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Sustainability in Higher Education Institutions: A Systematic Review of Key Sustainability Focus Areas

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ABSTRACT

Over the past two decades, sustainability has gained significant attention in higher education studies. This paper reviews the current literature that examines the sustainability areas in higher education. To meet the aim of the paper, a systematic literature review of peer-reviewed journals was conducted in four main steps including tracing, filtering, evaluating, and synthesizing the documents. Articles were retrieved from databases Google Scholar, Science Direct, Emerald Insight, and Springer Link. Subsequently, a total of 182 articles published between 1998 and 2024 were analyzed. The results suggested that the main contributions to the field are to be found in the areas of assessment and reporting, education, barriers and drivers, governance, conceptualization, campus, modeling, and research, respectively. Finally, an attempt has been made to outline the logical connection of these concepts in the form of a conceptual model. The main contribution of this research is providing a general and guiding framework focused on the areas of sustainability in higher education institutions. This study also contributes to enhancing the knowledge of the novel concepts, categories, and relations, which can guide future research. The results have considerable implications for beneficiaries, specifically university planners, policymakers, decision-makers, and professionals to understand the important areas that can assist in facilitating and accelerating sustainability efforts in higher education.

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1. Introduction

In today's dynamic, complex, and unsustainable world, acheiving sustainability is a major challenge that universities currently face. Higher education institutions (HEIs) are key actors in achieving sustainability in society as a whole. They are responsible for guiding this issue to both internal and external stakeholders (Lozano, Lukman et al., 2013; Omazic & Zunk 2021; Ramísio et al., 2019). The stakeholders, in turn, expect the HEIs to be sustainable (Aleixo et al., 2018).

Sustainability is defined as "the ability of a dynamic, stochastic, purposeful system, its components, boundaries, and hierarchical context to continue to the future" (Hansen, 1996, p.18). In this regard, a sustainable university is defined as the persistence and durability of HEIs over an indefinite future.

Due to the expanded level of consciousness in sustainability issues, a rising number of HEIs have been engaged in sustainability institutionalization in the last two decades (Ceulemans et al., 2011; Lozano, Llobet et al., 2013). With this objective in mind, more than 1,000 university leaders ratified their commitment to sustainability by signing international charters and declarations to facilitate and foster sustainability practices (Calder & Clugston, 2003).

Over the past two decades, sustainability in higher education has emerged as a subject of significant scholarly attention. In general, the dominant studies are empirical and descriptive in nature, focusing on specific approaches, strategies and initiatives implemented at specific institutions (Aguirre et al., 2023; Al Mahameed et al., 2023; Brundiers et al., 2021; Cornet et al., 2024; Curtis et al., 2021; Dawodu et al., 2023; Hassan et al., 2021; Hinduja et al., 2023; Jimu & Rennkam, 2024; Kimanzi, 2020; Leal Filho, Raath et al., 2018; Zang et al., 2022). The other includes prescriptive studies that often call on universities to play a more influential role in education for sustainability (Bowers, 2011; Cortese, 2008; Shava et al., 2023; Shawe et al., 2019; Weiss et al., 2021a).

Concerning the ample attention to sustainability in the context of higher education, providing a synthesis of the available literature on this topic is deemed crucial. Review papers, as critical evaluations of prior studies, provide readers with the ability to compare and contrast the findings of studies that have already been published.

University sustainability has been the subject of several literature reviews. A significant contribution of these reviews lies in proposing the main sustainability strategies, policies, priorities, attributes, and learning and institutionalization processes for higher education actors (Crawford & Cifuentes-Faura, 2022; Cheeseman et al., 2019; Fia et al., 2023; Viegas et al., 2016; Wals, 2014). Moreover, another category of the research studies focused mainly on the key sustainability factors, features, and competencies (Brundiers et al., 2021; Popowska & Sady, 2024; Velazquez et al., 2005).

Some scholars have argued the importance of university-based sustainability research and education of major stakeholders to increase the uptake of sustainability of HEIs through multi-stakeholder collaborations, collective action, and interdisciplinarity (Figueiró & Raufflet, 2015; Leal Filho, Will et al., 2021; Montenegro de Lima et al., 2020; Murray, 2018;). Ultimately, exploring critical challenges and potentials of sustainable HEIs has received special attention in sustainability studies (Hassan et al., 2021; Leal Filho, Pallant et al., 2018).

Despite the existence of an increasing literature seeking to understand the sustainability of HEIs, a conceptual framework including all key features remains poorly understood. While recent research highlights the importance of having a general and guiding framework to meet the aims of sustainability (Lukina et al., 2017; Zhao & Zou, 2015), the literature does not report a single model that includes all critical concepts and factors (Lozano, 2018; Lukina et al., 2017).

This absence may be partly due to the fact that HEIs still have misconceptions about sustainability (Waas et al., 2010). Therefore, one must understand the university as a dynamic system, with special attention to its functional areas, to achieve the integral incorporation of sustainability (Lozano, 2018) and integrate sustainability principles into universities (Lozano, Lukman et al., 2013; Lukina et al., 2017).

This research is significant as it attempts to fill this void by providing a general and guiding framework focused on the areas of sustainability in HEIs. The presented framework is conceived theoretical, facilitating an understanding of "what is" and "how to."

Based on the above discussions, this systematic literature review is conducted based on two main goals. The first goal is to present a comprehensive review of the research on key areas of sustainability

in HEIs over a relatively long period of time (About 26 years) and to establish structured categorization. The second goal is to present the logical connections between the themes in a conceptual management framework.

The outcome of this research provides policymakers, planners, and administrators with a better understanding of the sustainability conceptualization and implementation in higher education. Furthermore, sustainability embedded in all functional areas of HEIs can help universities to be an efficient example of sustainability in practice. In addition, this study promotes theoretical developments by pointing out future research directions based on gaps identified in existing studies.

The remainder of the article is structured as follows. Section 2 presents the research method. Section 3 discusses the results of this systematic review of the literature, and conclusions are presented in section 4.

2. Materials and Methods

To meet the aim of the paper, a systematic literature review of peer-reviewed journals was conducted. This method is considered especially beneficial when synthesizing the literature in a rigorous, transparent, and reproducible manner, as this is cruacial (González-Torres et al., 2020). It is commonly used by researchers who wish to craft insightful conclusions in their review papers (Stanitsas et al., 2019).

Following the proposed procedure for retrieving and selecting academic publications (Boyle et al., 2016; Stanitsas et al., 2019؛ Thürer et al., 2018), we structured the research design into four distinct phases: tracing, filtering, evaluating, and synthesizing the documents (Figure 1).

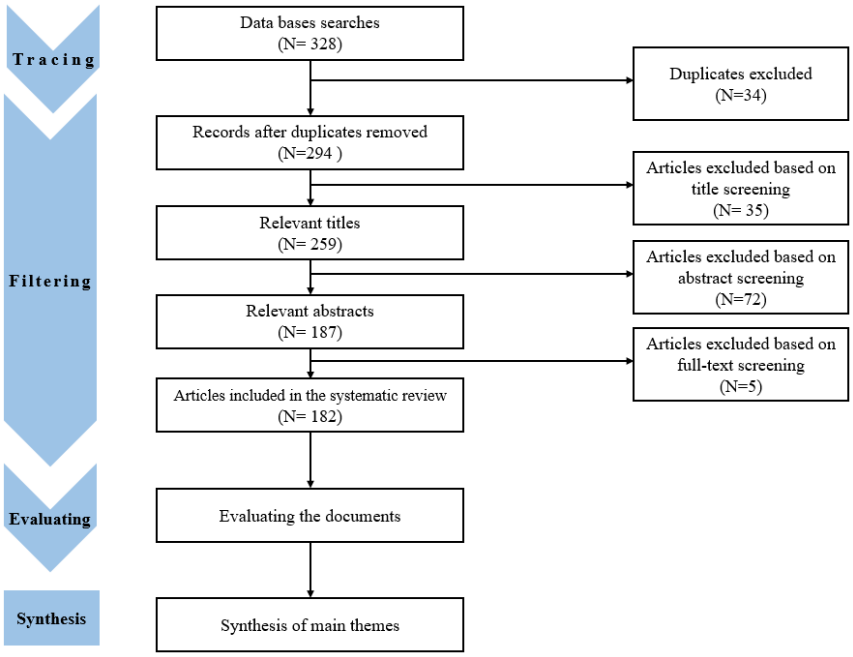

Fig. 1. Systematic Review Steps

2-1. Tracing the Documents

The selection of publications on the topic of sustainability in higher education was conducted through a search for the following keywords: "sustainability" and "higher education," "sustainability" and "university," "sustainable universities," "sustainable higher education," "sustainability in universities," "sustainability in higher education," "sustainability areas," "higher education," "sustainability areas," and "university," To manage the number of documents and to ensure the significance of the sources, exclusion criteria were identified (time, subject area, language, citations, accessibility, etc.).

Only English publications were considered for selection. Relevant documents were identified from four databases: Google Scholar, Science Direct, Springer Link, and Emerald Insight. Accessibility and large coverage of documents were the main rules for selecting these four proprietary online databases.

The searchers considered papers published from 1998 to April 2024. In total, 328 journal articles were analyzed as the initial sample in this study. To control the quality of this process (Calabrò et al. 2019; Ordanini et al. 2009), books, book chapters, conferences, theses, and other non-referred publications were excluded from the analysis. In total, 328 journal articles were analyzed as the initial sample in this study.

2-2. Filtering the Documents

The initial sample of 328 documents was further reduced to 187 by reading the titles and abstracts. After reading the full texts, the sample was further reduced to 182 documents. keeping relevant documents safe from being lost, all the references were validated twice. The progression of documents retrieved from scientific databases is presented in Figure 2. Google Scholar, with 58 documents, and Springer Link, with 23 documents, had the highest and the lowest contribution in searches, respectively.

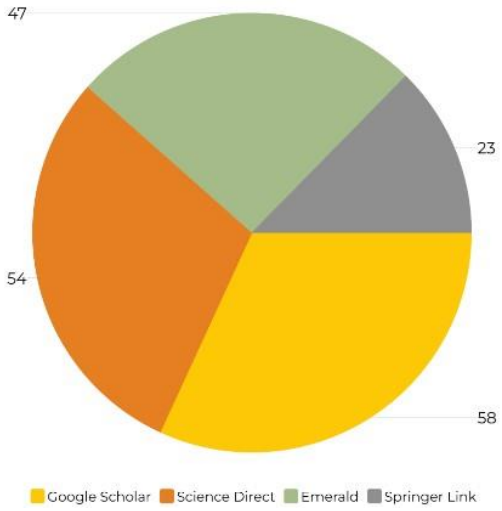

Fig. 2. Progression of Documents Retrieved from Scientific Databases

2-3. Evaluating the Documents

This phase involved documenting information from each of the 182 final documents. To avoid subjective decisions, a double-checked analysis, and extra discussion were conducted among researchers to confirm they fit the subject matter of the study and to identify any possible illogicalities in the review results. The important part of the evaluation process lies in the concept of how sustainability in higher education is hypothesized by the writers, and which practices are suggested and applied to achieve that.

2-4. Synthesis

For each study, we identified historical publication trends by year, distribution of articles by journals, the first authors' institutions' nationality, methodological approaches, as well as a thematic analysis of the main areas of sustainability in higher education studies. Eight main areas were recognized in the results: assessment and reporting, education, barriers and drivers, governance, conceptualization, campus, modeling, and research.

To avoid biases and also enhance the confirmability of findings, investigator triangulation and theoretical triangulation techniques were employed (Lincoln & Guba, 1986). Investigator triangulation involves the participation of different researchers, interviewers, data analysts, or observers in a study to provide multiple observations and conclusions (Bans-Akutey & Tiimub, 2021; Carter, 2014). Theoretical triangulation integrates several theoretical frameworks in analyzing a phenomenon (Forero et al., 2018).

In this study, investigator triangulation was obtained by consensus decision-making through collaboration, discussion, and the participation of researchers with different perspectives. This

technique is particularly important for mitigating biases in tracing, filtering, evaluating, synthesizing the documents, and presenting the final conceptual model.

Theoretical triangulation was achieved by using and exploring different theoretical perspectives, such as the university dynamic system model (Gough & Scott, 2008; Hernández-Diaz et al., 2021; Miller, 2016) and models of critical attributes (Omazic & Zunk, 2021; Viegas et al., 2016), that could be applied in the context of the study to generate theory-driven codes.

3. esults and Discussion

This section comprises two subsections. The first one discusses bibliometric analysis and the second section presents the thematic analysis of the main areas of sustainability in HEIs.

3-1. Bibliometric Analysis

A sample of 182 papers, representing the core themes for sustainability in higher education, was gathered from the scientific databases. Publications on the selected topic started from 1998, with a significant increase noted in 2010 (Figure 3). This finding aligns with the results from Popowska and Sady (2024). Specifically, almost 60% of the included articles (106 in total) were published during the last six years. Accordingly, it could be argued that, from this period (2019–2024), the research area of sustainability in higher education gained more attention from academia. However, for the year 2024, the data is not complete, as the search was completed in April 2024, and only a few studies were available online by that time.

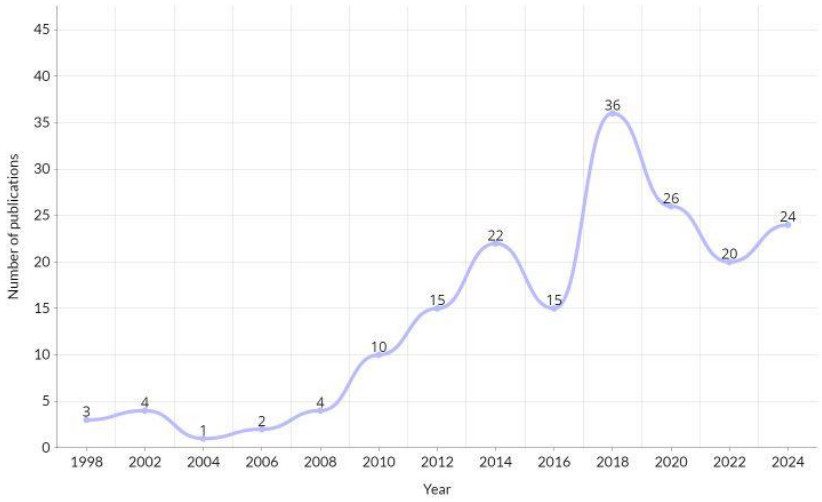

Fig. 3. Distribution of the 182 Analyzed Publications Over Time

The publications were obtained from 59 different journals, with the majority of studies appearing in the International Journal of Sustainability in Higher Education (n = 63), followed by the Journal of Cleaner Production (n = 36), and Sustainability (n = 17). The survey conducted by Leal Filho, Will et al. (2021) confirmed that these journals have had more pivotal roles in the development of the field.

Considering the institutions' nationality of the first authors (from 44 different countries), the USA (n = 34), the UK (n = 16), Spain (n = 14), Canada (n = 12), Brazil (9), Germany (9), Australia (n = 9), India (6), and Saudi Arabia (5) were identified as the ten top countries with the highest number of publications (Figure 4). The results demonstrated the highest number of contributions come from Western countries, which is similar to the findings of Cheeseman et al. (2019) on the review of research on sustainability education policy. It does not imply that sustainability in higher education does not hold a significant position in other countries; rather, it may simply lack the same extent of published peer-reviewed research in English-language journals.

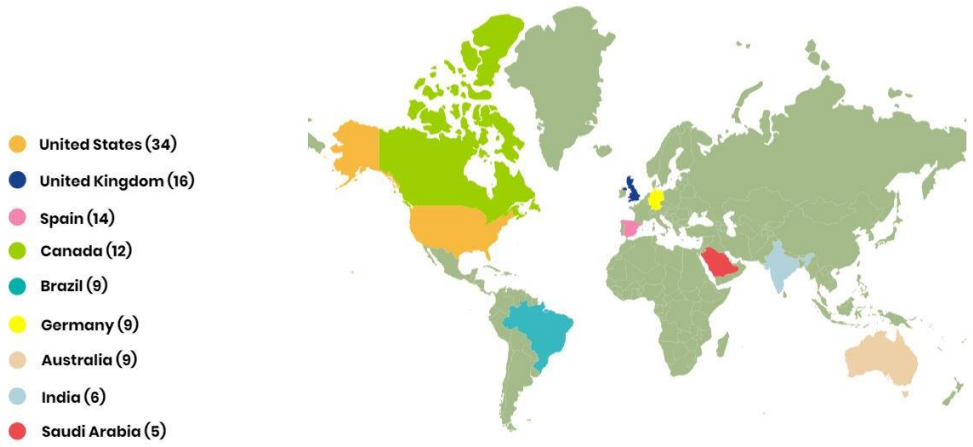

Fig. 4. Map of Ten Top Countries Represented in This Review (In Brackets, the Total Number of Studies for Each Country is Provided)

As presented in Figure 5, the methodological approaches adopted in the papers indicate that the qualitative study is the most frequently utilized research approach (n = 92), followed by quantitative study (n = 39), the archival study (n = 33), and the mixed methods study (n =18).

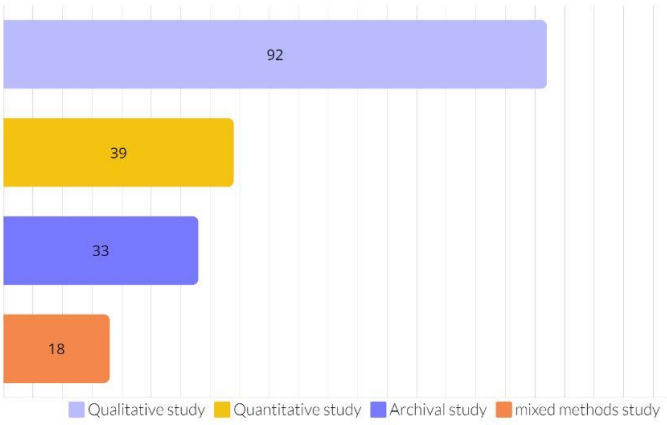

Fig. 5. Main Research Approaches of the Analyzed Publications

3-2. Thematic Analysis

In terms of the distribution of publications among the different areas of sustainability in HEIs, the content analysis of the articles was organized into eight topical themes that emerged from the coding. Each of the themes is discussed below.

3-2-1. Assessment and Reporting

These encompasse all the information regarding the university's sustainability activities and goals, and they provide an assessment of the current state of the university's progress toward sustainability. Assessing and reporting the implementation of sustainability practices was the category with the greatest number of studies, with 46 articles. The papers analyzed in this category concerned sustainability declarations, assessment tools, and sustainability evaluation reports.

Seven studies described and analyzed 31 declarations related to sustainability in higher education as a set of guiding principles from 1972 to 2010 (Clugston & Calder, 1999; Grindsted, 2011; Grindsted & Holm, 2012; Lozano, Lukman et al., 2013; Ruiz-Mallén & Heras, 2020; Sylvestre et al., 2013; Wright, 2002;). The first declaration made by universities was The Stockholm Declaration on the Human Environment, and the last was the International Sustainable Campus Charter.

Fifteen articles focused on assessment tools to discuss their implementation and applicability in higher education. The 28 tools were critically analyzed based on definite indicators (Alghamdi et al., 2017; Aguirre et al., 2023; Berzosa et al., 2017; Bullock & Wilder, 2016; Caeiro et al., 2020; Décamps

et al., 2017; Maragakis & Van den Dobbelsteen, 2013; Maragakis & van den Dobbelsteen, 2015; Roorda, 2002; Sepasi et al., 2018; Shriberg, 2002; Tanaka, 2012; Yang, 2021; Yarime & Tanaka 2012; Waheed et al., 2011; Zizka & Varga, 2021). The results highlighted that the Assessment Instrument for Sustainability in Higher Education (AISHE) and The Sustainability Tracking, Assessment and Rating System (STARS) are the most used systems. In addition to the introduction of tools, Berzosa et al. (2017) and Yarime and Tanaka (2012) presented two different categories of areas addressed in sustainability assessment tools. Considering general dimensions of sustainability, Berzosa et al. (2017) introduced social, curricula, environmental, and economic areas. Moreover, emphasizing the key functions of universities, Yarime and Tanaka (2012) analyzed assessment tools in four areas: governance, operation, education, research, and outreach.

Twenty-four more articles evaluated sustainability practices of higher educations in different countries (Al Mahameed et al., 2023; Alshuwaikhat et al., 2016; Beringer et al., 2008; Bizerril et al., 2018; Brusca et al., 2018; de Castro & Jabbour, 2013; Ferreira & Tilbury, 2012; Fonseca et al., 2011; Habib et al., 2021; Jenny Su & Chang, 2010; Lambrechts & Ceulemans, 2013; Leal Filho, Dinis et al., 2021; Lozano, Llobet et al., 2013; Malandrakis et al., 2017; Qammar et al., 2023; Reza, 2016; Sassen et al., 2018; Sebestyén et al., 2024; Shuqin et al., 2019; Son-Turan & Lambrechts, 2019; Stough et al., 2017; Udida et al., 2009; Ulmer & Wydra, 2020; Xiong & Mok, 2020). The results indicated that the majority of HEIs are engaged in sustainability practices, most notably in the area of pedagogy and curriculum. Additionally, various programs and research activities have been conducted. However, there is currently no institute having all the principles mentioned in declarations and assessment tools under the same umbrella. Therefore, according to de Castro and Jabbour (2013), there are still several opportunities for universities to get more sustainable.

According to the evaluation reports, signing international sustainability declarations would not be enough if the universities ignore basic sustainability principles and ethics in their operations and do not make valuable efforts in practice. This result supports the findings of Nejati and Nejati (2013). Additionally, it is crucial to investigate the characteristics of higher education institutions that disclose a sustainability report all over the world (Sassen et al., 2018).

3-2-2. Education

In this context, education refers to a process that focuses on administrators, faculty members, students, and staff developing the knowledge, skills, values, and dispositions necessary to encourage and achieve sustainability.

A total of 43 studies formed the education category. Effective pedagogy and curricula were two main themes in this category. In the pedagogy theme, most authors highlighted the role of pedagogical approaches for sustainability of higher education, especially the transformative approach (Hensley, 2017; Sandri & Holdsworth, 2022; Seatter & Ceulemans, 2017; Trevisan et al., 2024; Wals, 2011), the transdisciplinary approach (Liu & Kan, 2024; Steiner & Posch, 2006; Tejedor et al., 2018), the collaborative approach (Bucea-Manea-Ţoniş et al., 2020; Leal Filho, Raath et al., 2018), the integrative approaches (Leal Filho et al., 2016), and the experiential approach (Domask, 2007; Hensley, 2017).

Others discussed teaching techniques that can be adapted to teach sustainability issues better, such as lecturing, case studies, problem-based learning, community service learning, participatory action learning, virtual learning, placed-based learning, integrating mathematical concepts, e-learning, experiential learning, and adaptive learning (Adib, 2024; Alonso-Garcia et al., 2019; Belinda, 2013; Earl et al., 2018; Hensley, 2017; Isaias & Issa, 2013; Lafuente-Lechuga et al., 2024; Leal Filho et al., 2019; Lozano et al., 2019; Mashroofa et al., 2023; Mintz & Tal, 2013).

Furthermore, some researchers presented the importance of developing sustainability awareness among faculty members (Alkhayyal et al., 2019) and using psychological theory to expose students to intellectual–moral growth and identity alternatives beneficial to the difficulties and complexities of sustainability practice (Myers & Beringer, 2010). Lastly, Hyytinen et al. (2023), aimed to uncover internal and external factors that hinder universities from reaching a sustainable education.

The other studies evaluated the integration of sustainability in higher education curricula and examined the outcomes of relative activities. To integrate sustainability into the curriculum with the transdisciplinary approach (Argento et al. 2020), the project method (Fuertes-Camacho et al., 2019),

an institutional procedure (Sammalisto & Lindhqvist, 2008), and the approval, implementation, and management process (Hill & Wang, 2018) were highlighted.

Biedenweg et al. (2013) and Fisher and McAdams (2015) argued that the type of courses that students adopt significantly impacts their attitude to sustainable practices. In their results, a focus on ethical concepts, natural sciences, humanities, social sciences, business, economics, and policy was revealed. In addition, Sánchez-Carracedo et al. (2021) analyzed the extent to which sustainability is present in the curricula of the sixteen education degree programs. Results indicated that the most common one is the application of ethical principles of sustainability in personal and professional behaviors, while the least common is the sustainable use of resources and the prevention of negative environmental impacts (Sánchez-Carracedo et al., 2021).

However, some authors emphasized that although most courses equipped the students with theoretical knowledge, they had limited effects on motivating their attitudes and behaviors (Green, 2013; Jung et al., 2019; Mintz &, Tal 2014).

In line with this, Winter and Cotton (2012) discussed the role of hidden curriculum in sustainability literacy. Their findings illustrated the impacts of the hidden curriculum on students' conceptions of sustainability and the enhancement of their engagement through structured reflection.

In addition to the studies mentioned above, the arguments presented by Figueiró and Raufflet (2015), Viegas et al. (2016), Briens et al. (2023), and Sherman (2008) reinforced the potential of both pedagogy and curricula in developing education for sustainability in HEIs. Our results are in line with the reflections made by Bizerril et al. (2018), Lozano et al. (2015), and Wals (2014). Due to the emphasis on the education of students and faculty members in the literature, this study identified a lack of education programs for staff and administrators, as well as for other key stakeholders of higher education. In fact, more holistic education systems are urgently needed to address today's challenges, as education is one of the most powerful and proven vehicles for the sustainability of HEIs (Wamsler, 2020).

3-2-3. Barriers and Drivers

Barriers and drivers to sustainability in higher education were considered in thirty articles. Barriers include characteristics that prevent progress, while drivers refer to factors that can help universities achieve sustainability. While those identified in the literature were vast, there were also some commonalities. Table 1 presents the most common barriers and drivers identified in the reviewd research literature (Adams et al., 2018; Aleixo et al., 2018; Ávila et al., 2017; Brundiers et al., 2021; Caniglia et al., 2017; Corres et al., 2020; Disterheft et al., 2015; Dlouhá et al., 2017; Driscoll et al., 2013; Ezeokoli & Ayodele, 2014; Hassan et al., 2021; Hidalgo & Arjona Fuentes, 2013; Jimu & Rennkamp, 2024; Jorge et al., 2015; Krizek et al., 2012; Lambrechts et al., 2017; Leal Filho, Pallant et al., 2018; Leal Filho, Amaro et al., 2021; Manzoor et al., 2020; Moratis & Melissen, 2019; Nejati & Nejati, 2013; Ralph & Stubbs, 2014; Velazquez et al., 2005; Wang et al., 2019; Weiss et al., 2021b). To improve the clarity and coherence of the findings, the authors categorized barriers and drivers within the key sustainability areas, except for modeling, for which no suitable results were found.

Regarding the results identified in Table 1, governance is the area that is reported to present the highest barriers and drivers to implement sustainability in HEIs. Due to the importance of this area, universities should establish strong and comprehensive structures to guide the implementation of sustainability policies and programs with specific personnel (Leal Filho et al., 2017).

3-2-4. Governance

It refers to a comprehensive system of the structure, process, and relationship through which policies are developed, implemented, and reviewed. Twenty-two total articles dealt with governance orientation in HEIs were selected. These studies mainly addressed the importance of management and leadership, policies and strategies, key stakeholders' participation (leaders, staff, students), and change issues.

According to the results, a set of necessary and sufficient conditions for higher education governance toward sustainability included innovative (Barnard & Van der Merwe, 2016; Daub et al., 2020) and transformative management/leadership strategies (Stephens & Graham, 2010; McNamara, 2010), authentic leadership (Srivastava et al., 2020), sustainability leadership (Aung & Hallinger, 2022

Table 1. Summary of the Barriers and Drivers to the Sustainability of HEIs

	Barriers	Drivers
Education	Lack of effective sustainability training programs	Strong teaching culture
		problem–based teaching approach
		Demonstrable achievement in operations and teaching
	Traditional disciplinary curriculum	Sustainability-based curriculum innovation
		Interdisciplinary curriculum
Assessment and reporting	Lack of sustainability reporting and accountability mechanisms	Robust assessing, reporting, and accountability
Governance	Lack of the appropriate leadership style and governmental policy to encourage sustainability	Strong leadership
	Resistance to sustainability-oriented change	Managing change for sustainability
	Lack of integrated strategic Planning	Clear vision, mission, and values
		Consolidated policies, strategies, and programs
		Measurable goals and objectives
	Vertical and fragmented organizational structure	A functionally – integrative organizational structure
	Lack of sustainability funding	Sufficient funding
	Lack of commitment, interest, and involvement in human resources	Institutional commitment to sustainability
		Emotions management for sustainability
		Empowerment and involvement of human factors
		Active engagement, collaboration, and participation
		Developing sustainability intelligence
		Developing attitudinal competencies
		Developing critical thinking
	Lack of collaboration between universities, national corporate, and international networks	Sustainability networking
		Community engagement
		Community outreach on sustainability
		Proper university external image
	Disruptive cultural and behavioral change	University culture of sustainability
	Lack of specific sustainability working groups, and committees	Clearly defined roles and responsibilities in groups
	lack of ethical obligation of sustainability	Implementation competency
	Lack of adequate data and facilities	Access to the right technology, materials, facilities, and tools
Campus	Technical problems	Sustainable campus operations e.g. energy
Conceptualization	Lack of knowledge of sustainability issues	A common awareness of sustainability
	Lack of standard definitions of sustainability concepts	Introducing a standard definition of sustainability of HEIs
Research	Lack of interdisciplinary research in sustainability	Establishing sustainability research centers
		Methodological competencies
		Interdisciplinary approach

a,b), knowledge management (Martins et al., 2019), sustainability culture (Salvioni et al., 2017), paying attention to financial sustainability indicators (Al-Filali et al., 2023; Alshubiri, 2021; Jose & Chacko, 2017; Madu et al., 2022), corporate social responsibility (Nazneen et al., 2023), sustainability policies and strategies (Shawe et al., 2019), strategic planning with discussion of sustainability (Bieler & McKenzie, 2017; Cheeseman et al., 2019; Sen et al., 2022), organizational characteristics (Roosa &

Mischen, 2022), the key role of leaders, faculty members, staff, and students as critical in their efforts to achieve lasting progress towards higher education sustainability (Brinkhurst et al., 2011; Chase, 1998; Chuvieco et al., 2018; Shephard & Furnari, 2013; Srivastava et al., 2019), and effective change management and change implementation (Barth, 2013; Broadbent et al., 2010; Mader et al., 2013) to reduce change resistance and promote sustainability in higher education.

In consistency with Shawe et al. (2019) and Salvioni et al. (2017), the findings highlighted the importance of management sustainability and change issues as key quality improvement factors in universities. Furthermore, consistent with Cheeseman et al. (2019) and Brinkhurst et al. (2011), active participation by faculty, staff, and students in sustainability efforts fosters long-term change.

3-2-5. Conceptualization

This refers to the act or process of specifying what we mean and do not mean by the terms we use in relation to sustainability. Twelve studies focused on the conceptualization of sustainability. These articles addressed the introduction of sustainability as a science, the understanding of sustainability among the university's key stakeholders, the coherence between sustainability conceptualization and its implementation, and the challenges of misconceptions about the concept of sustainability.

Martens et al. (2010), introduced sustainability and numerous fundamental barriers as well as practical obstacles in translating the concept of sustainability into science and education. Stumpf et. al. (2015) identified the core characteristics of the concept of sustainability, and discussed underlying ethical, ontological, and epistemological assumptions. With a focus on rhetorical analysis, Weisser (2017) argued that HEIs definitions of sustainability reflect a similar adaptability approach to those found in political and public discourse, while revealing particular trends in persisting the concepts of interconnection, technological problem-solving, and temporality in sustainability definitions within universities.

In stakeholders' conceptualizations of sustainability, Wright (2010) and Wright and Horst (2013) argued that the majority of faculty leaders and university presidents were well-versed in the concept of sustainability; however, they were less familiar with the concept of a sustainable university. Emanuel and Adams (2011) and Dagiliūtė et al. (2018) also identified that an understanding of students' perceptions of sustainability affects their engagement in sustainable practices. Owens and Legere (2015), analyzed how faculty, staff, and students define sustainability. The authors believed their definitions caused a deep and easy understanding of sustainability in the context of HEIs.

Agostino and Dal Molin (2016) claimed that the coherence between sustainability conceptualization and its implementation suggests a heterogeneity of practice. Furthermore, Leal Filho (2000) and Djordjevic and Cotton (2011) emphasized that some of the misconceptions surrounding sustainability at universities caused some particular difficulties and problems concerning communicating messages about sustainability successfully. The authors concluded that it is crucial to address various misconceptions to facilitate action. According to Dziubaniuk et al. (2024), due to the key challenges of sustainability that may emerge in HEIs as a result of varied understandings, there is a need for effective communication of HEIs' strategic vision and consideration of the multiplicity of sustainability values among stakeholders.

Supporting the work of Cheeseman et al. (2019) and Emanuel and Adams (2011), the findings implied that understanding key stakeholders in sustainability may provide insight into whether and how they are likely to engage in sustainable practices. However, the inherent conceptual ambiguity and complexity of the term 'sustainability' present significant challenges.

3-2-6. Campus

It includes all environmentally oriented activities related to an efficient and safe campus operation that is consistent with the findings of Hinduja et al. (2023). A total of 11 articles focused on campus sustainability issues were selected. The main focus area of these studies included designing suitable power systems, such as carbon-neutral energy systems (de Souza Silva et al., 2022; Silva et al., 2024; Tian et al., 2022), installation of technologies that save mains water and grid electricity (Zang et al., 2022), promoting sustainable waste management (Jakimiuk et al., 2023), healthy and sustainable diets (Franchini et al., 2023), considering organizational constraints, such as the lack of internal communication and inflexible procedures, undermining efforts on campus energy and buildings

operations (Amaral et al., 2023), campus sustainability assessment tools (Arafat et al., 2023; Dawodu et al., 2024), utilizing the potential of deep organizational learning to develop long-term strategies for addressing the climate crisis (Washington-Ottombre, 2024), and finally, offering a conceptual assessment model of environmental sustainability in higher education to test the environmental sustainability level of a higher education institution (Menon & Suresh, 2022).

3-2-7. Modeling

It covers identifying the key variables of sustainability in higher education and the relationships between those variables through visualizations to aid in understanding complex concepts and facilitating effective communication among sustainability stakeholders. Nine papers were classified within the modeling category, which included papers that presented a model to provide a useful theoretical and practical basis for transformation toward sustainability. Six of these studies analyze the pedagogical approach in modeling sustainability, while other studies focus on the managerial approach. In pedagogical models, the main purpose was to develop a framework or model to integrate sustainability into the teaching-learning process and research activities. These include the I3E model (Cebrián, 2018), the butterfly model (Warwick, 2016), education, research, and practice model (Jain et al., 2013), organizational learning toward sustainability (Cebrián et al., 2013), the Global Seminar (GS) curricula model (Savelyeva & McKenna, 2011), and the general matrix to integrate sustainability in higher education (Rusinko, 2010).

On the other hand, the papers presented managerial approach depicted structured frameworks with a focus on organizational transformations and management processes for sustainability, including the organizational transformation model (Baker-Shelley et al., 2017; Grecu & Ipiña, 2014) and the sustainable university model (Velazquez et al., 2006).

In line with the findings of Rusinko (2010), the common aim of studies in adopting both approaches was to develop a framework for integrating sustainability in higher education so that faculty members and administrators can make more appropriate and strategic choices. However, there is a lack of an innovative and comprehensive model in the field of sustainability in higher education based on the two approaches simultaneously.

3-2-8. Research

This involves a process of detailed study of sustainability questions, issues, and problems to discover new information or reach a new understanding. The research category is exemplified in nine articles. Of these, two analyzed the driving factors that contribute to the visibility of sustainability contents in university graduate and postgraduate degree titles (Öztürk, 2017; Zorio-Grima, 2018). The visibility of sustainability contents in university degree titles highlights the importance of sustainability issues in the university strategy and the sustainability expertise of degree holders as key stakeholders of this system.

Emphasizing interdisciplinarity, Ouellet Dallaire et al. (2018) claimed that student-organized symposia can be effective mechanisms to increase interdisciplinary research and integrate sustainability outside the classroom. Furthermore, Yarime et al. (2012) presented academic, institutional, and social challenges in sustainability science and explored the potential of uniting education, research, and societal contributions to form a systematic and integrated response to the sustainability crisis. Another research presented a typology of sustainability centers differing in their goals, objects, scope, and scale of research, knowledge production, as well as outreach activities (Soini et al., 2018).

Focusing on research methodologies, Fien (2002) discussed that the diverse nature of the questions, issues, and problems of sustainability in higher education requires the adoption of suitable research methodologies or paradigms. In this regard, alternative research paradigms –empirical analytical, interpretive, critical, and post-structural paradigms– were summarized.

Corcoran et al. (2004) criticized the case study methodology in sustainability within higher education. Based on an analysis of 54 journal articles, they identified four areas of concern: 1. The absence of a clear *purpose;* 2. It is important that all the actors be involved in the study, and that their *role* in the innovation is explained; 3. Regarding the *tension* between the universal and the contextual,

a study must address the transformation of practice and learning beyond the context; 4. A study is more transformative when it poses *challenges* for both the readers and the writer.

Lastly, two papers examined research trends on sustainability. Leal Filho et al. (2023) investigated the focus areas of sustainability in higher education (curriculum, campus greening, research, governance, or outreach). Results indicated that, despite the intrinsic value of sustainability research in higher education, the emphasis given to this area is not as strong as one might expect. In another effort, Weiss and Barth (2019), with a focus on research on sustainability curricula implementation, argued that this process has produced a growing output in a variety of journals.

3-3. Thematic Map for Sustainability in Higher Education

This section discusses the rationality of the areas through a conceptual framework. Using investigator triangulation and theoretical triangulation, three broad themes were the starting point of sustainability in higher education concepts: the academic, the administrative, and the collaboration of academic and administrative categories (Figure 6).

Gough and Scott (2008) defined a university as an open and dynamic system that is composed of two subsystems with their respective subcultures: the academic and the administrative subsystems (Hernández-Diaz et al., 2021). The last category, the collaboration of academic and administrative, was added based on the findings of this study to facilitate the holistic and systemic view that sustainability studies demand (Lozano & Huisingh, 2011; Lozano, 2015).

The academic category comprises education and research (Hernandez-Diaz et al., 2020; Leal Filho et al., 2019; Lozano et al., 2019; Miller, 2016). Furthermore, modeling, as the process of determining the key variables of sustainability and the relationships between those variables through visualizations, lies in the academic category, as it is a more research-based activity. Modeling is one of the most efficient methods of learning new skills (Bandura, 1986). Direct experience or trial-and-error efforts reduce the rate of human learning progress (Salisu & Ransom, 2014). In sustainability efforts, modeling is an instructional strategy that describes the process of learning or acquiring new information, skills, or behavior toward sustainability through observation, rather than trial-and-error efforts. Accordingly, this study is presented as a separate and significant area in the field of sustainability.

Those topics and concepts such as assessment and reporting, governance, and campus formed the administrative category (Gough & Scott, 2008; Hernandez-Diaz et al., 2020; Hernández-Diaz et al., 2021). Lastly, barriers, drivers, and conceptualization shaped the category of collaboration between academic and administrative entities.

The faculty-administrator collaboration in universities is central to the effectiveness of sustainability practices (Del Favero & Bray, 2005). A collaboration can effectively facilitate and accelerate the kinds of "bridging activities" that foster sustainability (Leslie, 2004). Consequently, a novel category was introduced into the sustainability of higher education to indicate the importance of collaboration between academic and administrative subsystems of higher education.

As Popowska and Sady (2024) found, collaboration is fundemental to identifying HEIs' barriers and drivers toward sustainability, as well as to harnessing the institution's social capital by achieving a common understanding of sustainability among the key stakeholders within the considered categories. Therefore, it is crucial to remove barriers, develop drivers, and spread a common understanding of the concept of sustainability in a collaborative effort.

4. Conclusion

This study provided an overview and synthesis of the literature on sustainability areas in higher education. It aimed to complement prior literature reviews on the topic of higher education sustainability. In this systematic literature review, a more systematic understanding of key areas of sustainability in higher education was developed, and a logical connection between the themes was presented as a conceptual framework. Accordingly, the sustainability of higher education is considered in three main categories: The academic category covered education, research, and modeling; the administrative category was comprised of assessment and reports, governance, and campus; finally, barriers, drivers, and conceptualization were in the collaboration category. According to the findings, assessment, reporting, and education were found as the most studied areas in the literature. In contrast, modeling and research were less frequently addressed.

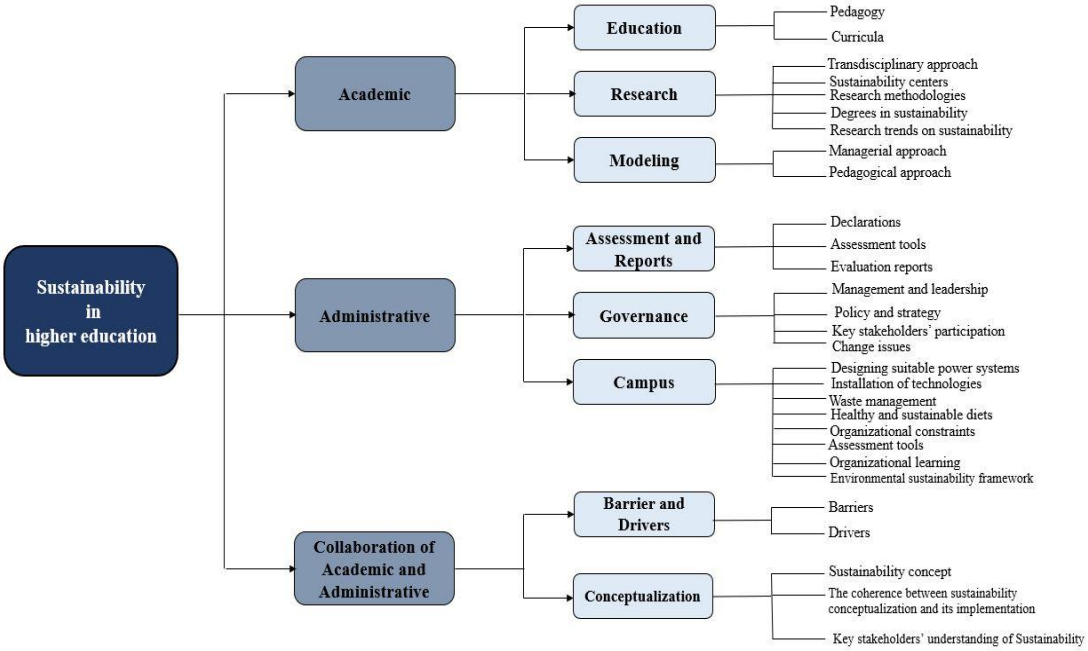

Fig. 6. Thematic Map for Main Areas of Sustainability in Higher Education

Given that few studies have proposed multidimensional approaches and indices to identify and assess areas of sustainability in HEIs, identifying, synthesizing, and integrating common themes in a conceptual framework is a valuable and unique contribution. Additionally, considering the category of academic-administrative collaboration and modeling, barriers, drivers, and conceptualization, as sustainability areas, is a noteworthy theoretical contribution that contributes to the originality and value of this research.

When interpreting the results of this study, some limitations should be captured. Notably, this study was limited by restricted access to certain databases, which may have led to the exclusion of relevant literature. In the future, researchers are encouraged to conduct a literature review on the theme across a broader range of databases. However, the results should be regarded as an input for future and more holistic studies.

Furthermore, this review just includes research papers published in double-blind, peer-reviewed journals, excluding any unpublished studies. We have assumed that all the studies are objective and impartial; however, if this is not the case, it poses a threat to the validity of the research.

The findings have four main implications for theory and practice. Firstly, it provides a solid background to the subject matter of sustainability in higher education. Drawing upon the results, several gaps are identified in the present studies, including a lack of attention to the importance of the interactive environment and boundary interactions, resource and capital management, and sustainability dynamics. Secondly, the presented framework brings some discussion topics: the necessity of sustainability conceptualization, modeling sustainability efforts, and drivers and barriers in sustainability plans.

Thirdly, this systematic review creates a critical foundation for accelerating policymakers' understanding of crucial areas that can facilitate and accelerate sustainability efforts in higher education. The proposed conceptual model can be employed by university planners, policymakers, and decision-makers to design strategies and long-term development plans. It can also be used as a foundation for the current state of sustainability reporting. It is recommended that HEIs establish an independent sustainability reporting center to develop sustainability policies, strategies, goals, and plans and implement monitoring practices across various sustainability areas.

Finally, opportunities for future research are presented, which may be followed up in further research. The study's conceptual model may need further investigation for empirical validation. Future studies should examine the applicability of the developed model across settings and over time to substantiate its socio-cultural effectiveness and enhance its generalizability. Furthermore, it is

recommended that researchers identify specific strategies and provide insights for the successful integration of sustainability–oriented practices. The analytic hierarchy process (AHP) is also suggested to rank the identified areas. This may help the HEIs be soundly managed by classifying these factors. Last but not least, exploring how digital transformation can support the sustainability of HEIs in the mentioned areas, and mapping types of smart technologies implemented on HEIs to ensure sustainability are recommended.

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