. Academic sustainability involves evaluating how universities integrate sustainability principles into their educational programs and curricula. It encompasses teaching sustainability-related subjects, promoting research on sustainability issues, and fostering a culture of sustainability among students and faculty. Physical sustainability pertains to the eco-friendly practices and resource management within university campuses. This includes energy conservation, waste management, water efficiency, and the promotion of sustainable transportation options. Social sustainability focuses on the well-being and inclusivity of the university community, including aspects such as diversity, equity, and social responsibility initiatives. Lastly, environmental sustainability examines how higher education institutions contribute to the preservation and protection of the natural environment. This includes efforts in environmental conservation, reducing carbon emissions, promoting biodiversity, and addressing climate change.

Based on the information provided above, the main research question that can be formulated is as follows: To what extent is sustainability applied in higher education institutions from the perspective of faculty members in Saudi universities?

To further clarify the scope of the study, the following sub-questions are proposed:
1. To what extent is academic sustainability being implemented in Saudi universities?
2. To what extent is research sustainability implemented in Saudi universities?
3. To what extent is social sustainability being practiced in Saudi universities?
4. To what extent is environmental sustainability being implemented in Saudi universities?

STUDY HYPOTHESES

In order to address the research questions, the following hypotheses have been formulated: Main hypothesis:

H1: Sustainability is applied in higher education institutions from the point of view of faculty members in Saudi universities, with a significance level of 0.05.

Sub-hypotheses:

H2: Academic sustainability is applied in Saudi universities, with a significance level of 0.05.

H3: Research sustainability is applied in Saudi universities, with a significance level of 0.05.

H4: Social sustainability is applied in Saudi universities, with a significance level of 0.05.

H5: Environmental sustainability is applied in Saudi universities, with a significance level of 0.05.

The significance of the study

The present study carries great importance due to its scientific subject matter and its practical application within the context of evolving circumstances and changes observed in higher education institutions. The following points highlight the significance of this study:

• Establishing a connection between the core functions of universities and sustainability by examining the key pillars of higher education sustainability, namely academic sustainability, research sustainability, social sustainability, and environmental sustainability.

• Leveraging the concepts of academic, research, social, and environmental sustainability in universities to enhance sustainable awareness, foster the dissemination of sustainability culture, and promote its application both within and beyond the university campus.

- Making a scientific contribution by enriching applied studies on sustainability issues in universities. This study can serve as a valuable resource for researchers to further explore areas that were not covered in the previous research.

- Generating added value through the study's findings, insights, and recommendations, which are expected to be implemented on the ground, leading to the establishment of sustainable practices in Saudi universities. These outcomes have the potential to drive positive change and foster sustainability in the higher education sector.

Objectives of the study

The study encompasses several primary objectives, each contributing to a comprehensive exploration of sustainability in higher education:

1. Conceptualization and Significance: Define the concept of university sustainability. Explore the importance, underlying motives, and key stages of implementing sustainability in higher education institutions.

2. Current State Assessment: Evaluate the existing state of sustainability application in Saudi higher education institutions. Gather insights from faculty members regarding their perceptions of sustainability practices within universities.

3. Level of Sustainability Application: Determine the extent of sustainability application in higher education institutions based on faculty perspectives in Saudi universities.

4. Strategic Proposals: Propose a diverse set of strategic approaches aimed at aiding higher education institutions, particularly universities, in the effective implementation of sustainability practices.

These objectives collectively seek to advance our understanding of sustainability in higher education, assess its current status, and offer strategic recommendations tailored to support the successful integration of sustainability principles across various higher education institutions, with a specific emphasis on universities.

Previous studies

The study conducted by Beringer and Adombent (2008) meticulously examined the status of sustainable research and development projects within universities, focusing specifically on projects at the University of Luneburg in Germany and the University of Prince Edward Island in Canada. Through a descriptive methodology, the researchers identified that sustainable projects aim for institutional transformation through strategic and methodological approaches. They recognized universities as dynamic systems capable of both education and change, emphasizing the crucial integration of sustainability principles into core operations. Wooltorton et al.'s study (2011) assessed the outcomes of the second phase of the "Transformation to Sustainability: ECU Southwestern" project at Edith Cowan University. Employing a descriptive methodology, the study highlighted inadequate work-life balance, mainly due to limited time availability, as a significant obstacle to the success of social sustainability transformation projects. These findings underscore a tangible challenge requiring attention to facilitate the progress of sustainability initiatives within organizations.

AlAli et al.'s research in 2023 delved into the effectiveness of STEM-based teaching in achieving sustainable development goals among educators in Saudi Arabia. The study revealed the potential of STEM pedagogy to realize sustainable development goals in learning, with goals systematically ranked based on perceived effectiveness. Notably, the study underscored the highest average score for the goal of inclusive and equitable quality education. Leal Filho et al. (2020) explored sustainability leadership in Higher Education Institutions (HEIs), aiming to understand key characteristics and challenges. Through purposive sampling, participants in top management positions provided information-rich perspectives, emphasizing inclusivity in leadership styles. Urbanski and Filho's study (2014) comprehensively investigated the application of sustainability in American and Canadian universities, employing a descriptive approach. Findings highlighted varying commitment levels among universities, with a growing interest in the Sustainability Tracking, Evaluation, and Rating System (STARS). Sebire and Sabeles-Flores (2023) stressed the importance of incorporating education for sustainable development in higher education practices. They advocated for strategies to seamlessly integrate sustainable development across disciplines, positioning higher education institutions as leaders in sustainability.

Al-Khawaldeh's study (2016) explored obstacles to sustainability in higher education, focusing on faculty perceptions in Jordanian universities. The findings uncovered substantial obstacles, emphasizing challenges that demand attention for long-term sustainability. Bosaha and Bahous (2019) emphasized the role of universities in sustainable development, highlighting shortcomings in university center performance. Importantly, demographic variables did not significantly influence perceptions of sustainable development. Badrakhan et al.'s study (2022) assessed private universities' role in sustainability, revealing varied perceptions among teaching staff across academic, research, political, and economic dimensions. The study emphasized the need for improvements and further research. Al-Kurd's study (2018) in Palestine aimed to identify the anticipated role of universities in promoting sustainable development, emphasizing priorities such as intellectual capital, international collaborations, technical education, creativity, and innovation. The shift in focus from employment to job creation aligned with sustainable development objectives.

The collective studies delve into sustainability initiatives in higher education, presenting a comprehensive overview. Beringer and Adombent's (2008) scrutiny of German and Canadian universities underscores the pursuit of institutional transformation through strategic sustainability approaches. Wooltorton et al.'s (2011) study at Edith Cowan University highlights the challenge of work-life balance hindering social sustainability projects. AlAli et al. (2023) research showcases the potential of STEM-based teaching, particularly in achieving inclusive and equitable quality education. Leal Filho et al. (2020) focus on sustainability leadership in HEIs, emphasizing inclusive leadership styles. Urbanski and Filho's (2015) comprehensive investigation reveals varying commitment levels in American and Canadian universities. Sebire and Sabeles-Flores (2023) stress the importance of integrating sustainable development into higher education practices. Al-Khawalda's (2016) study in Jordan identifies substantial obstacles to sustainability. Bosaha and Bahous (2019) underscore

the role of universities in sustainable development, with minimal influence from demographic variables. Badrakhan et al. (2022) assessment of private universities highlights varied perceptions, emphasizing the need for improvements. Al-Kurd's (2018) study in Palestine identifies anticipated roles, emphasizing intellectual capital and job creation in alignment with sustainable development objectives. Reviewing existing studies on sustainability in higher education institutions, the literature generally focused on identifying barriers and challenges. In contrast, the present study distinguishes itself by concentrating specifically on Saudi universities. While building upon existing knowledge, this research contributes by examining the nuanced application of sustainability within the unique context of Saudi higher education institutions. This targeted approach aims to unravel distinctive challenges, opportunities, and practices, providing insights that could inform tailored strategies for promoting sustainability in the Saudi higher education landscape.

The Concept of University Sustainability and Its Significance:

The significance of sustainability in education, particularly in higher education institutions, has witnessed a notable increase. Over the years, there has been a growing awareness of the importance of sustainability in education, particularly in higher education institutions. This recognition stems from the understanding that universities play a crucial role in shaping future leaders, professionals, and citizens who can contribute to sustainable development. Universities are seen as key drivers of change and innovation in addressing global challenges such as climate change, resource depletion, and social inequality. United Nations' Focus on Sustainability in Education: The United Nations has played a significant role in highlighting the importance of sustainability in education. During the years 1975 to 1995, the United Nations International Environmental Education Program acknowledged the concept of sustainability in higher education.

This recognition marked a significant milestone in promoting sustainability as a fundamental aspect of education. Decade of Education for Sustainable Development: The United Nations declared the years 2005 to 2014 as the Decade of Education for Sustainable Development. This initiative aimed to integrate the principles, values, and practices of sustainable development into all aspects of education and learning. The goal was to equip learners with the knowledge, skills, and attitudes necessary to address sustainability challenges and contribute to a more sustainable future.

Holistic Approach to Education: The concept of sustainability in higher education goes beyond environmental concerns and encompasses social, economic, and cultural dimensions. It emphasizes a holistic approach to education that integrates sustainability principles, values, and practices into curriculum design, teaching methodologies, research, campus operations, and community engagement. This approach seeks to provide students with a comprehensive understanding of sustainability issues and empower them to become agents of change in their respective fields. Future-Oriented Vision: Embracing sustainability in higher education institutions reflects a forward-thinking vision. It recognizes that sustainable development is not only essential for the present but also for future generations. By integrating sustainability into education, universities contribute to creating a more sustainable society by fostering knowledge, critical thinking, and innovative solutions that address complex sustainability challenges.

The Concept of University Sustainability

Education stands as one of the most influential and powerful avenues for promoting and advancing sustainability. The concept of university sustainability recognizes that education has the power to bring about transformative change. It goes beyond simply imparting knowledge and skills and aims to cultivate a mindset and values that prioritize sustainability. Sustainable education seeks to create a shift in thinking and behavior, empowering individuals to make informed decisions that contribute to the well-being of both society and the environment. University sustainability involves an interdisciplinary approach that integrates various fields of study, such as environmental science, social sciences, economics, and humanities.

It recognizes that sustainability is a complex and multifaceted issue that requires collaboration and diverse perspectives to address effectively. Through interdisciplinary education and research, universities can foster a more comprehensive understanding of sustainability challenges and develop innovative solutions. University sustainability emphasizes the importance of balancing human and economic prosperity with the preservation of natural resources and environmental integrity. It recognizes that sustainable development is not solely about economic growth but also about ensuring the well-being of current and future generations. By incorporating sustainability principles into education, universities can equip students with the knowledge and skills to navigate the complexities of sustainable development and contribute to a more balanced and equitable society. The concept of university sustainability acknowledges the importance of preserving cultural traditions and diversity. It recognizes that culture plays a vital role in shaping sustainable practices and promoting a sense of identity and belonging. By integrating cultural dimensions into sustainability education, universities can foster an appreciation for diverse cultural perspectives and encourage sustainable practices that respect and preserve cultural heritage. University sustainability underscores the role of education in promoting environmental stewardship and social cohesion. It aims to empower individuals to become responsible stewards of the environment, promoting sustainable practices and mitigating environmental degradation. Moreover, sustainable education fosters social cohesion by addressing social inequalities and promoting inclusivity, diversity, and social justice (Ismail and Khidr, 2019).

Interest in sustainability and its transition is often observed to be more feasible in universities compared to other educational institutions, primarily due to two main factors (Al-Omari, 2018):

• Higher Degree of Autonomy and Flexibility: Universities typically enjoy a higher degree of freedoms and flexibility compared to other educational institutions. This autonomy allows them to implement sustainability initiatives and integrate sustainability principles into their operations, curriculum, and research more readily. The academic environment within universities often fosters innovation and experimentation, providing a conducive setting for the exploration and advancement of sustainability practices.

- External and Internal Pull Factors: Universities are subject to both external and internal pull factors that drive their interest in sustainability. External pull factors include the influence of government policies, civil society movements, professional organizations, and accreditation agencies. These stakeholders often advocate for sustainability and encourage universities to incorporate sustainable practices into their operations and educational programs. Internal pull factors arise from the motivation and commitment of university leaders, faculty, staff, and students who recognize the importance of sustainability and actively push for its integration. Their passion and dedication play a crucial role in driving sustainability initiatives within the university. A sustainable university can be defined as an institution of higher education that strives to minimize negative environmental, economic, and societal impacts by maximizing the efficient use of its resources and core functions of teaching, education, awareness, collaboration, and oversight. Its overarching purpose is to facilitate the transition of society towards sustainable lifestyles and models (Too and Bajracharya, 2015). Furthermore, it can be described as an educational institution that actively works towards integrating the principles of sustainability and their associated requirements into its mission and future vision. As a vital hub for academic knowledge, a sustainable university ensures that its graduates possess a well-rounded understanding of sustainability and are equipped to apply this knowledge in their respective fields (Ting and Others, 2012). Universities make continuous and multifaceted efforts to achieve sustainability in the present and future. These efforts go beyond mere preparation and awareness initiatives and encompass all aspects of their operations, including education, research, and community service. Additionally, universities strive to optimize resource utilization and minimize energy consumption within their campuses. By adhering to the fundamental principles of sustainability in university education, they aim to preserve the environment, protect natural resources, and prevent adverse impacts (Al-Omari, 2018).

Academic sustainability refers to the comprehensive endeavors and initiatives undertaken by universities and their affiliated entities, both within and beyond the confines of the university campus, to promote and pursue sustainability in all facets of academic life. These efforts encompass a wide range of activities, including education, training, awareness campaigns, and educational programs. The primary goal is to enhance sustainability practices and principles throughout the academic community, fostering a holistic approach that integrates sustainability into teaching, research, operations, and engagement with external stakeholders.

Research Sustainability: Research sustainability refers to the endeavors and activities conducted by universities and their affiliated entities, both within and beyond the university setting, to advance sustainability through research, innovation, inventions, and development. These efforts aim to enhance and pursue sustainable practices and solutions, addressing key sustainability challenges and fostering long-term sustainability outcomes.

Social Sustainability: Social sustainability encompasses the efforts and activities undertaken by universities and their affiliated entities, both within and beyond the university campus, that target social aspects and community service. The primary objective is to promote and seek sustainable behaviors and practices, fostering social well-being, equity, and inclusivity. These endeavors extend to activities that benefit society as a whole, regardless of their proximity to the University City.

Environmental Sustainability: Environmental sustainability refers to the ongoing efforts and activities conducted by universities and their affiliated entities, whether within or outside the university campus, to address various environmental aspects. The aim is to prevent the depletion or degradation of natural resources and to promote long-term environmental sustainability. These endeavors encompass practices that minimize negative environmental impacts, promote conservation, and foster the preservation of ecosystems for future generations. The importance of sustainability for universities stems from the recognition of their significant role in promoting sustainable education and development. Various international initiatives have underscored the significance of sustainability in higher education institutions.

One notable initiative is the **Talloires Declaration**, which was established in 1990 during a global conference organized by Jean Mayer, the President of Tufts University. The conference, held in Talloires, France, was facilitated by the University Leaders for a Sustainable Future (ULSF), an organization based in Washington, DC. The Talloires Declaration outlines a ten-point action plan aimed at integrating sustainability and environmental literacy into education, research, operations, outreach, and policies within universities. It represents the first official statement declaring the commitment of higher education institutions to become world leaders in the development, promotion, support, and maintenance of sustainability. To date, the Talloires Declaration has garnered signatures from more than 122 university leaders across over 50 countries (Association of University Leaders for a Sustainable Future, 1990). This initiative highlights the global recognition of the pivotal role that universities play in advancing sustainability and emphasizes the need for concerted efforts within the higher education sector to drive sustainable practices forward.

Kyoto Declaration on Sustainable Development in Higher Education: This declaration was adopted at the United Nations University in Kyoto, Japan, in 1993 during the "Universities' Commitment to the Environment and Sustainable Development" conference organized by the International Association of Universities (IAU). The declaration serves as a guiding framework for universities to take concrete steps in their pursuit of sustainable development. It emphasizes the importance of universities in conducting research and engaging with society based on the principles of sustainable development. The Kyoto Declaration calls for increased environmental awareness, the promotion of environmental ethics within universities and society, and encourages universities to review their operations to align with sustainable development principles (International Association of Universities, 1993).

The UNESCO World Conference on Education for Sustainable Development took place in 1998. During this conference, the tasks and functions of higher education were defined, with a key emphasis on their contribution to

sustainable development and the creation of a sustainable society. UNESCO called for the promotion of scientific excellence, prosperity, and the advancement of new knowledge in the context of education for sustainable development. To achieve the goals of education for sustainable development, UNESCO encouraged the participation of networks of higher education institutions and organizations during the Decade of Education for Sustainable Development. The conference emphasized the mobilization of universities' core functions, namely education, research, and service to society, to enhance global and international knowledge about education for sustainable development (UNESCO, 1998). The adoption of sustainability by universities is driven by compelling motives, as it has evolved from being a discretionary choice to an imperative requirement. To attain the vision of a sustainable university, a series of essential steps are followed to ensure the institution's ongoing and future capacity to achieve sustainability while maintaining continuity. The application of sustainability involves a deliberate and systematic approach that aligns with the urgent need for universities to address environmental, social, and economic challenges and secure a sustainable future. Motivations for universities to embrace sustainability are multifaceted and encompass various key factors. These motives contribute to the commitment of higher education institutions in incorporating sustainability principles within their campuses. Some of these motivations include: (Ismail and Khidr, 2019).

1. Organizational Motives: Universities, as significant consumers of resources, recognize their role in minimizing negative impacts on the local and global environment. Embracing sustainability aligns with their responsibility to reduce environmental footprints and contribute positively to society.

2. Cognitive Reasons: Universities serve as beacons of knowledge and scientific advancements. Since sustainability is an evolving and complex issue, universities play a crucial role in generating new knowledge and solutions to address emerging sustainability challenges.

3. Social Responsibility Motives: As integral parts of society, universities have a broader responsibility to foster sustainable practices and produce a competent generation that embraces contemporary sustainability trends. By prioritizing sustainability in their educational programs, universities contribute to social well-being and the development of future leaders committed to sustainable practices.

4. Legal Motives: Countries worldwide are subject to laws and regulations that support sustainable development. Universities must comply with these legal requirements as sustainability has become a cultural imperative in society, necessitating their adherence to relevant regulations.

5. Motives for Optimal Effectiveness: Integrating sustainability requirements into university curricula ensures that graduates are equipped to meet the demands of the labor market. By forging partnerships with the business sector and society, universities foster community engagement and resource management. Graduates, armed with the knowledge acquired at universities, are well-positioned to handle available resources efficiently and contribute to sustainable solutions.

6. Motivations for community support arise when a university's mission explicitly focuses on promoting sustainable development. When the university establishes a clear and robust commitment to sustainability, it generates broad support from external stakeholders, including government entities, businesses, tourism organizations, and others. This support stems from the recognition of the university's dedication to advancing sustainability and its potential to contribute positively to the community and its various sectors. By aligning with sustainability goals, universities can foster meaningful partnerships and collaborations with external parties, collectively working towards sustainable development objectives.

The application of sustainability in universities involves distinct stages aimed at leveraging their role in supporting sustainable practices. Universities fulfill this role through the provision of knowledge, technical expertise, training, and simulations that contribute to guiding society towards a sustainable future. To achieve these objectives, universities integrate sustainability issues into their curricula, following a series of stages outlined as follows (Lozano et al., 2013):

1. Incorporating sustainable development into all curricula and systems: Universities prioritize the integration of sustainable development principles across all academic disciplines and educational programs. By infusing sustainability into their curricula, universities ensure that students are equipped with the knowledge and skills necessary to address sustainability challenges.

2. Encouraging research in the field of sustainable development: Universities actively promote research activities focused on sustainable development. By fostering a research culture that emphasizes sustainability, universities contribute to the generation of new knowledge, innovative solutions, and evidence-based practices that advance sustainability goals.

3. Guiding campus operations for sustainability: Universities adopt sustainable practices within their own campus operations. This includes implementing environmentally friendly measures, resource conservation strategies, waste management systems, and adopting sustainable energy sources. By leading by example, universities demonstrate their commitment to sustainable practices and inspire broader societal change.

4. Collaboration with other universities in the field of sustainability: Universities actively collaborate with other academic institutions to share best practices, exchange knowledge, and develop joint initiatives focused on sustainability. Through partnerships and networks, universities strengthen their collective impact and promote collaboration towards achieving sustainability goals.

5. Collaboration with policy makers, governments, NGOs, and businesses: Universities engage in partnerships and collaborations with various stakeholders, including policy makers, governments, non-governmental organizations (NGOs), and businesses. By working together, these entities leverage their collective expertise, resources, and influence to drive sustainable development at local, regional, and global levels.

For universities to effectively implement sustainability and establish a sustainable university model, several key steps need to be taken. These steps involve setting a sustainability vision, forming a sustainability committee, and defining policies and goals aligned with the university's mission. Additionally, a set of sustainability principles should be published, addressing the following main areas:

1. Education: The university should incorporate sustainability topics into its educational programs, equipping students with knowledge and fostering positive attitudes toward environmental issues. This ensures that students are prepared to tackle sustainability challenges and contribute to sustainable practices in their future endeavors.

2. Scientific research: The university should emphasize and prioritize scientific research that addresses sustainability issues. This includes developing innovative solutions and advancing knowledge in areas relevant to sustainability. By conducting research that focuses on sustainability, universities contribute to the development of practical solutions and evidence-based approaches to address environmental and social challenges.

3. Community service: Universities have a responsibility to increase awareness of the importance of sustainability within the broader community. This can be achieved through various outreach initiatives, educational campaigns, and collaborations with community organizations. By promoting sustainability principles and goals, universities actively engage with the community and encourage sustainable practices among stakeholders.

4. Campus operations: Universities should lead by example and strive to reduce their environmental impacts through sustainable practices in their own operations. This involves implementing strategies to minimize energy and water consumption, reduce waste generation, and promote sustainable transportation options. By practicing sustainable principles on campus, universities demonstrate their commitment to environmental stewardship and inspire others to adopt similar practices. To attain sustainability in its holistic sense, it is crucial for universities to pursue sustainability across all diverse domains in a synchronized and consistent manner. This underscores the interconnected nature of sustainability. By unifying and integrating administrative processes, scientific research, education, teaching, and community engagement, universities can bolster the transformative journey towards sustainability. This approach not only fosters excellence and leadership for the institution but also ensures that sustainability is pursued collectively rather than in isolated fragments. By embracing this comprehensive approach, universities can embrace sustainability as an overarching goal, fostering a culture of sustainability and striving for excellence in each individual area, ultimately contributing to a more sustainable future (Beringer and Adombent, 2008).

METHODOLOGY

The study utilized a descriptive analytical approach. It is a research method that aims to examine and describe the current state or characteristics of a particular phenomenon or system. In this study, the approach was chosen to assess the reality of sustainability application within Saudi higher education institutions. By employing this approach, the researchers sought to provide a comprehensive and accurate description of the current practices, policies, and challenges related to sustainability in these institutions. To build the theoretical framework for the study, the researchers relied on scientific references and sources. They conducted an extensive review of existing literature on sustainability in higher education, seeking relevant theories, models, and frameworks that could guide their investigation. This process involved synthesizing and integrating key concepts

Figure 1. flow chart of the sequential steps involved in the study

and theories from multiple sources to form the foundation for their analysis and evaluation. For the practical aspect of the study, the researchers designed an electronic questionnaire to collect data from faculty members. The questionnaire was carefully constructed to address the specific research objectives and capture relevant information related to sustainability application. It likely included questions about institutional policies, curriculum integration, research initiatives, student involvement, and other aspects of sustainability practices within higher education institutions. During the first semester of the 2022/2023 academic year, the electronic questionnaire was distributed to faculty members across various departments. This approach allowed for broad participation and ensured representation from different areas of the institution. The researchers likely employed appropriate strategies to encourage high response rates, such as reminders, incentives, and assurances of confidentiality. The collected data from the questionnaire would serve as the empirical basis for analyzing and evaluating the current application of sustainability in Saudi higher education institutions.
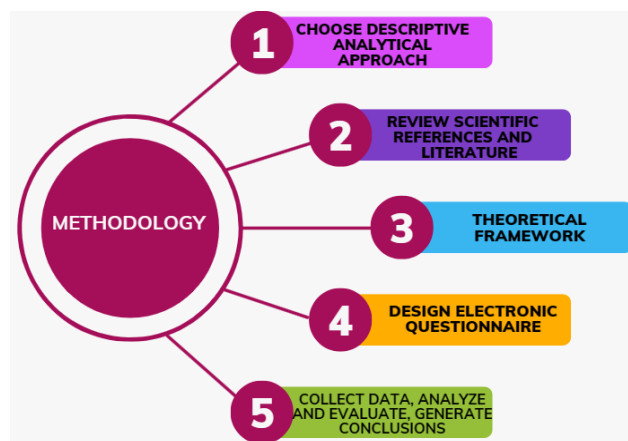
Study population and sample

The study population comprised all faculty members and lecturers employed at Saudi universities during the first semester of the academic year 2022/2023. These universities were geographically distributed across five regions, namely the north, south, east, west, and middle regions of the Kingdom of Saudi Arabia. The sample for this study was randomly selected from faculty members across all colleges within Saudi universities, resulting in a sample size of 270 faculty members and lecturers.

Procedures

After formulating the initial research framework, a comprehensive literature review was conducted to gather relevant scientific literature on the study topic. Subsequently, the research instrument was developed and subjected to rigorous validation and expert assessment. To ensure the ethical integrity, validity, and reliability of the instrument, necessary approvals were obtained from the University's Committee on the Ethics of Scientific Research, along with necessary permissions for application. Data collection commenced with a deliberate selection of five universities from the study

population, aiming to capture diverse perspectives from different geographical regions. Educational materials and a link to the instrument were distributed through WhatsApp, utilizing a Google form to collect responses in an Excel file format. Colleagues from the selected universities actively assisted in the distribution process, while the WhatsApp message included clear instructions and reassurances for the participating faculty members. Additionally, the instrument included confirmation instructions. In cases where universities exhibited a low response rate, the instrument was reapplied, and researchers personally engaged with faculty members to encourage their participation, aided by the cooperation of their colleagues from those universities. The research team was committed to ensuring a representative study sample.

Research Instrument Development

In line with the comprehensive literature review and examination of previous studies, an instrument was meticulously developed to serve the research objectives. The instrument's dimensions were determined following a clear definition of the research objectives, and subsequently, the instrument items were formulated. To ensure the instrument's robustness, certain criteria and items from relevant studies within the theoretical framework were incorporated into the instrument development process. The instrument comprised four distinct dimensions, namely, Application of Academic Sustainability (AAS) (8 items), Application of Research Sustainability (ARS) (8 items), Application of Social Sustainability (ASS) (8 items), and Application of Environmental Sustainability (AES) (8 items). Consequently, the final version of the instrument consisted of a total of 32 items, systematically designed to capture the multifaceted aspects of the research domain. The instrument's validity and reliability were rigorously examined and established through a series of procedures. Initially, ten experts from Saudi Universities evaluated the instrument's items and provided their expert opinions. Based on their valuable feedback, the researchers made necessary modifications and reformulations to certain items, while also omitting others. To further ensure the instrument's validity and reliability, a pilot test involving 25 faculty members was conducted, and their responses and feedback were utilized to refine the final version of the instrument. Data analysis was performed using SPSS version 26. In order to assess the validity of the instrument, the discriminant coefficient (corrected item-total correlation) was calculated using SPSS. Items with a discriminant coefficient below 0.20 were excluded from further analysis. Sample responses were then utilized to calculate matrix correlation coefficients between the instrument's dimensions. The total score, as presented in Table 1, illustrates the matrix correlation coefficients between the means of the dimensions and the mean of the total score (overall average). The observed correlation coefficients, ranging from 0.88 to 0.93, indicate a relatively high level of correlation. This suggests that all dimensions effectively contribute to the measurement of a single concept, highlighting the interrelatedness of sub-scores with the total score.

Table 1. Correlation matrix of the scale ** (Correlation is significant at the 0.01 level (2-tailed)

		AvAAS	AvARS	AvASS	AvAES
AvAAS	Pearson Correlation	1	.905**	.900**	.875**
	Sig. (2-tailed)		.000	.003	.000
AvARS	Pearson Correlation	.905**	1	.893	.869**
	Sig. (2-tailed)	.000		.016	.000
AvASS	Pearson Correlation	.900**	.893	1	.967
	Sig. (2-tailed)	.003	.116		.217
AvAES	Pearson Correlation	.635**	.869**	. 967	1
	Sig. (2-tailed)	.000	.000	.013	
AvTOT	Pearson Correlation	.890**	.882**	.910**	.928**
	Sig. (2-tailed)	.000	.000	.000	.000

To ensure the construct validity of the instrument, Rasch model analysis was employed as a robust tool for evaluating measurement properties. This analytical approach is known for its objectivity in psychological and educational measurement. The collected data underwent analysis utilizing the Rasch Model to assess validity and reliability. The analysis encompassed several aspects. Item polarity analysis was conducted using point-measure correlation (PTMEA) to assess item consistency, with acceptable values falling within the range of 0.2 to 1. Additionally, the Infit and outfit mean square (MNSQ) values were examined, with values between 0.4 and 1.5 considered appropriate. The standardized fit statistic (Zstd) values were also evaluated, with values ideally falling within the range of -2 to 2. In terms of dimensionality, a minimum criterion of 40% was set to ensure that the dimensions adequately captured the variation in the data. The unexplained variance in the first contrast should be below 15%, indicating a coherent dimension structure. Furthermore, item and persons separation were assessed. Acceptable item reliability was established by setting a criterion of item reliability exceeding 0.50. Adequate discrimination between individuals was indicated by a minimum separation value of 2, ensuring effective differentiation (AlAli and Al-Barakat, 2022; AlAli and Saleh, 2022). By employing the Rasch model analysis, the study aimed to thoroughly evaluate the instrument's construct validity, ensuring the reliability and accuracy of the measurement process.

The results of the dimensionality data analysis, consistent with the calibration measurement analysis, are presented in Table 2 below. The findings demonstrate that the measures effectively account for a raw variance exceeding 40%, indicating a satisfactory representation of variation within the data. Furthermore, the unexplained variance in the first contrast falls below the threshold of 15%. These outcomes affirm that the dimensionality data align appropriately with the Rasch model, validating its suitability for the study. The instrument's validity was evaluated through the examination of infit mean square (MNSQ) values, indicating a satisfactory level of validity. The MNSQ values, which assess the fit of the instrument, were found to fall within the recommended range of 0.4 to 1.5, indicating a good fit.

Table 2. Item Dimensionality of the Applying sustainability in higher education instrument

	Empirical		Modeled
Total raw variance in observations	23.5	100.0%	100.0%
Raw variance explained by measures	9.6	44.3%	34.7%
Raw variance explained by persons	3.5	9.6%	14.3%
Raw Variance explained by items	6.0	22.1%	22.2%
Raw unexplained variance (total)	16.0	61.8% 100.0%	63.7%
Unexplained variance in 1st contrast	2.3	7.9% 11.8%	
Unexplained variance in 2nd contrast	1.7	7.4% 10.9%	
Unexplained variance in 3rd contrast	1.6	6.1% 9.9%	
Unexplained variance in 4th contrast	1.4	4.8% 6.8%	
Unexplained variance in 5th contrast	1.2	4.4% 6.8%	

This finding is consistent with the results of the item polarity analysis, as demonstrated by the point-measure correlation (PTMEA) values, which should ideally range from 0.2 to 1. Additionally, the instrument displayed an appropriate standardized fit statistic (Zstd) value, falling within the range of -2 to 2, as presented in Table 3 below. These outcomes collectively support the instrument's validity, indicating its suitability for measuring the desired constructs.

Table 3. Item Fit Analysis for applying sustainability in higher education instrument

items	Measure	Model S.E	Infit		outfit		Pt-measure	
			MNSQ	ZSTD	MNSQ	ZSTD	CORR	EXP
ASS4	0.06	0.03	1.54	1.9	1.95	1.9	0.63	0.62
ARS5	0.33	0.06	1.46	1.7	1.69	1.9	0.61	0.58
ARS4	0.11	0.06	1.44	1.8	1.41	1.8	0.59	0.64
AAS3	0.57	0.05	1.15	0.8	1.16	1.6	0.58	0.57
AES3	0.65	0.05	0.96	1.4	0.97	1.4	0.64	0.58
AAS1	0.27	0.05	1.11	1.6	0.98	1.2	0.67	0.62
ARS6	0.18	0.04	0.94	1.5	0.93	1.5	0.68	0.61
AES1	0.17	0.05	0.92	1.5	0.89	1.4	0.68	0.62
AES2	0.15	0.05	0.92	1.4	0.88	1.2	0.71	0.64
ARS2	0.03	0.04	0.93	1.3	0.91	1.2	0.71	0.65
ASS7	0.17	0.07	0.88	1.2	0.89	1.6	0.73	0.64
ARS7	0.13	0.04	0.81	1.1	0.80	1.2	0.73	0.63
AAS5	0.59	0.05	0.84	-1.3	0.78	1.1	0.74	0.63
AAS4	0.14	0.05	0.94	-0.7	0.92	-1.1	0.75	0.69
AES7	0.29	0.04	0.79	-1.2	0.76	-0.9	0.65	0.65
ARS3	0.18	0.05	0.79	-1.5	0.73	-1.3	0.76	0.63
ASS5	0.36	0.04	0.78	-1.4	0.77	-1.3	0.77	0.66
AES6	0.28	0.05	0.93	1.5	0.89	1.2	0.77	0.62
ASS3	0.27	0.04	0.95	1.5	0.88	1.7	0.78	0.64
ASS2	0.25	0.07	0.93	1.4	0.91	1.4	0.78	0.65
ASS1	0.13	0.04	0.89	1.3	0.89	1.2	0.73	0.64
AES4	0.19	0.05	0.84	1.4	0.81	1.3	0.74	0.66
AAS6	0.14	0.05	0.87	1.1	0.78	1.5	0.75	0.64
AAS7	0.58	0.04	0.91	-1.4	0.91	1.2	0.67	0.69
ASS6	0.24	0.05	0.80	-0.8	0.77	-1.1	0.71	0.65
ARS1	0.39	0.06	0.83	-1.3	0.71	-1.3	0.74	0.67
AES5	0.28	0.06	0.88	-1.6	0.78	-1.4	0.73	0.69

The "Sustainability in Higher Education" instrument utilized a five-category scale to capture respondents' perspectives. The scale categories were defined as follows: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. Table 4 and Figure 2 present a summary of the category structure, illustrating the gradation and size of the intersections related to the application of sustainability in higher education. In the observation section, the columns display the respondents' answers based on the ranking scale (observed count).

As depicted in Table 5, the most frequently selected response by respondents was scale 4, with a count of 11 (43%). The next most common scale chosen by respondents was scale 5, with 6 (25%) responses. Scale 3 received 5 (21%) responses, while the least frequently selected scale was scale 2, with 2 (7%) responses. Scale 1 had the fewest responses, with 1 (4%) respondent. The observed averages reflect the pattern of responses, which is expected to follow a relatively normal distribution with a systematic progression from negative to positive, as indicated in Table 4.

Table 4. Calibration scaling analysis of applying sustainability in higher education instrument

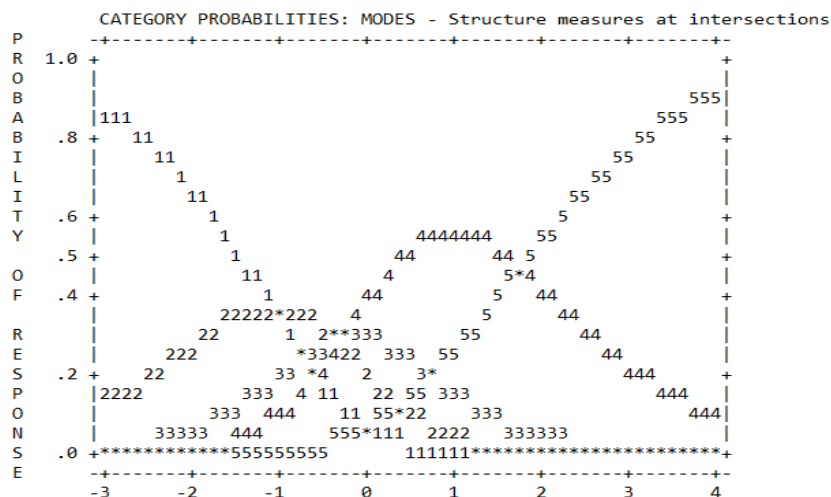| Category Label	Observed Count %		Observed Average	Infit MNSQ	Outfit MNSQ	Structure Calibration	Category Measure
1	1	4	-0.62	0.97	0.95	None	(-2.53)
2	2	7	-0.22	1.19	1.15	-1.19	-1.05
3	5	21	0.15	0.91	0.80	-0.57	-0.55
4	11	43	0.41	0.79	0.87	-0.40	0.84
5	6	25	1.15	1.10	1.15	1.66	(2.99)

Figure 2. The summary of the category structure of Applying sustainability in higher education instrument

To evaluate reliability using the Rasch model, it is crucial to assess both person reliability and item reliability. Reliability criteria exceeding 50% are considered satisfactory. Moreover, item and person separation values exceeding 2 are deemed acceptable, in accordance with previous studies (AlAli and Al-Barakat, 2022; AlAli and Saleh, 2022). In this study, the scale's reliability was examined by measuring both person reliability and item reliability. The results indicated that the scale demonstrated an appropriate level of reliability for its items, as depicted in Table 5.

Table 5. Person and Item separation and reliability of applying sustainability in higher education instrument

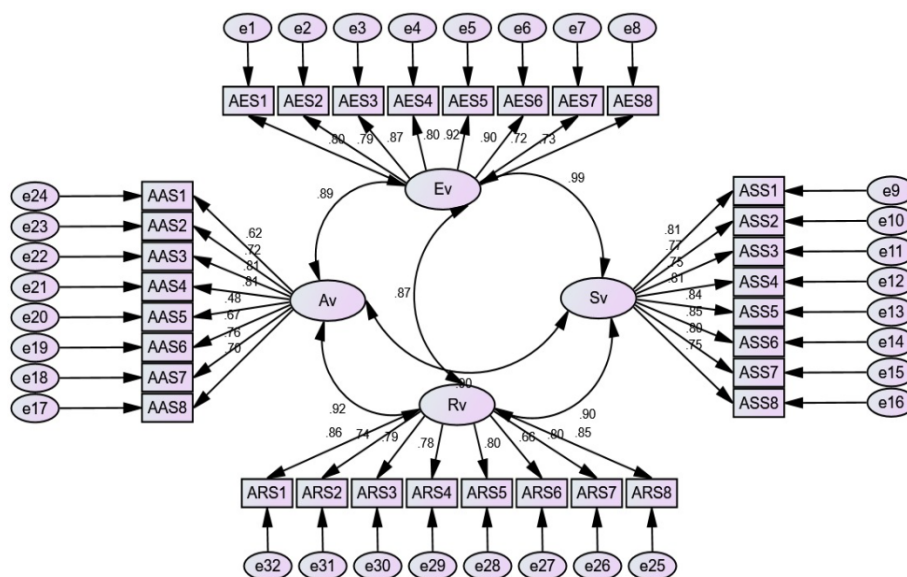|	Score	Count	Measure	Error	Infit		Outfit	
					MNSQ	ZSTD	MNSQ	ZSTD
Mean	109.9	28.0	.84	.29	1.01	-.5	1.02	- .4
S.D	14.0	.0	1.07	.05	.74	2.6	.70	2.5
Real rmse	.26							
Adj. sd	1.01							
Separation	3.49							
Person reliability	.92							
Mean	490.8	100.0	.00	.13	0.99	- .3	1.02	.1
S.D	23.7	.0	.35	.02	.29	1.8	.36	2.3
Real rmse	.15							
Adj. sd	.32							
Separation	2.25							
Item reliability	.91							

Figure 3. Results of the confirmatory factor analysis of the model adopted for the relationship of the scale items to its dimensions

Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis was utilized to ascertain the factorial construct validity of the scale. The final version of the scale was administered to the study sample to conduct confirmatory factor analysis of the scale items within their respective dimensions. The adopted model illustrated the interrelationships among the scale's 32 items, which were categorized into four

distinct dimensions, as depicted in Figure 3. Figure 3 exhibits the loading factors of each item within its corresponding dimension. The analysis revealed that each item exhibited a high degree of loading, indicating a strong association between the items and their respective dimensions. Moreover, the results indicated a robust correlation among the dimensions of the scale. The alignment of the model with the data signifies that all indicators meet the predetermined criteria of the study. Consequently, these findings provide evidence for the stability of the model in capturing the relationships among the scale items.

RESULTS

This section presents the findings of the study, focusing on addressing the first research question concerning the dimensions of the instrument regarding the extent of applying academic sustainability in higher education. The analysis involved calculating the means, standard deviation, ranks, and levels of agreement related to the application of academic sustainability in higher education. Table 6, displayed below, provides an overview of the means, standard deviation, ranks, and degree of applying academic sustainability in higher education for the scale.

According to the findings presented in Table 6, faculty members in Saudi universities generally exhibited a moderate level of approval regarding the application of academic sustainability in higher education institutions. The average rating was 2.95, with a standard deviation of 2.13. Moreover, there was noticeable variation in the degree of agreement among the study sample, as indicated by the difference of (2.38 – 3.65). Most items received a moderate level of agreement, with two exceptions: one item received a high degree of agreement, while another received a weak degree of agreement based on the responses of the study participants. Item 3, which states "The university organizes courses, study days, and scientific forums on sustainability topics and issues," received a high level of approval, with a mean of 3.65 and a standard deviation of 1.09. On the other hand, item 6, which states "The university holds competitions among relevant parties and offers prizes to integrate and activate sustainability in their work, tasks, and practices," obtained high approval with a mean of 2.38 and a standard deviation of 1.08. To answer the second question concerning the dimensions of the instrument regarding the extent of applying research sustainability in higher education. Table 7, displayed below, provides an overview of the means, standard deviation, ranks, and degree of applying research sustainability in higher education for the scale.

Table 6. The means, standard deviation, ranks, and degree of applying academic sustainability on the scale

Rank	Items	Mean	Std. Deviation	Degree of Applicability
2	AAS1	3.06	1.19	Medium
6	AAS2	2.89	1.14	Medium
1	AAS3	3.65	1.09	High
3	AAS4	2.96	1.12	Medium
5	AAS5	2.92	1.23	Medium
8	AAS6	2.38	1.08	Low
4	AAS7	2.92	1.16	Medium
7	AAS8	2.79	1.12	Medium
	Overall average	**2.95**	**1.13**	**Medium**

Table 7. The means, standard deviation, ranks, and degree of applying research sustainability on the scale

Rank	Items	Mean	Std. Deviation	Degree of Applicability
4	ARS1	3.08	1.14	Medium
1	ARS2	3.51	1.10	High
5	ARS3	2.95	1.02	Medium
8	ARS4	2.58	1.08	Low
2	ARS5	3.12	1.19	Medium
7	ARS6	2.69	1.08	Medium
6	ARS7	2.76	1.09	Medium
3	ARS8	3.11	1.02	Medium
	Overall average	**2.98**	**1.08**	**Medium**

Based on the data presented in Table 7, it is evident that faculty members in Saudi universities expressed a moderate level of approval regarding the application of research sustainability in higher education institutions. The average rating was 2.98, with a standard deviation of 1.08. Furthermore, there was a noticeable disparity in the degree of agreement among the study participants, as indicated by the difference of (2.58 – 3.51). Most items received a moderate level of agreement, except for two items. One item garnered a high degree of agreement, while the other received a weak degree of agreement based on the responses of the study sample. Item 2, which states "The university organizes and hosts research projects and scientific conferences on sustainability and its topics," obtained a high degree of agreement, with a mean of 3.51 and a standard deviation of 1.10. On the other hand, item 1 received weak approval, with a mean of 2.58 and a standard deviation of 1.08. This item states, "The university provides the resources, incentives, and capabilities necessary for sustainable research, inventions, and innovations on campus."

To answer the third question concerning the dimensions of the instrument regarding the extent of applying Social sustainability in higher education. Table 8, displayed below, provides an overview of the means, standard deviation, ranks, and degree of applying social sustainability in higher education for the scale.

Based on the data presented in Table 8, it is evident that faculty members in Saudi universities expressed a moderate level of approval regarding the application of social sustainability in higher education institutions. The average rating

was 3.07, with a standard deviation of 1.09. Moreover, there was a notable variation in the degree of agreement among the study participants, as indicated by the difference of (2.82-3.41). Most items received a moderate level of agreement, with the exception of one item that garnered a high degree of agreement according to the responses of the study participants. Item 5, which states "The university participates in local, national, and international conferences, seminars, and programs to exchange experiences in the fields of sustainability," obtained a high degree of approval, with a mean of 2.82 and a standard deviation of 3.41. On the other hand, item 8 received moderate approval, with a mean of 2.82 and a standard deviation of 1.19. This item states, "The university strives to develop its skills and expertise in the field of sustainability by integrating members of the local community with its sustainability teams".

Table 8. The means, standard deviation, ranks, and degree of applying social sustainability on the scale

Rank	Items	Mean	Std. Deviation	Degree of Applicability
6	ASS1	2.90	1.09	Medium
3	ASS2	3.13	1.07	Medium
4	ASS3	3.12	1.09	Medium
7	ASS4	2.89	1.07	Medium
1	ASS5	3.41	1.09	High
2	ASS6	3.19	1.13	Medium
5	ASS7	3.11	1.03	Medium
8	ASS8	2.82	1.19	Medium
	Overall average	**3.07**	**1.09**	**Medium**

To answer the fourth question concerning the dimensions of the instrument regarding the extent of applying Environmental sustainability in higher education. Table 9, displayed below, provides an overview of the means, standard deviation, ranks, and degree of applying Environmental sustainability in higher education for the scale.

Table 9. The means, standard deviation, ranks, and degree of applying Environmental sustainability on the scale

Rank	Items	Mean	Std. Deviation	Degree of Applicability
3	AES1	3.06	1.19	Medium
5	AES2	2.89	1.15	Medium
1	AES3	3.65	1.09	High
4	AES4	2.96	1.12	Medium
8	AES5	2.58	1.08	Low
2	AES6	3.12	1.19	Medium
7	AES7	2.69	1.08	Medium
6	AES8	2.76	1.09	Medium
	Overall average	**2.97**	**1.10**	**Medium**

Based on the data presented in Table 9, it is evident that faculty members in Saudi universities expressed a moderate level of approval regarding the application of environmental sustainability in higher education institutions. The average rating was 2.97, with a standard deviation of 1.10. Furthermore, there was a noticeable disparity in the degree of agreement among the study participants, as indicated by the difference of (2.58 – 3.65). Most items received a moderate level of agreement, with two exceptions: one item received a high degree of agreement, while another obtained weak agreement based on the responses of the study sample. Item 3, which states "The university publishes programs on its page to develop water resources in the present and future," obtained a high degree of approval, with a mean of 3.65 and a standard deviation of 1.09. On the other hand, item 5 received weak approval, with a mean of 2.58 and a standard deviation of 1.08. This item states, "The university allocates containers on campus to sort waste and work on recycling it."

Testing Hypotheses

The study hypotheses were tested, including both the main hypothesis and the sub-hypotheses, to evaluate the degree of sustainability application in Saudi universities. The T-test was utilized, along with the corresponding level of significance, to assess each hypothesis. Table 10 displays the outcomes of the T-test and the significance level in evaluating the application of sustainability in Saudi universities across different dimensions of the scale.

Table 10. T-Test and Significance Levels for Assessing the
Application of Sustainability in Saudi Universities for all dimensions of the scale

Dimension	Mean	Std. Deviation	Application percentage	T-Value	Sig.	Statistical significance
First hypothesis	2.95	0.83	58.9%	1.01	0.32	Not statistically significant
Second hypothesis	2.98	0.84	59.5%	0.48	0.64	Not statistically significant
Third hypothesis	3.07	0.92	61.4%	1.29	0.19	Not statistically significant
Fourth hypothesis	2.97	0.83	59.3%	0.65	0.51	Not statistically significant
Main hypothesis	2.95	0.78	59.1%	0.97	0.33	Not statistically significant

Table 10 presents an overview of the application of sustainability in Saudi universities. The findings indicate that the application of academic sustainability yielded an arithmetic mean of 2.95 and a standard deviation of 0.83. Additionally, the table provides information on the percentage of academic sustainability application in Saudi universities, with an average rate of 58.9. The calculated T-value was 1.01, associated with a significance level of 0.32, which exceeds the critical value of 0.05. Consequently, the alternative hypothesis is rejected, and the null hypothesis is accepted.

The null hypothesis states that academic sustainability does not demonstrate significant application, as perceived by faculty members in Saudi universities, at a significance level of 0.05. The findings further revealed that the application of research sustainability exhibited an arithmetic mean of 2.98 and a standard deviation of 0.84. The table also presents the percentage of research sustainability application in Saudi universities, indicating an average rate of 59.5. The calculated T-value was 0.48, with a significance level of 0.64, exceeding the critical value of 0.05. Consequently, the alternative hypothesis is rejected, and the null hypothesis is accepted. The null hypothesis posits that research sustainability does not demonstrate significant application, as perceived by faculty members in Saudi universities, at a significance level of 0.05.

The findings also revealed that the application of social sustainability yielded an arithmetic mean of 3.07 and a standard deviation of 0.92. The table further presents the percentage of social sustainability application in Saudi universities, with an average rate of 61.4. The calculated T-value was 1.29, associated with a significance level of 0.19, which exceeds the critical value of 0.05. As a result, the alternative hypothesis is rejected, and the null hypothesis is accepted. The null hypothesis states that social sustainability is not applied at a significance level of 0.05, as perceived by faculty members in Saudi universities. Further, the findings indicated that the application of environmental sustainability exhibited an arithmetic mean of 2.97 and a standard deviation of 0.83. The table also presents the percentage of environmental sustainability application in Saudi universities, with an average rate of 59.3. The calculated T-value was 0.65, associated with a significance level of 0.51, surpassing the critical value of 0.05. Consequently, the alternative hypothesis is rejected, and the null hypothesis is accepted. The null hypothesis posits that environmental sustainability is not applied at a significance level of 0.05, as perceived by faculty members in Saudi universities. Lastly, the results revealed that the application of sustainability in Saudi universities demonstrated an arithmetic mean of 2.5157 and a standard deviation of 2.80211. The table also presents the percentage of sustainability application in Saudi universities, with an average rate of 2.802. The calculated T-value was 1.220, associated with a significance level of 2.011, surpassing the critical value of 2.21.

As a result, the alternative hypothesis is rejected, and the null hypothesis is accepted. The null hypothesis posits that sustainability is not applied at a significance level of 0.05, as perceived by faculty members in Saudi universities.

DISCUSSION

The present study revealed that higher education institutions, as perceived by teaching staff at universities, have not effectively implemented sustainability. Specifically, academic, research, social, and environmental sustainability are lacking in Saudi higher education institutions. The study also yielded several findings pertaining to the evaluation of the sustainability landscape within these institutions. The study identified a lack of universities in organizing competitions involving relevant parties and a dearth of prizes for integrating and promoting sustainability in their work, tasks, and practices. This implies that universities are not actively engaging stakeholders in collaborative efforts or recognizing and incentivizing sustainable initiatives. This result is consistent with the study of (Mohammadi et al., 2023; Khaldi and Mekimah, 2022; McCowan et al., 2021). This is attributed to the fact that it can competitions can serve as a valuable platform for fostering innovation, creativity, and collaboration among various parties, including students, faculty, staff, and external stakeholders. By organizing competitions focused on sustainability, universities can encourage the development and implementation of innovative ideas and practices that contribute to a more sustainable campus and community.

Additionally, offering prizes for sustainability initiatives can provide tangible recognition and rewards for individuals or teams who actively engage in sustainable practices. Prizes can range from financial rewards to public recognition, scholarships, or opportunities for further research or professional development. Such incentives can motivate and inspire individuals to actively contribute to sustainability efforts, leading to a more sustainable culture within the university. However, the absence of these competitions and prizes suggests a missed opportunity for universities to harness the collective wisdom and creativity of their community members in addressing sustainability challenges. It indicates a need for universities to establish mechanisms that promote and reward sustainability-related initiatives, fostering a culture of sustainability and encouraging meaningful participation from all relevant parties.

The study found that while universities do publish sustainability programs on their electronic platforms, the extent of these publications is limited. Specifically, there is a lack of comprehensive coverage, such as the inclusion of lectures on modern international studies in the field of university sustainability. This result is consistent with the study of (Demele et al., 2021; Nicolò et al., 2021). This is attributed to the fact that publishing sustainability programs on electronic pages is a positive step towards promoting sustainability within universities. It allows for the dissemination of information and resources related to sustainability initiatives, policies, and practices. These publications can serve as valuable references for students, faculty, staff, and external stakeholders who are interested in engaging with sustainability issues.

However, the limited extent of these publications suggests that universities may not be fully utilizing their digital platforms to provide comprehensive and up-to-date information on sustainability. Lectures on modern international studies in the field of university sustainability, for example, can offer valuable insights into global best practices, emerging trends, and innovative approaches to sustainability in higher education. Expanding the scope and depth of sustainability programs published on electronic platforms can contribute to raising awareness, knowledge, and engagement in sustainability among the university community. By providing access to a broader range of resources and educational materials, universities can

empower individuals to deepen their understanding of sustainability and inspire them to take action towards creating a more sustainable future. To address this gap, universities could consider enhancing their electronic publications by incorporating a wider range of sustainability-related content, including lectures, case studies, research findings, and success stories from both local and international contexts. This would enable stakeholders to access diverse perspectives and knowledge, fostering a more comprehensive and robust understanding of university sustainability.

The study revealed that a majority of universities do not adequately provide the necessary resources, incentives, and capabilities to support individuals engaged in sustainable research, inventions, and innovations on campus. This result is consistent with the study of (McCowan et al., 2021; Živojinović et al., 2019). This finding suggests a significant gap in the support systems and infrastructure required to foster and nurture sustainable initiatives within higher education institutions. For sustainable research, universities should ideally provide researchers with access to relevant data, funding opportunities, research facilities, and collaborative networks. These resources are crucial for conducting in-depth studies, collecting empirical evidence, and generating knowledge that can contribute to sustainable practices and solutions. Insufficient availability of such resources can hinder the progress and impact of sustainability-focused research. Incentives play a vital role in motivating individuals to pursue sustainable research, inventions, and innovations. Universities can establish recognition programs, grants, scholarships, or awards specifically targeted towards sustainability-related projects.

By offering these incentives, universities can encourage faculty, staff, and students to actively engage in sustainable initiatives, fostering a culture of innovation and problem-solving. Additionally, universities need to provide the necessary capabilities and support mechanisms for individuals undertaking sustainable research or developing sustainable inventions and innovations. This includes access to specialized training, mentorship programs, technical expertise, and guidance on intellectual property rights and commercialization. Building a supportive ecosystem enables individuals to navigate the complexities of sustainable research and innovation, increasing their chances of success and impact. By addressing the lack of resources, incentives, and capabilities, universities can create an enabling environment that empowers individuals to pursue sustainable research, inventions, and innovations. This, in turn, can lead to the development of practical and impactful solutions for sustainability challenges, benefiting both the university community and the wider society.

The study found that while universities do provide students with practical experiences, these opportunities are not predominantly focused on practicing and participating in sustainability research through collaboration with relevant parties. This suggests a gap in the integration of sustainability principles and interdisciplinary cooperation within practical learning experiences at universities. This result is consistent with the study of (Khaldi et al., 2021; Kioupi and Voulvoulis, 2019). Practical experiences are valuable for students as they provide hands-on learning opportunities, allowing them to apply theoretical knowledge, develop skills, and gain real-world insights. However, when it comes to sustainability, it is crucial to go beyond individual projects or isolated activities and emphasize the collaborative nature of addressing sustainability challenges. Sustainability challenges are complex and multifaceted, requiring interdisciplinary approaches and engagement with various stakeholders. By providing students with practical experiences that involve cooperation with relevant parties (such as local communities, organizations, policymakers, or industry partners), universities can enhance the students' understanding of sustainability as a broader societal issue and promote the development of sustainable solutions that are inclusive and contextually appropriate.

Through collaborations, students can learn to navigate diverse perspectives, engage in problem-solving processes, and develop skills in teamwork, communication, and negotiation. Furthermore, working with external partners can expose students to real-world sustainability initiatives, challenges, and best practices, fostering a deeper understanding of the practical implications and complexities of sustainability. To address this gap, universities can explore opportunities to integrate sustainability-focused projects or modules that encourage interdisciplinary collaboration and engagement with relevant stakeholders. This can be achieved through partnerships with external organizations, community-based initiatives, or research projects that involve interdisciplinary teams of students, faculty, and external experts. By incorporating sustainability research and collaboration into practical experiences, universities can better prepare students to address sustainability challenges and contribute meaningfully to sustainable development in their future professional endeavors.

The study indicates that universities allocate some time to developing their skills and expertise in the field of sustainability by integrating the community's desire to engage with sustainability issues. This result is consistent with the study of (Mohammadi et al., 2023; Khaldi and Mekimah, 2022; Tilbury, 2011). This finding suggests that universities recognize the importance of responding to the needs and aspirations of the broader community regarding sustainability. Universities have a unique role to play in addressing sustainability challenges. They serve as hubs of knowledge, research, and education, and have the potential to influence and shape sustainability practices within their communities. By considering and incorporating the community's desire to engage with sustainability issues, universities can ensure that their efforts align with the needs and priorities of the stakeholders they serve. Integrating the community's desire involves actively seeking input, feedback, and collaboration from various community members, including local residents, businesses, non-profit organizations, and government entities. This can be done through community engagement initiatives, public consultations, partnerships, or participatory research projects. By involving the community in decision-making processes and co-creating sustainability initiatives, universities can foster a sense of ownership and relevance, ensuring that their efforts are well-aligned with local needs and aspirations. Furthermore, universities can also leverage the expertise, knowledge, and resources available within the community. This can include collaborating with local organizations, experts, and practitioners who are actively working on sustainability issues. By establishing partnerships and engaging in knowledge exchange, universities can tap into the existing expertise and experiences, gaining valuable insights and enhancing their own capacity to address sustainability challenges effectively. By spending time on developing skills and

expertise in sustainability in response to the community's desire, universities demonstrate their commitment to being responsive and accountable institutions. This approach helps to ensure that sustainability efforts are rooted in the reality of local contexts, effectively addressing the specific challenges and opportunities that exist within the community.

The study indicates that while universities encourage stakeholders to document their distinctive work and contributions in the field of sustainability, this encouragement is not largely evident. This suggests that universities may not be fully leveraging the potential of showcasing and disseminating sustainability-related achievements through internet platforms. This result is consistent with the study of (Khaldi and Mekimah, 2022; Mian et al., 2020; Leal Filho et al., 2017). Documenting and sharing distinctive work and contributions in sustainability is important for several reasons. Firstly, it allows for recognition and celebration of the efforts and achievements of individuals, groups, or departments involved in sustainability initiatives. Recognizing and highlighting their work can inspire others and create a positive culture of sustainability within the university community. Secondly, publishing these contributions on the internet can have a broader impact by reaching a wider audience beyond the immediate university community. It can inspire other institutions, researchers, practitioners, and the general public, and contribute to the collective knowledge and understanding of sustainable practices and innovations. Additionally, sharing sustainability-related work on the internet can foster collaboration and knowledge exchange. It provides a platform for stakeholders to connect, learn from each other, and build networks, which can lead to new ideas, partnerships, and opportunities for joint initiatives. To address the limited extent of encouraging stakeholders to document and publish their sustainability contributions on the internet, universities can take proactive steps. This can include establishing dedicated platforms or digital repositories where stakeholders can share their work, creating guidelines and incentives for documenting and showcasing sustainability initiatives, and actively promoting and disseminating the published content through various channels, including social media, newsletters, and university websites. By enhancing these efforts, universities can amplify the impact of sustainability initiatives, foster a culture of transparency and collaboration, and facilitate the sharing of best practices and lessons learned, ultimately contributing to the broader advancement of sustainability in academia and society.

The study reveals that universities do not allocate containers for sorting waste and actively working on recycling it. This finding suggests that there is a lack of emphasis on waste management and recycling practices within university campuses. This result is consistent with the study of (Khaldi and Mekimah, 2022; Tangwanichagapong et al., 2017; Bailey et al., 2015). Waste management and recycling are vital components of sustainable practices. By implementing proper waste sorting systems and recycling initiatives, universities can significantly reduce the amount of waste sent to landfills, conserve resources, and minimize the environmental impact of their operations. Allocating containers for waste sorting is an essential first step in establishing an effective waste management system. These containers typically include separate bins for different types of waste, such as recyclables (e.g., paper, plastic, glass, metal), organic waste, and non-recyclable waste. By providing clear and easily accessible containers for waste sorting, universities can encourage individuals to participate in responsible waste disposal and recycling practices. In addition to waste sorting, universities should also actively work on recycling the collected materials. This involves establishing partnerships with recycling facilities or waste management companies, implementing recycling programs, and ensuring that the collected recyclables are properly processed and reused. Recycling initiatives can be extended to various areas on campus, including classrooms, offices, cafeterias, and dormitories. By incorporating waste sorting containers and recycling initiatives on campus, universities can educate and engage the university community in sustainable waste management practices. This can include raising awareness about the importance of waste reduction, recycling guidelines, and providing educational materials and campaigns to encourage active participation. Furthermore, universities can also consider implementing strategies to reduce waste generation, such as promoting the use of reusable products, implementing composting programs, and encouraging sustainable procurement practices. Overall, allocating containers for waste sorting and actively working on recycling not only demonstrates a commitment to environmental stewardship but also provides practical opportunities for individuals within the university community to actively contribute to sustainability efforts. The study suggests that universities provide somewhat specialized scientific courses in the field of environmental protection for various members of society. This result is consistent with the study of (Khaldi and Mekimah, 2022; Al-Omari, 2018; Al-Khawalda, 2016). This finding indicates that universities recognize the importance of offering educational opportunities that focus on environmental protection and sustainability. Specialized scientific courses in environmental protection serve several purposes. Firstly, they provide individuals with the knowledge and skills necessary to understand and address environmental challenges. These courses typically cover topics such as environmental science, ecology, conservation, climate change, pollution, and sustainable resource management. By offering specialized courses, universities enable students and other members of society to develop a deeper understanding of environmental issues and equip them with the tools to contribute to solutions. Secondly, these courses can serve as a platform for interdisciplinary learning and collaboration. Environmental protection is a complex field that requires expertise from various disciplines, including biology, chemistry, geology, engineering, policy, and social sciences. Specialized courses bring together individuals from diverse backgrounds, fostering collaboration and the exchange of ideas. This interdisciplinary approach helps to develop holistic and well-rounded perspectives on environmental challenges and encourages innovative thinking and problem-solving. Furthermore, specialized courses in environmental protection can cater to different members of society, including students, professionals, and the general public. Universities often offer these courses through continuing education programs, professional development initiatives, or open enrollment, allowing individuals to access education and training in the field of environmental protection regardless of their educational background or career stage. By providing specialized scientific courses in environmental protection, universities contribute to building a more environmentally literate society. These courses empower individuals with the knowledge and skills needed to make informed decisions, contribute to sustainable practices in their respective

fields, and become advocates for environmental stewardship. However, it is important to note that the extent and availability of specialized courses may vary among universities. Some institutions may offer a wide range of specialized courses, while others may have more limited offerings. Nonetheless, the provision of these courses demonstrates the recognition of the importance of environmental protection and sustainability within higher education.

CONCLUSION

The study findings indicate that Saudi higher education institutions, according to teaching staff, have not effectively implemented sustainability in various aspects. This includes academic, research, social, and environmental sustainability. The study identifies several key areas that need improvement, such as the lack of initiatives, incentives, and competitions to promote sustainability, limited sustainability programs on university websites, inadequate resources for sustainable research and innovation, limited practical experiences and collaborations for students in sustainability research, partial commitment to enhancing sustainability skills, inadequate documentation and sharing of sustainability contributions, absence of waste sorting and recycling initiatives, and partial provision of specialized scientific courses on environmental protection for different segments of society. These findings highlight the need for enhancing sustainability practices in higher education institutions to create a more sustainable academic environment.

Recommendation and Future Direction

This study provides recommendations and Future Direction for Saudi universities to effectively implement sustainability. Long-term Strategic Planning: Saudi universities should focus on developing a comprehensive and well-defined strategic vision for sustainability. This involves setting specific goals, targets, and timelines to guide sustainability initiatives across all aspects of university operations. Mandatory Sustainability Measures: To ensure consistent progress, it is recommended that Saudi universities establish mandatory sustainability measures. These measures can include requirements for sustainable construction and design, energy and water conservation practices, waste management protocols, and sustainable transportation options. Optimal Resource Utilization: Universities should prioritize optimizing resource utilization by implementing efficient energy management systems, promoting sustainable procurement practices, and adopting recycling and waste reduction programs. This will minimize resource consumption, reduce environmental impact, and contribute to cost savings.

Foster Sustainable Research and Innovation: Encouraging and supporting research and innovation in sustainability-related fields is crucial. Saudi universities can establish dedicated research centers or institutes focused on sustainability, provide funding opportunities for sustainability research projects, and foster interdisciplinary collaborations to address sustainability challenges effectively. Organize Sustainability Competitions: Hosting sustainability competitions within the university community can promote awareness, engagement, and creative problem-solving. These competitions can encourage students, faculty, and staff to develop innovative solutions and initiatives that contribute to sustainability goals. Engage the Local Community: Saudi universities should actively engage with the local community to raise awareness about sustainability issues and involve community members in sustainability initiatives. Collaborative efforts can include joint projects, community outreach programs, and knowledge-sharing platforms to foster a sense of shared responsibility for sustainability. Continuous Review and Improvement: Regular evaluation and review of sustainability practices are essential. Saudi universities should establish mechanisms to monitor progress, measure performance against set targets, and identify areas for improvement. This iterative process will facilitate ongoing refinement and enhancement of sustainability efforts.

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