Review

Sustainability in the Modernization of Higher Education: Curricular Transformation and Sustainable Campus—A Literature Review

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Abstract: Supported by a literature review, the present article looks to address the issue of sustainability in the modernization of higher education. Education for sustainability and the encouragement of a sustainable lifestyle are increasingly present in the academic and professional training of individuals. Progressively more responsible for the environment in which they operate, individuals, in order to preserve their quality of life and, above all, ensure quality of life for future generations, begin to assume new behaviors, such as the rationalization of energy and water consumption, reducing the use of paper, recycling products, and eliminating the use of plastics, among other behavioral changes. In this context, considering higher education institutions as a vital source for the development of sustainability and, consequently, a key lever in the definition and implementation of strategies conducive to sustainable development, it is through the teaching, training, research, and development carried out by them that these behavioral changes occur. Aware of this issue's relevance, the present article, consisting of a critical review of the literature, seeks to answer a set of questions, such as "What role do academic managers, teachers and students assume in the search for sustainability?"; "What measures/actions have been developed by the HEIs in terms of curricula reform and the promotion of a sustainable campus?"; "What sustainability metrics are used in higher education?". Giving particular emphasis to some studies about sustainability in different HEIs, the results of the research allow us to conclude that education for sustainability is seen as a tool of crucial importance in the current decade of the 21st century.

Keywords: sustainability; modernization; higher education; curriculum reform; sustainable campus; HEIs

1. Introduction

Currently, the terms sustainability and sustainable development are widely used in the most varied situations of everyday life, often without a rigorous form of application. They spread very quickly as politically correct vocabulary in the media and in public and private organizations. In most cases, the terms sustainable development and sustainability are used interchangeably. These are concepts that are commonly used as synonyms and are perfectly interconnected [1,2]. In fact, sustainable development corresponds to development that incorporates economic growth and social progress and is directed towards sustainability [3,4]. Therefore, technically, we are dealing with different concepts as far as sustainable development is seen as a process to achieve sustainability [5]. Sustainability that places priority emphasis on the environment [1,6,7].

The concepts referred to in the previous paragraph began to be outlined in the sixties, even before the oil crisis of 1973, when, in 1968, the Club of Rome was founded by the

Italian industrialist Aurelio Peccei and the Scottish scientist Alexander King. This club is made up of a group of distinguished people (Nobel laureates, politicians, economists, and heads of state) who meet to discuss international politics and economics and, above all, the environment and sustainable development. In 1972, the Club of Rome published a famous report prepared by the MIT group led by Dennis L. Meadows, which resulted in a widely circulated book in several languages, entitled "The Limits to Growth". In the same year, the first United Nations conference on the human environment (Stockholm Conference 1972)—UNCHE (United Nations Conference on the Human Environment)—took place in Stockholm, where great concern emerged from the participating countries about environmental protection standards and the need to establish a global environmental policy.

The concept of sustainable development, which combines environmental, social, and economic aspects, was presented in the famous WCED (World Commission on Environment and Development) report known as the Brundland Report, entitled "Our common future" in 1987. WCED was established in 1983 by the Assembly General of the United Nations. It is a multidisciplinary concept, still widely used today, whose definition, according to Brundland [8] (p. 41), is as follows:

> "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:
>
> - the concepts of "needs", in particular the essential need of the world's poor, to which overriding priority should be given; and
> - the idea of limitations imposed by the state of technology and social organization on environment´s ability to meet present and future needs".

A highly relevant concept, it establishes links among the three fundamental pillars, namely the economic, social, and environmental aspects. Despite the criticism for being a vague concept, it remains very current, which fully justifies its use. We can also say that it is a multifaceted and complex concept because it involves different approaches, aspirations, and desires.

The way in which the Brundtland Report describes sustainable development has been generally accepted, yet it is difficult to implement in practice. "Meet the needs of the present generation . . . " how?; "Future generations . . . " how many generations? Thus, an attempt was made to make the concept of sustainability more concrete. One of the best known was created by Serageldin (1996), quoted by Roorda [9] as the "Triple P", or "the 3P" of "people", "planet", and "profit". When together, they are designated the "pillars of sustainability".

In sustainable development, these aspects are interrelated in such a way that various interests, problems, and solutions are harmoniously weighted and interconnected. The 3Ps must be in balance.

The UNCED conference (United Nations Conference on Environment and Development), known as the Rio-92 conference, proved to be a milestone of the highest importance, as it allowed for the official delineation and definition of the global sustainability policy as a new development model through the adoption of AGENDA 21 (global action plan for sustainable development), as well as presenting the well-known Rio Declaration on environment and development, confirming and expanding the principles set out in the 1972 Stockholm Conference. This conference, through the United Nations Framework Convention on Climate Change, made it possible to prepare the Kyoto Protocol, which is an international treaty, negotiated in 1997, for the reduction of gas emissions that aggravate the greenhouse effect, generally considered an anthropogenic cause of global warming. This agreement, which was signed by 175 countries, came into force in 2005.

In 2002, the United Nations organized the WSSD (World Summit on Sustainable Development) conference in Johannesburg (also known as Rio +10) with the aim of analyzing the implementation of AGENDA 21. The Johannesburg Declaration confirms the international

policy for sustainable development embodied in AGENDA 21, the Rio Declaration, and the proposed plan to accelerate the implementation of AGENDA 21.

The UNCSD conference (United Nations Conference on Sustainable Development), known as Rio +20, was held in Rio de Janeiro in 2012 with the aim of analyzing the political commitment to sustainable development. It was the largest conference organized by the United Nations that took place in the middle of the financial crisis and allowed establishing guidelines for economic growth, social justice, and environmental respect. The outcome of the conference can be seen in the paper "The future we want" [10], which consists of a document that respects the accredited definition of sustainable development as "that meets the needs of present generations without compromising the ability of future generations to meet their own needs" [8] (p. 41).

In September 2015, at the United Nations headquarters, at the Post-2015 Sustainable Development Summit, 193 world leaders agreed on a new agenda for the following 15 years, called the 2030 Agenda, which includes the 17 sustainable development goals (SDGs) [11].

In this new 2030 Agenda, the sustainable development objectives include not only concerns about water and the environment but also other objectives such as improving health, reducing poverty and hunger, as well as gender inequality. These objectives form part of the three dimensions of sustainable development: economic, social, and environmental. Here, the commitments of the 2030 Agenda are highlighted in aspects of great importance for humanity, such as the search for prosperity, peace, and partnerships with the aim of safeguarding people and the planet (5P). These sustainable development goals (SDGs) follow the millennium development goals (MDGs) [12,13] contained in the Millennium Declaration, promoted by the United Nations, in September 2000, for the period 2000–2015.

Philosophical and ethical considerations in the interpretation of sustainable development gave rise to concepts of sustainability that prioritize economic or environmental objectives. Thus, we are faced with the concepts of weak sustainability and strong sustainability, respectively [14–17].

The weak sustainability view is illustrated in Figure 1, which links the economy, society, and environment. The economy is seen as partially independent of social and environmental aspects. Therefore, although most of the area of each circle is considered the three pillars of sustainability, in this mechanistic/functionalist approach, it remains unconnected, not completely reflecting the environmental impact of human activity.
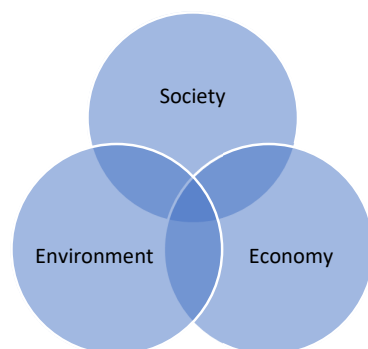
Figure 1. Sustainability: mechanistic/functionalist approach—weak sustainability.

On the contrary, the strong, extremely ecological, holistic/interpretive vision of sustainability is represented in Figure 2, which gives primacy to the environment and encompasses social and economic aspects. The economic system lies within the social system, and together they exist and function within the environmental system, all of which are totally dependent on each other.
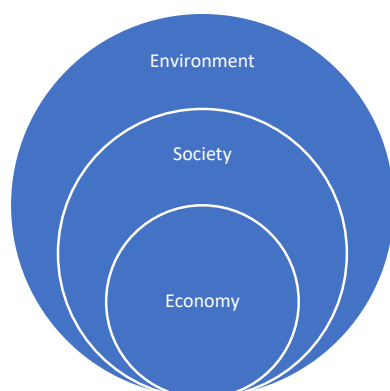
Figure 2. Sustainability: holistic/interpretive approach—strong sustainability.

In recent years, the pillar or institutional dimension of sustainable development, also understood as "democracy" or "governance", has been considered the fourth pillar of sustainability (Figure 3). This new line of thinking highlights the importance of institutional change for sustainable development, as explained in "Our Common Future" and embodied in AGENDA 21, where the institutional dimension constitutes a different section alongside the other dimensions [1,18].
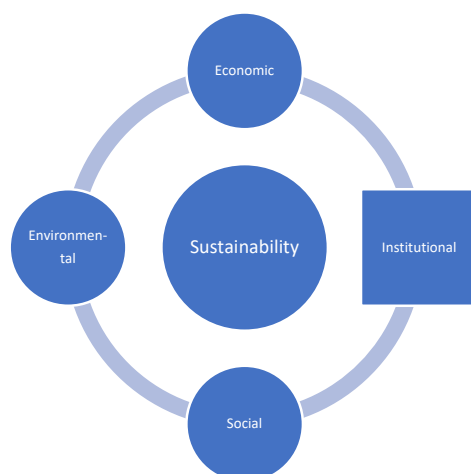
Figure 3. Four-pillar sustainability model (institutional dimension highlighted).

The model points to harmonious integration, in a dynamic environment, as "a process of change" with four pillars, namely [1,18,19]:

- Economic: economic growth as the lever to create long-term well-being to meet the critical needs of employment, food, energy, water, sanitation, social security, and consumption opportunities;
- Environmental: environmental protection with a view to both maintaining and increasing, from a long-term perspective, the resource base within the Earth's environmental limits.
- Institutional: institutional change to blend the environment and the economy in the decision-making process and to assert the common interest through greater participation of individuals, both locally and internationally;
- Social: social justice is compatible with an equitable distribution of well-being, equal access to natural resources, as well as equal opportunities among individuals (in terms of gender and social groups, among others).

Over time, opinions regarding the "correct" number of pillars have diverged. Some authors defend from two pillars (environment and socio-economic), to three (environment,

social, and economic—the most common) or to four, as mentioned above, or even five, with culture emerging as a separate dimension [20,21].

Lozano [5] suggests that sustainability emerged as an alternative to the dominant socio-economic paradigm. However, as we saw earlier, it is still a difficult concept to fully understand. To help this perception, the previously described visual representations were used, namely the Venn diagram, that is, the three circles that interconnect, where the resulting overlap represents weak sustainability, and the three circles in which the inner circle represents the economic aspects, the medium the social aspects, and the external the environmental aspects that represent strong sustainability. Each of the representations has been useful in helping to engage the public in raising awareness of sustainability.

According to Lozano [5], the previously described models present partition and continuity problems, which may limit their use. Thus, in his work, he presented an innovative attempt to represent sustainability in three dimensions, which shows the complex dynamic balance between the economic, environmental, and social dimensions as a function of time (short and long term) (Figure 4).
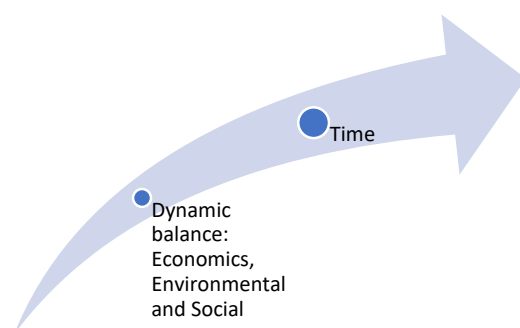
Figure 4. Dynamic balance sustainability model as a function of time (adapted from [5]).

The science of sustainability is relatively recent, as it emerged practically at the turn of the millennium and has been developing since the beginning of the 21st century. Kates et al. [22] suggest that, although it is a maturing science, some scientists have reached agreement on a common approach for the science of sustainability. "[. . .] encompass the interaction of global processes with the ecological and social characteristics of particular places and sectors; integrate the effects of key processes across the full range of scales from local to global; and achieve fundamental advances in our ability to address such issues as the behavior of complex, self-organizing systems, as well as the responses of the nature-society system of governing to multiple and interacting stresses [. . .]" [23] (p. 2).

We can say that this transdisciplinary science studies the complex and dynamic interactions between natural and human systems and the ways in which these can be sustainably transformed from a long-term perspective [24].

Education for sustainability is an emerging field with a strong bond with sustainability science. Sustainability education and sustainability science constitute the scientific support for sustainability education in higher education. This is a research niche that can open the institution to society through transformative approaches, especially in terms of concerns for the development of skills. It is important that the educational sciences, like other sciences, participate in this dialogue to enhance, diversify, and expand the forms of communication necessary for the global discourse of sustainability.

After analyzing the concepts and highlighting the relevance that the issue of sustainability and sustainable development has assumed, this article, based on a critical review of the literature and focusing on sustainability in higher education, seeks to answer some questions, such as "What role do academic managers, teachers and students assume in the search for sustainability?"; "What procedures have been developed by HEIs in terms of curriculum reform and the promotion of a sustainable campus?"; and "What sustainability metrics are used in higher education?".

2. Literature Review

2.1. Sustainability in the Modernization of Higher Education

Education for sustainability must consider respect for others, including present and future generations; respect for difference and cultural and social diversity; and respect for the environment and planetary resources. It is based on a holistic and interdisciplinary view and should enable students to understand the complexity of global environmental, social, and cultural settings. Education for sustainability must propose sustainable alternatives to current practices. It is essential that students understand that, in order to respond to the current situation, they must develop a critical, responsible, and participatory attitude based on sustainability [25].

Leal Filho et al. [26] describe the achievements of the United Nations (UN) in the Decade of Education for Sustainable Development (2005–2014), with a focus on higher education. The work refers to the deliberations carried out at the Rio +20 Conference, with a special emphasis on the document "The future we want". Sustainability is and will continue to be an issue of critical international concern. The developments achieved over the past 20 years have been considerable, but there are still many gaps and needs that need to be addressed in order to improve the perspectives for the next two decades.

According to Leal Filho [27], although more than 600 universities around the world (in a universe of more than 20,000 higher education institutions (Ranking Web of Universities [28]) are committed to promoting sustainability through the formalization of international agreements and conventions, many of them have not been able to fully implement the principles of sustainability in practice due to various reasons, from a lack of institutional interest to limited material resources or to the involvement of teaching and non-teaching staff.

Implementing sustainability practices in an institution is not just a matter of policy, as statements and action plans are useless, unless they can be supported by concrete actions, namely, the definition of appropriate curricula, sustainable campus, research, continuing education, cooperation with society, and even specific projects [27].

Over time, there have been several milestones in the design of approaches and mechanisms to consider the issue of sustainability when defining higher education policies (Table 1).

Table 1. Chronology of some of the main statements related to education for sustainability in higher education.

Year	Declaration
1977	Tbilisi Declaration, Intergovernmental Conference on Environment Education [29]
1987	"Our Common Future", The Brundtland Report [30]
1988	Magna Charta of European Universities [31]
1990	University Presidents for a Sustainable Future: The Taillores Declaration [32]
1991	Halifax Document "Creating a Common Future: an Action Plan for Universities [33]
1992	Association of University Leaders for a Sustainable Future founded [34]
1993	Ninth International Association of Universities Round Table: The Kyoto Declaration [35]
1993	Association of Commonwealth Universities' Fifteenth Quinquennial Conference: Swansea Declaration [36]
1994	COPERNICUS "Universities Charter on Sustainable Development" [37]
1998	World Declaration on Higher Education for the twenty-first century: Vision and Action [38]
2000	Global Higher Education for Sustainability Partnership (GHESP) [39]
2001	Luneburg Declaration on Higher Education for Sustainable Development [40]
2002	Ubuntu Declaration on Education and Science and Technology for Sustainable Development [41]
2004	Declaration of Barcelona [42]
2005	Graz Declaration on Committing Universities to Sustainable Development [43]
2006	Declaration on the Responsibility of Higher Education for a Democratic Culture—Citizenship, Human Rights and Sustainability [44]
2008	G8 University Summit: Sapporo Sustainable Declaration [45]

Table 1. *Cont.*

Year	Declaration
2009	Abuja Declaration on Sustainable Development in Africa: The role of higher education in Sustainable Development [46]
2009	Turin Declaration on Education and Research for Sustainable and Responsible Development [47]
2010	G8 University Summit: Statement of Action [48]
2011	Copernicus Charta 2.0 [49]
2012	People's Sustainability Treaty on Higher Education [50]
2012	UN Higher Education Sustainability Initiative Rio +20 [51]
2015	UN Higher Education Sustainability Initiative (Paris) [52]
2019	40th Session of the UNESCO General Conference [53]
2019	UN General Assembly Resolution 74/223 [54]

Own elaboration (based on [24,27,55,56]).

In his work at the beginning of the millennium [57], reinforced by another study he also developed about a decade later [27], Walter Leal Filho points out several reasons for the difficulty of implementing sustainability in HEIs. More specifically:

- Sustainability is a very abstract and broad concept: on the one hand due to the scope of the subject and on the other hand due to the lack of information. Some institutions consider the theme abstract and very distant from reality. However, a careful analysis of the activities of HEIs, such as teaching, research, cooperation with society, or even the purchase and use of energy, allows us to conclude that sustainability plays a very relevant role. Sustainability principles can be applied to different parts of an institution when properly contextualized.

- Limited human resources: in general, work at a university (e.g., tutoring, counseling) is carried out by highly qualified professionals. The problem can be overcome by resorting to professionals who are knowledgeable in the principles and practices of sustainability, prone to the impact that higher education activities have on the environment, and motivated for tasks, provided they have adequate training to deal with these issues.

- Material resources: the financial benefit does not seem to be the main reason for institutions that have adopted sustainability policies. However, they should be encouraged to implement energy-saving initiatives, thus reducing their energy bill. Such savings can be used to acquire goods or services or to reinvest.

- The scientific basis: the low scientific level of the topic is not often mentioned, but unfortunately it is nevertheless quoted as a problem. However, sustainability is now a concept found at the forefront of the scientific agenda. In many European countries, sustainability research is well supported by substantial resources. As an example, it should be noted that in the Horizon 2020 Program of the European Commission [58], sustainability was a research topic to which substantial funding was allocated.

- Competitiveness: refers, in general, to the high demand to obtain funds and financial resources to support sustainability initiatives. However, this reality is not exclusive to the field of sustainability. Indeed, other areas of knowledge are also experiencing the same or greater competition in what concerns the presentation of research proposals.

Another interesting key question raised by Walter Leal Filho [27] is to know "why is sustainability—as a process—so difficult to understand?". Regarding this issue, and according to this author, there are several reasons:

- Sustainability is not an issue in itself: there is a tendency to consider sustainability as an abstract concept—with a component that can be incorporated into all disciplines.

- Sustainability is very theoretical: sustainability approaches are seen as theoretical matters, departing from political discourse and, therefore, a simple theory.

- Sustainability is a very recent issue: some institutions think they should wait and see how the issue evolves, contrary to taking a proactive role.

- Sustainability is in vogue: this aspect hampers the true purpose of sustainability and negatively affects the development of sustainability at an institutional level.

What was mentioned above highlights some aspects of the problem that arises when one intends to effectively implement sustainability in HEIs. However, these difficulties have not prevented the association of HEIs around the sustainability objective in recent years. Let us then analyze some of the most significant associations based on the work of Stephen Derrick [59] (updated to our days).

One of the oldest is the University Leaders for a Sustainable Future (ULSF) association, which is based on the Talloires Declaration, initially signed by 12 founding institutions in 1990. The signatories committed themselves, with their institutions, to "contribute to sustainability as a critical focus of teaching, research, operations and awareness in higher education through publications, research and evaluation". There are currently more than 500 signatories [60].

In 2001, the European University Association (USA) was created, with more than 850 members in 49 European countries [61]. Although its focus goes far beyond issues related to sustainability, its 2012 Annual Conference, "The sustainability of European Universities", clearly highlights the association's interest in this topic.

Also worthy of mention are the American College and University Presidents' Climate Commitment (ACUPCC), formed in 2006 and which currently has more than 700 signatories [62], and the Association for the Advancement of Sustainability in Higher Education (AASHE), also created in 2005/2006 and which at the time had 900 members, including 721 higher education institutions [63].

In 2007, the People & Planet University League was established to assess the environmental and ethical performance of each UK university. Currently, in the 1st class universities, Cardiff Metropolitan University leads the UK's most sustainable universities in the 2022/2023 publication, just followed by the University of Bedfordshire, Manchester Metropolitan University, University of Reading, and University of the Arts London (to highlight only the first five), with Edinburgh Napier University at the top of Scottish universities [64].

Finally, reference is made to the International Sustainable Campus Network (ISCN) [65], Sustainable Campus, with about 101 members (universities from 32 countries on 6 continents), each of which has engaged in a Sustainable Campus Charter, as well as the Environmental Association for Universities and Colleges (EAUC) [66], which refers to an organization that has the membership of more than 300 universities and deals with sustainability issues in the higher education sector in the United Kingdom.

According to Derrick [59], the adherence and focus of all the aforementioned associations, as well as many others not mentioned, vary significantly. However, there is an almost similar interest that focuses on the assessment and measurement of environmental performance. Some associations also include evaluations of economic and social performance. It appears that there is no typical pattern of analysis, but it is clear that environmental assessment and performance play a leading role.

Reunamo and Pipere [67], resorting to the implementation of a survey among 83 researchers of education for sustainability, mainly from European countries, developed a relevant study in which they sought to explore the nature of research in education for sustainability. The desire expressed by the researchers, who participated in the study, to contribute to the development of society was the issue that assumed greater relevance. It is also important to emphasize that researchers need to keep in mind their preferences and orientations in order to study complex and controversial themes, such as sustainability.

Having HEIs as one of their responsibilities to promote sustainability through the implementation of the 2030 Agenda, Ruiz-Mallén and Heras [68], considering that the way in which this is being understood and integrated into theory and practice remains an unexplored issue, developed a study in which they question the concept of sustainability adopted by 10 key networks of HEIs at global and regional levels, identifying and discussing the main actions presented by them. The results obtained by these authors showed that in

most of the HEI networks studied, the path taken towards sustainability fits into a "green" discourse, which seeks to improve nature and people's well-being through economic growth that is less harmful to the environment, in line with the objectives of the 2030 Agenda. With this action, "these networks promote the integration of sustainability values in HEIs strategic planning, academic and organizational work, emphasize the need for partnerships and support actions mainly oriented to learning and teaching" [68] (no page). Since "greening" is the dominant sustainability discourse, this study also allowed us to identify two other smaller and regional discourses, such as "resilience" and "alternative", the latter understood as the only one that brings a critical approach to the objectives of the 2030 Agenda.

In recent years, research in the field of education for sustainability in higher education has developed very quickly. A search performed on the popular Web of ScienceTM database (Thomson Reuters©, Toronto, ON, Canada) on 31 March 2023 combining topic (Higher Education*) and topics (Sustainability* OR Sustainable Development*) found 13,216 items. Based on this number, it is interesting to observe that over the last 8 years, publications in this area have assumed greater evidence. Effectively, of these 13,216 items, 2924 refer to the period between 1990 and 2014 (inclusive), with a total of 58,231 citations, showing the period between 2015 and 2022 (inclusive) an interesting amount of 9996 items, to which correspond a total of 87,444 citations, as can be seen in Figure 5 below.

With regard to 2023, although only one quarter has passed, this year 296 items have already been published, with a total of 46 citations.

From the foregoing, it follows that, as this is a topic that has been arousing great interest in terms of research, there is no doubt that it is over recent years that this interest has gained greater relevance, which demonstrates the high degree of awareness that the topic of education for sustainability in higher education has been observed, as well as the critical role that HEIs have been assuming as important players in the promotion and implementation of issues related to sustainability.

Figure 5 above shows the evolution of publications and citations over the last 30 years, among which the years 2015 onwards assume greater intensity in terms of publications. It is important to look more closely at the indicators of the latter period that demonstrate their relevance. More specifically, alongside the total number of published items and the underlying number of citations, it is also important to highlight that the average citation per item, in the period from 2015 to 2022, stands at 8.75 and the h-index at 94 (at least 94 articles were cited 94 times or more in indexed journals). It is also important to emphasize that among these items, articles assume, without a doubt, greater relevance. More specifically, in the period from 2015 to 2022, of the 9996 items published, 7717 refer to articles, which, cited by 54,368 articles (51,654 without self-citations), present a total of 74,261 citations (62,885 without self-citations), for an average of 9.62 per item and an h-index of 84.

In Table 2, we can see a list of the main international journals where scientific articles on education for sustainability in higher education are published. In addition to these magazines, others not specialized in the subject publish articles due to the interest and modernity of the topic.

***Topic*:** (Higher Education*) *AND*
***Topic*:** (Sustainability* OR Sustainable Development*)
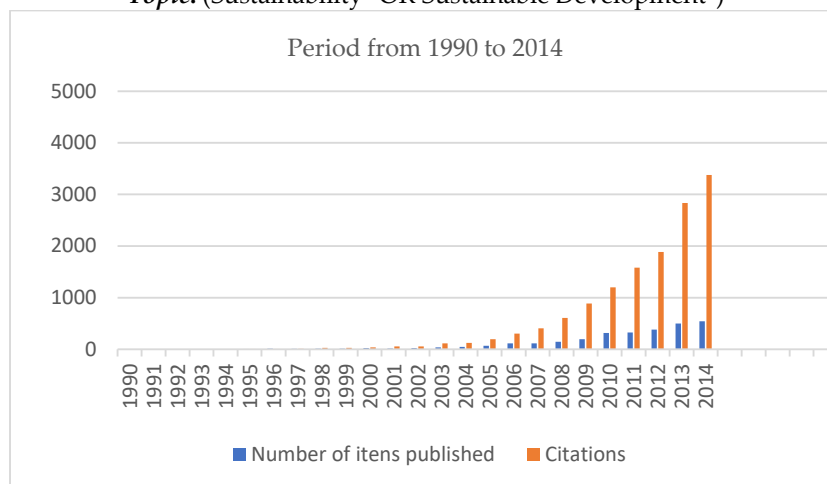
Results found	2924
Sum of the number of citations	58,231
Sum of the number of citations without self-citations	56,926
Articles that have cited	45,747
Articles that cite without self-citations	45,312
Average citations per item	19.91
h-index	106
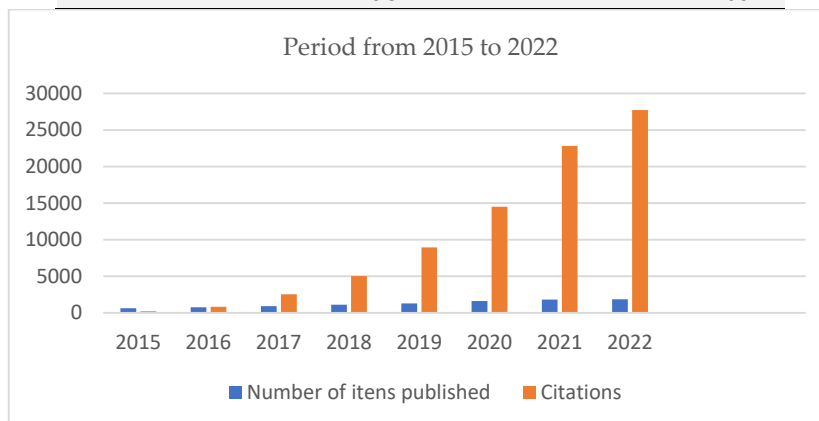
Results found	9996
Sum of the number of citations	87,444
Sum of the number of citations without self-citations	72,088
Articles that have cited	63,731
Articles that cite without self-citations	60,472
Average citations per item	8.75
h-index	94

Figure 5. Results of the search for items and citations, in the periods of 1990 to 2014 and 2015 to 2022. Own elaboration: data obtained from the ISI Web of ScienceTM database (Thomson Reuters©) on 30 March 2023.

Table 2. Some of the main international journals where scientific articles on education for sustainability in higher education are published.

Year of Beginning	Journal/Publisher
1969	The Journal of Environmental Education/Taylor & Francis
1990	Environmental Education Research/Taylor & Francis
1993	Journal of Cleaner Production/Elsevier
2000	International Journal of Sustainability in Higher Education/Emerald
2002	Journal of Teacher Education for Sustainability/DE Gruyter
2006	Sustainability Science/Springer
2007	Journal of Education for Sustainable Development/SAGE
2009	Sustainability/MDPI
2010	The Journal of Sustainable Education/The Prescott College
2015	International Journal of Higher Education and Sustainability/Inderscience

The Journal of Environmental Education, published by Taylor & Francis (USA) since 1969, is the pioneering journal of environmental education. With regard to education for sustainability in higher education, the International Journal of Sustainability in Higher Education, published by Emerald (UK) since 2000, is the second journal that publishes the most articles in this field, preceded by Sustainability, published by MDPI, which appeared for the first time in 2009. Indexed in the main international databases (IJSHE—Web of ScienceTM (Thomson & Reuters©), [IF(2021) = 4.120] and SCOPUS (Elsevier), [Q1-SJR(2021) = 0.86]; and Sustainability—Web of ScienceTM (Thomson & Reuters©), [IF(2021) = 3.889] and SCOPUS (Elsevier), [Q1-SJR(2021) = 0.66]), they are seen as two reference journals in the area of education for sustainability in higher education.

2.2. The Role of Administrators/Managers and Teachers/Students

The role of administrators/managers of universities/organic units, as well as professors/students, is fundamental for the implementation of policies for education for sustainability in higher education.

Nicolaides [69] in his work shows that practices, processes, and resources for university environmental management must be aligned to meet the growing need for sustainability. Universities must strive to become leaders in the development of environmental programs—they must practice, demonstrate, and educate on the path to sustainability. According to this author, environmental management systems must be adopted in order to manage and evaluate the university's impact on the environment and on education for sustainability. Two of the critical tools for achieving sustainability are undoubtedly politics and education. A concerted effort must be made to raise awareness, educate, and train on the concept of sustainability at a university that is concerned about the environment. Unfortunately, many signatories to international sustainability agreements in higher education are concerned with environmental issues in their essence and not with their quick and efficient execution. According to the author, this work intends to make HEIs aware of the need to act on environmental issues. Effective knowledge of environmental consequences must urgently be encouraged in universities, and there must be a firm commitment on the part of university hierarchies to take a more responsible approach to managing the improvement of environmental performance.

Velasquez et al. [70] explore some of the factors that could hinder the implementation of sustainability initiatives in HEIs as a way to improve the effectiveness of these potential initiatives during the decade of education for sustainable development ("United Nations Decade of Education for Sustainable Development"—DESD (2005–2014)) [71]. The appropriate conditions for the successful implementation of sustainability programs do not exist. There are indeed many constraints that impede the success of sustainability initiatives around the campus. The research carried out by these authors points to ways of anticipating solutions to overcome institutional barriers.

Brinkhurts et al. [72] showed in their work the interaction that is felt between organizational change and environmental sustainability on the university campus. While leadership from administrators/managers is important, no less important is institutional leadership from faculty and staff. Professors and staff are often important social entrepreneurs, that is, those who work for the social aspect and for a good environment within the university. The faculty's role is crucial in implementing successful strategies to overcome the barriers that oppose sustainable practices.

Wright and Wilton [73] and Wright and Horst [74] developed a study whose aim was to understand how administrators/managers of universities in Canada conceptualize sustainable development, sustainable universities, and the implementation of initiatives for sustainability in their institutions. Using in-depth interviews, the research focused on 37 administrators/managers. Although most of the interviewees are of the opinion that universities play a critical role with regard to sustainability in global terms, the results obtained also allowed us to conclude that not everyone had a clear idea regarding the concepts of sustainable development and sustainable universities. It should also be noted that almost all respondents highlighted environmental sustainability as the most important aspect of sustainable development. Likewise, it was also highlighted by the participants in the study that, with regard to initiatives to implement sustainability in their university, the biggest obstacle focuses not only on financial resources but also on resistance to change. Many of the interviewees also mentioned that either they had never thought about this matter or they had never had the opportunity to reflect on or discuss sustainability at the university until the present study.

Seeking to define sustainability indicators associated with the specificities of an HEI, Machado, Silveira, Weber, and Petarnella [75] developed a study through which they sought to find out what, in the opinion of managers, is the responsibility of HEIs in relation to sustainability and sustainable development. Collecting data from ten managers of the institution under study, the authors highlighted that the managers are of the opinion that the application of sustainability concepts in management practices assumes great relevance since they can serve as an example for other institutions and at the same time contribute to the sustainable development of the region in which they are located. Having been listed by the managers as several actions developed by HEIs, the results of the study are particularly relevant as they contribute to the construction of a system of sustainability indicators that facilitate adequate monitoring and assessment of the effectiveness of the actions developed.

Aware of the vital role that HEIs assume in the operationalization of sustainable development goals, Iqbal and Piwowar-Sulej [76] sought to analyze the influence that sustainable leadership has on sustainable performance based on the analysis of social innovation. Focusing on China and Pakistan, the authors sought to examine the position of universities in these two countries, as well as how they contribute to sustainable development. It is highlighted here that HEIs are still based on reductionist and mechanistic paradigms, thus making it difficult to consider sustainability in theory and practice. The authors emphasize that the study developed constitutes an important vehicle for a greater understanding of the mechanism by which HEIs can achieve higher sustainable performance. More specifically, the study concludes that sustainable leadership significantly influences social innovation, which, in turn, has a significant impact on the sustainable performance of HEIs, also mediating, albeit partially, the relationship between sustainable leadership and sustainable performance. Emphasizing that HEIs are responsible for creating a sustainable future, this study contributes to a greater integration of different research fields such as sustainable development, higher education, leadership, and innovation, thus expanding academic knowledge in this area of knowledge.

In more recent works, Markauskaite, Carvalho, and Fawns [77] seek to relate the growing challenges that are being felt with the demands that are being placed in order to reach a more sustainable university. Looking, on the one hand, at the growing digitization that is felt in regular university education (largely a result of the pandemic period we have just experienced) and, conversely, at a broad set of global challenges, as is the case

of ecological crises, which require sweeping changes in university teaching, with a more effective interaction between the natural, human, and digital, the authors emphasize that this interaction requires an action that goes beyond the digital transition. More specifically, the need to rethink the way we think about the university, the role of teachers, as well as their skills to use digital technologies is highlighted here. Based on examples of ecopedagogies and pedagogies of care and self-care, the authors emphasize that in the current context, teaching requires a greater capacity to embrace different forms of knowledge, as well as a collective awareness about the way digital and human practices are in deep interaction, within and across the different levels (macro, meso, and micro) of the educational ecosystem, namely, global developments, local teacher practices, and daily activities. This results in the need to move from a perspective centered on the person/teacher to a more holistic and ecological one, as well as overcoming a more functionalist view of the role of professors and promoting a more active involvement, leading to a more sustainable and future-oriented university.

In an ongoing quest for sustainable education, the OECD [78] and Tripon [79], focusing their attention on the growing challenges arising from digitalization, give particular attention to the figure of the teacher of the future. According to them, teachers, by developing students' digital and computational skills, play a fundamental role in their learning processes. These new ways and techniques of learning, based on a sustainable education and conducive to the acquisition of new competences and skills, contribute to the construction of more qualified individuals, capable of more efficiently and effectively contributing to the achievement of the desired levels of sustainable development.

No less important is the students' perception of education for sustainability, as mentioned in the article by Zeegers and Clark [80]. In this research, the authors studied a course that focused on raising students' awareness of sustainability from a balanced perspective, i.e., whether equal attention was paid to social and economic aspects as well as the environment. The results of this study revealed that, initially, students had a more environmental view of sustainability. Despite the study encouraging discussion, debate, and balanced reflection on sustainability, many of the students still focused on the environmental perspective of sustainability. The results show the need for a change in the students' perception of the theme of sustainability.

Providing students with a set of key skills that allow them to make decisions in an assertive and thoughtful way is a reality that is increasingly perceived nowadays, and that takes on particular emphasis in the socio-scientific context of sustainable development, where decision making is critical for processing information and implementing sustainable actions. Due to the multidisciplinary and informal structure they assume, extracurricular activities in promoting education for sustainable development constitute an important lever for promoting decision making. Aware of this potential, Garrecht, Bruckermann, and Harms [81] developed a study based on a literature review that sought to analyze different empirical studies focused on students' decision making in extracurricular activities aimed at education for sustainable development. The authors concluded that, in empirical terms, there is hardly any research where the interaction between students' decision making, extracurricular activities, and education for sustainable development is studied, considering these three aspects in the same proportion. On the contrary, what is observed is that, as a rule, each of these aspects is analyzed individually, keeping the others as a backdrop. That is, contrary to the development of studies that make it possible to explore the potential underlying the interrelation that can be felt between those three aspects, the results obtained are more conducive to the existence of studies that are fundamentally focused on decision making, understood as a competence that can be measured in quantitative terms.

Considering that in the post-pandemic era, studies on the perception of higher education students regarding sustainable development in Pakistan have not been implemented, Aslam et al. [82] developed a study that would contribute to a better understanding of how to elevate sustainable development in Pakistani HEIs, highlighting students' perceptions of the involvement of their educational institutions in promoting Sustainable Development

Goals and Sustainable Development. Providing relevant contributions in terms of students' perceptions and behaviors regarding sustainable development, as well as the way Pakistani HEIs face this issue, the authors come to the conclusion that the vast majority of students support their HEIs by actively incorporating and promoting sustainable development, particularly in terms of its training programs. Moreover, most students are of the opinion that their HEIs should make greater efforts to ensure that their students acquire more skills and abilities oriented towards sustainable development.

2.3. Curricula Transformation

The contribution of the reform of the curricula of undergraduate and graduate courses is an aspect that can be decisive in teaching the concepts of sustainability.

Shephard [83] sought in his work to interpret the issues of education for sustainability and its relationship with educational theories of the affective domain (values, attitudes, and behaviors). He suggests that using these theories and relevant experience in other teaching areas could benefit sustainability education. This work further suggests that most teaching and evaluation in higher education focuses on the cognitive skills of knowing and understanding rather than on the affective outcomes of values, attitudes, and behaviors. It also helps educators reflect on how to use these new approaches within the liberal traditions of higher education.

Desha et al. [84] in their work showed how engineering departments can undertake rapid curricula reform in relation to education for sustainability. They begin by noting that HEIs face some time difficulties in incorporating new knowledge and skills into curricula because they are not keeping up with industry and regulatory bodies. According to the authors, if strategically implemented, the curricula renewal process can help address risk exposure from likely and imminent changes in industry and regulatory bodies.

Watson et al. [85] presented a study on the incorporation of sustainability in the curricula of engineering courses at the Georgia Institute of Technology (USA). They report that there has been a considerable increase in the number of engineering schools in HEIs that have integrated the topic of sustainability into their teaching. However, curricula reforms are still needed to more effectively educate engineers regarding the implications that the work they develop has on the environment and society, not only for the current generation but also for future ones. An important aspect is assessing the contribution of engineering curricula to sustainability. This work presents the results of the evaluation of the sustainability content of civil engineering curricula. The results of the curricula evaluation indicated that the course mainly addressed environmental issues. The results also made it possible to detect divergencies between the sustainability content in the curricula and the teaching of sustainability in the classroom. This study can contribute to promoting educational changes by guiding university leaders in the elaboration of curricular reforms to encourage sustainability learning and thus providing students with opportunities to reflect on the subject.

Green [86] studied the integration of sustainability in three introductory economics courses at three universities in Canada: the University of British Columbia, Simon Fraser University, and the University of Victoria. Interviews were conducted with 54 students who had completed an introductory level of the economics course. Students reported that the course placed little emphasis on the environment and sustainability and did not contribute substantially to increasing students' understanding of sustainability and the link between the environment and the economy. The results suggested that the economics curriculum weakened the sustainability commitments assumed by these universities.

Stubbs [87] presented a study on the effect of introducing the business-sustainability relationship in graduate education curricula. The objective of this work is to present a pedagogical approach to the design of a course curriculum that aims to meet the growing need for qualified professionals with skills in business and sustainability. The work uses a pedagogical approach that allows developing students' knowledge, skills, and attitudes (behaviors) in sustainability. Knowledge of attitudinal skills appears to be an appropri-

ate pedagogical approach to guide the design of sustainability management education programs that prepare students for systemic organizational change.

Sidiropoulos [15] analyzed sustainability education in business education programs at a university in Australia, Central Queensland University. This work states that sustainability is a concept that should include individual, organizational, and community perspectives. The author outlines a pedagogy to integrate the concept of sustainability into business courses. Practical examples are presented for economics and marketing courses that show different possibilities for integrating sustainability using educational practices that vary from gradual integration (discussion of the topic) to an introductory course on sustainability or to seminars with the aim of greater integration of sustainability in the course curricula. The students' opinions showing the impact of these interventions, attitudes, and behaviors on sustainability are also discussed.

Highlighting that the introduction of issues related to sustainable development in HEI curricula has become increasingly relevant, Lozano, Barreiro-Gen, Lozano, and Sammalisto [88] are of the opinion that despite the focus given to skills for sustainable development and the pedagogical approaches used, there are still very limited studies that seek to assess the relationship established between the way in which these pedagogical approaches are used and the way in which they can develop skills for sustainability. In this sense, and based on the relationship between these two variables, the authors developed a study with a view to investigating how sustainability is being taught, which skills are developed, as well as the pedagogical approaches used in European HEIs. The results obtained allowed us to conclude that, despite the social dimension being the least considered, the economic, environmental, and cross-cutting dimensions assume, among themselves, a very similar attention. Looking in particular at the objectives of the study, the correlation analyses carried out led to the conclusion that there is a relationship between the contribution to sustainability and the strength of competences, and between this latter and the strength of pedagogical approaches. With this research, the authors have contributed to a more realistic picture of how pedagogical approaches are being used to develop sustainability competences. Emphasizing the need to carry out a combination of pedagogical approaches, it is emphasized here that traditional pedagogical approaches, such as lectures and case studies, need to be reviewed and renewed to more effectively develop skills and, in general, sustainability education; at the same time, it is also possible to generate capacities to relate the pedagogical approaches with more potential to the appropriate competences.

Sidiropoulos [89], aware that education for sustainability still remains outside of conventional curricula and is promoted in an ad hoc way, sought to investigate its influence on the vision, knowledge, behavior, and agency of university students to contribute to transitions to sustainability. Focusing on students' personal context, teaching context, and learning outcomes, the author concluded that "key transversal findings are resistance to SE, converging views and attitudes towards an "anthropocentric environmentalist" perspective, limited empowerment and occasional disempowerment from SE, a focus on personal behavior change rather than professional action/agency, and a limited incidence of wider agency" (p. 1). The author also observes that the ad hoc approach to education for sustainability in higher education is ineffective in creating generalized agents of change. Reinforcing the role that HEIs assume as key elements in promoting transformations towards sustainability, the author emphasizes that "a strategic and systematic effort in SE is required to emphasize the importance of sustainability (to motivate students to engage with the challenging concept of holistic sustainability), to ground/anchor their learning experiences by connecting to meaningful/relevant situations in their lifeworld, and to scaffold the development of their sustainability competencies from each learning experience." (p. 28).

As sustainability in education, curriculum, research, extension, and campus operations are key issues that focus the attention of HEIs, Gomes, Brasileiro, and Caeiro [90] were aware of their importance and, with the central objective of analyzing the level of implementation of sustainability in higher education in the Amazon, developed a study

in which they sought to identify the characteristics of the greening curriculum in institutional development plans as well as analyze the perceptions of sustainability on the part of students in an HEI in the Amazon. Having the students of this institution as the target population of the study, the results obtained led them to notice the presence of some characteristics of the greening curriculum in institutional documents, with the result that the engagement to sustainability cannot be just a declaration of good intentions. Quite the contrary, it is of critical importance to discuss how sustainability is implemented in the academy since the need to implement changes in epistemological, political, and social conceptions is underlying.

2.4. Sustainable Campus

On a sustainable university campus, management is planned so that all stakeholders develop sustainable and responsible actions with the environment, seeking a balanced occupation, namely:

- Reduction of water, energy, and paper consumption;
- Use of renewable energies;
- Recycling and reduction of emission of toxic substances;
- Sustainable buildings and green infrastructure;
- Landscaping plans and green areas.

White [91] analyzes different ways of teaching environmental planning, with particular emphasis on campus sustainability and its planning process. It describes the development of an urban planning course focused on campus planning and environmental impact. A campus-based environmental planning course allows students to investigate sustainability issues from their perspective. If the teacher/monitor chooses an active learning approach, students can also develop valuable skills, namely data collection and environmental analysis. Campuses are not immobile; their planning is always ongoing. For this reason, campus environmental planning issues are of utmost importance for the future.

Alshuwaikhat and Abubakar [92] refer in their work that universities can nowadays be considered "small cities", due to their size, population, and the various activities that take place on campus, which naturally imply a serious impact on the environment. The pollution and environmental deterioration caused by universities (the energy expenditure and material consumption for teaching and research and the provision of services) can be considerably reduced through smart organization. A more systematic and sustainable approach to reducing the negative impacts of these activities leads to a more sustainable campus. This work proposes a suitable approach to achieving sustainability on campus through the integration of three strategies: an environmental management system, public participation and social responsibility, and the inclusion of sustainability in teaching and research.

Finlay and Massey [93] argue in their work that the "Richard Register's Ecocity" model provides a strategic framework to facilitate sustainability initiatives in US HEIs. This conceptual work studies the implications of proposed construction strategies for universities and colleges as institutions seeking to create more sustainable campuses—"Eco-campus". This model proactively addresses the "ecological footprint" of HEIs and allows for the development of sustainable community practices. Sustainability is a subject of research and teaching, and institutions in the US are faced with the challenge of reorienting institutional practices, processes, and resources to constitute full sustainability on campus.

Posner and Stuart [94] refer in their work that the university campus behaves as a complex system. Sustainability in higher education can be understood as an emerging aspect resulting from synergies that are established both within the institution and between it and the social and environmental context in which it operates. This approach identifies leverage points for actions aimed at improving sustainability on campus. Whether through specific ways of thinking or an organizational culture characterized by continuous improvement and business learning based on environmental and social principles, the institution will

benefit. Systemic thinking should develop the ability to rethink and work with current systems and, from these, plan and coordinate sustainability programs.

White [95] in her article describes and analyzes sustainability plans in higher education institutions in the USA. In this study, 27 campus sustainability plans are analyzed, concluding that they are immensely diverse. In these plans, environmental issues are the most evident, contrary to social equity issues perceived as less considered. Sustainability plans are an emerging tool for campus sustainability efforts and help colleges and universities analyze operational, academic, and administrative functions in an integrated way.

Too and Bajracharya [96], in their study, identified the main factors for involving the community in the construction of a sustainable campus. In general, awareness of sustainability issues has improved in recent years. However, this knowledge does not always materialize into real, sustainable practice. Two case studies were carried out to enhance the importance of factors that influence the level of community participation in sustainability programs. Community involvement considers factors such as physical facilities, personal motivations, pricing mechanisms, and policies. Research on behavior change has been undertaken in diverse courses such as urban planning, marketing, and psychology, but generally in isolation. The originality of this work is based on gathering knowledge from different disciplines. This framework has the potential to assist university administrators/managers in developing their community commitment strategy to mobilize and encourage their members to take effective action towards sustainable campus construction.

As the achievement of sustainable development is one of the biggest challenges of today, among its different promoters, HEIs are understood as one of the most relevant vehicles for its achievement, namely through their campus infrastructure and operations. Aware of this problem, Razman, Abdullah, and Wahid [97] are of the opinion that if it is true that some HEIs develop various green programs and initiatives, there is still no effective exploration of current campus sustainability practices. In order to overcome this gap, the authors developed a study in which they sought to analyze the current areas of focus and the common measures implemented by some of the main HEIs worldwide towards sustainable campus operation. Focusing on the particular case of HEIs in Malaysia, with this study, the authors seek to contribute so that these institutions, namely in their administrative dimension, are able to develop sustainable campus plans and structures in response to the United Nations Decade of Education for Sustainable Development.

Dawodu, Dai, Zou, Zhou, Lian, Oladejo, and Osebor [98] are of the opinion that despite the various studies that focus on the definition of assessment tools, so far no comprehensive study has researched the potential lags from the new campus sustainability assessment tools, as well as the sustainability initiatives on the campus as a whole. At the same time, to assess the sustainability of HEI campuses, indicator-based assessment continues to be seen as the most appropriate method. However, there is not yet an indicator-based assessment tool to assess sustainability on campus or an exhaustive set of indicators focusing specifically on various sustainability issues that are universally recognized. The existing literature, which focuses on the study of these indicators and/or tools, only covers some of the elements related to sustainability, not investigating the globality of potential problems on campuses. Being that the studies that focus on the existing gaps in terms of sustainability on campuses, through evaluation tools, still very limited, the authors, through a bibliometric analysis, analyzed more than 2000 articles about sustainability on campuses and tools for assessment in order to identify gaps, tendencies, and the main area of sustainability on campus through the campus sustainability assessment tools. The interest of this study is based on the possibility of highlighting the common campus sustainability issues and associated sustainability indicators, as well as their impacts, relevance, or absence, and how sustainability on campus is obtained. The authors also emphasize that from these results, it will be possible to develop new tools for assessing sustainability on campus and sustainability initiatives on campus as a whole.

2.5. Some Sustainability Studies in Several Universities

Over the last few years, education for sustainability has become a topic on the agenda of a large number of universities of international prestige in different countries of the world. Let us look at some of the main studies published in the international scientific literature.

Juárez-Nájera et al. [99] studied a new academic and professional culture through sustainability in Mexican higher education. According to these authors, education for sustainability cannot follow the usual path because much of what students learned in their former training does not fit into the sustainability paradigm. Thus, education for sustainability must consider a partial "re-education" of students. The study presented took place at the Universidad Autónoma Metropolitana, Unidad Azcapotzalco (UAM-A) and included the implementation of an environmental plan for the entire university. This study was supported by the National Association of Universities of Mexico, fitting in very well with the decade of education for sustainable development that began in January 2005. The results of the study made it possible to start a new course entitled "Environmental challenges", created in the Division of Basic Sciences and Engineering at UAM-A.

Stephen et al. [100] carried out an interesting study on higher education as an agent of change for sustainability in different cultures and contexts. The authors point out that society faces unprecedented challenges associated with environmental change, a shortage of resources, increasing inequality and injustice, as well as fast technological changes that provide new opportunities for higher education. The study identifies five critical issues to be considered, which include specific regional sustainability challenges, the funding structure, institutional organization, communication, and interaction with society. Bearing in mind the challenges and opportunities for education in higher education, as an agent of change, the synthesis and integration of common themes prove to be a valuable contribution.

Ferrer-Balas et al. [101] carried out an international comparative analysis of the transformation towards sustainability in seven universities: Universitat Politècnica Catalunya (Spain), TERI University (India), Carnegie Mellon University (USA), University of Tokyo (Japan), Kyoto University (Japan), Hokkaido University (Japan), and Linkoping University (Sweden). The objective of this work was to identify the main issues in the metamorphosis of universities towards sustainability, namely the ideal characteristics of a "sustainable university". The study showed that the main obstacle to overcome is the absence of incentives to promote changes at the individual level. The main factors for change are the link with society, the existence of coordination bodies and projects, as well as the availability of funding. Reinforcing interdisciplinarity is a strategic objective for almost all of these universities. Another common characteristic is to create and support networks of competences within universities.

Correia et al. [102] showed the relevance of scientific literacy in promoting education for sustainability in university education in Brazil. Scientific literacy can be considered a new tool in post-industrial society. According to these authors, it is important to promote education for sustainability throughout students' academic careers. This new integrative, inter-, and transdisciplinary epistemological approach is necessary to encourage autonomous citizenship, that is, that each citizen is prepared to understand and participate in discussions about the complex issues posed by post-industrial society. This work shows the role of scientific literacy in promoting education for sustainability.

Nomura and Abe [103] analyzed higher education policies and progress towards sustainability in Japan. The analysis suggests that the promotion and development of leadership for sustainability among members of the university administration is fundamental to continuing and intensifying efforts in this area in higher education. This study states that environmental education and awareness are well developed in Japan, but higher education as a broader field of education for sustainability is still not sufficiently investigated and documented.

Ryan et al. [104] studied the developments, challenges, and perspectives of education for sustainability in university education in the Asia-Pacific region. This region offers many creative initiatives and shows considerable progress in the field of education for

sustainability. At the same time, it reflects global trends where more work is needed to drive systemic change, notably in terms of strategically integrating sustainability into HEIs.

Su and Chang [105] described in their paper the context of national policy and other initiatives to support education for sustainability in higher education in Taiwan. The government initiated and funded a national project linking education and practice for sustainability. It was hoped that the execution of this project could serve as an example to promote the practice of sustainability and education in different national and social contexts. The level of voluntary participation suggested that targeted funding for sustainability practices could be an extremely effective vehicle for promoting sustainability in higher education.

López [106] presented a work that took place at Texas State University (USA) on the creation of a community and "sustainable university". The experience is a pedagogical innovation designed to promote a common campus-wide intellectual conversation, enhance student participation in the intellectual life of the campus, and encourage a sense of community. The experience inspires people on campus and in the community to change behavior and social policy, build scientific understanding, relate to environmental issues, and revise values (a critical component of education for sustainability).

Bilodeau et al. [107] refer in their work that universities can play a leading role in developing and mobilizing knowledge in order to meet society's needs. In fulfilling their mission, universities can also play a role as agents of sustainable development on campus and in the communities in which they operate. This article summarizes the experience of the University of British Columbia (Okanagan campus, Canada) in developing sustainability initiatives and partnerships for greater operational efficiency, cost reduction, environmental management, and applied research. University leadership commitment to sustainability, economic opportunities, and legislative requirements are among the topics covered. This work provides an innovative partnership framework to support the sustainable development of communities. Sustainability in higher education can contribute to the development of initiatives and partnerships that benefit institutions and communities, thus contributing to achieve sustainability. This article provides relevant information that can be used by HEIs to promote sustainability within current economic conditions and societal needs. The experience and partnership framework presented in this article provides tools to engage students, teachers, and the community in sustainable development.

Vagnoni and Cavicchi [108] presented a paper on the current state of implementation of sustainability practices in the context of Italian public universities. They used a qualitative approach for the exploratory study by collecting data from the official websites and other related websites of Italian universities. The results of this exploratory study show that many universities are betting on a strong commitment to the challenge of sustainability. The study contributes to the sustainability debate and may have implications for policy makers and borrowing universities. According to the authors, the study enhances the relevance of managing the sustainability process at the university in all its phases (planning, monitoring activities, and new actions) and highlights the issues that are relevant to measuring and monitoring the sustainability implementation process in the specific field of higher education. The work can also contribute to raising academic awareness of sustainability actions.

Seeking to highlight the best that has been worked on in the area of higher education sustainability, Davim [109] and Davim and Leal Filho [110], in the books they edited, brought together the contributions given by different authors with regard to the incorporation of sustainability in higher education. Due to the social, environmental, and economic issues of sustainability discussed here, these books present several examples of how sustainability in higher education has been implemented in different countries. In particular, and among others, the cases of the USA, Mexico, the UK, Portugal, Brazil, Kosovo, and Canada are presented here.

Aware of the importance that the tools used to assess sustainability levels have come to assume, as influencers of sustainability strategies and activities in higher education

institutions, Berzosa, Bernaldo, and Fernández-Sanchez [111] sought to develop a study on the different approaches that exist to assess this issue. Based on the specific case of the Universidad Europea de Madrid (UEM), the authors, seeking to identify the different tools that are used, developed a sustainability diagnosis, advancing with a proposal to analyze the results for the creation of an action plan based on cost–benefit measures. Their conclusions point to the fact that increasing the sustainability of universities does not necessarily imply high costs. Quite the contrary. That is, given the priority to increase sustainability in universities, the results of the study developed by these authors led to the conclusion that, without major financial efforts, it is possible to achieve significant improvements in sustainability simply by assessing and planning the sustainability issues in accordance with each sustainability assessment tool and prioritizing these measures to achieve a more sustainable university.

Mawonde and Togo [112], through a case study at the University of South Africa, sought to demonstrate the key role that universities have in the implementation of the Sustainable Development Goals. As there is not much guidance available on how universities can contribute to the implementation of the SDGs, their ability to respond more effectively to social challenges through research and innovation is highlighted here. Seeking the university under study to involve students in its projects, the results obtained allowed to identify a set of practices that are aligned with the objectives of sustainable development in teaching, research, community involvement, and management of campus operations.

Presenting, from the contributions of multiple authors, a wide range of experiences that have been implemented by different universities in different countries, as is the case, among others, in South Africa, Latin America, Mexico, Bulgaria, Spain, Greece, Croatia, Portugal, and India, Azeiteiro and Davim [113], focusing on higher education sustainability, sought to present the opportunities and challenges to achieve the sustainable development goals. Specifically, with this book, the authors, highlighting the role that HEIs have been assuming in promoting sustainability and the variety of initiatives showing how SDGs are being implemented, looked, based on the different contributions that make up the book, to disseminate knowledge and international research and cooperation in the field of higher education sustainability.

With a particular focus on southern countries, Arocena and Sutz [114] sought to analyze how universities can contribute to social innovation. Emphasizing that universities need to play a leading role, the authors seek to analyze the context in which these institutions operate, considering the conceptualization of the National Systems of Innovation. The role that universities can play as agents of social innovation is discussed here. To this end, and resorting in particular to the specific case of a Latin American university (the University of the Republic in Uruguay), the importance of the experience of the South in innovating in a context of scarcity is reinforced here. The authors concluded that the cooperation of universities with weak social actors involving advanced knowledge is shown to be a fundamental theoretical issue but, at the same time, a difficult practical problem for a true engagement of universities with regard to social innovation. With this research, the authors seek to highlight the importance that social innovation assumes as a link between popular collective actors and advanced knowledge, understood as the main barrier to the engagement of universities as actors that promote sustainability and equality.

Focusing on reports from European higher education institutions, organized according to the most recent standards of the Global Reporting Initiative (GRI), Amiano Bonatxea, Gutiérrez-Goiria, Vazquez-De Francisco, and Sianes [115] developed a comparative study with a view to analyzing the relevance of activities promoting university social responsibility, considering the respective specificities of HEIs. Specifically, with this study, the authors sought to carry out a comparative analysis in order to better understand the extent to which the GRI standards are or are not corresponding to the information needs generated in the field of higher education. If, in relation to general issues transversal to all institutions, it is observed that they are all duly reported by the HEIs, the results obtained allow us to conclude that there are still many difficulties encountered with regard to the integration of

a vision that incorporates the role of the mission of these institutions in standards related to economic, social, and environmental issues.

Machado and Davim [116] present different contributions related to advances in higher education for sustainable development goals. Considering the HEIs as a lever of excellence for the achievement of SDGs, through their critical role in human training, knowledge generation, and innovation and development, this work, resulting from the contributions and experiences provided by a group of authors from different nationalities, intends to contribute to and increase the debate on the role of HEIs in the creation and dissemination of knowledge about sustainability and SDGs. Among others, studies on countries such as the USA, Portugal, and Brazil are presented here.

Aware of the importance that HEIs have assumed over the last few years as promoters of sustainability, Machado and Davim [117] developed a study, based on a bibliometric analysis and with information taken from the Scopus Database, in which they intended to analyze the issue of sustainability in higher education. More specifically, these authors analyzed which main studies have been developed, which are the main countries and institutions where these issues have been investigated the most, as well as which main researchers have been working on this problem. From the analysis carried out, and answering the questions posed, the authors highlight that the number of publications in this field of research has seen a significant increase over the last few years, which reinforces the critical role that higher education for sustainability has been taking over.

Looking at the specific case of Portugal, these same authors [118,119], gathering the contributions given by different Portuguese researchers, portray the investigations and experiences that, in terms of higher education sustainability, have been developed in this country. Specifically, among others, issues related to the Portuguese sustainable campus network, global academic rankings as a challenge or a chance for Portuguese HEIs, guiding principles for sustainability strategies, sustainability as a cultural transformation and a student motivation and well-being, SDGs in higher education, as well as a glimpse of what has been studied and published in the field of higher education for sustainability in Portugal, are highlighted here.

2.6. Sustainability Metrics in Higher Education

More recently, there has been great interest in standardizing the assessment and measurement of sustainability in HEIs. The process, beyond the environmental assessment, also includes economic aspects and social performance. However, there is a growing trend to try to compare the sustainability performance of HEIs above all the environmental aspects. Making comparisons among individual institutions in different countries and climates is always very difficult. For example, an institution located in the hot and dry climate of North Africa will always be quite different with regard to the environment than one located in Northern Europe [59].

In order to standardize the assessment and measurement of sustainability, there are at least four sustainability indicators that deserve to be highlighted for their use and timeliness, the LiFE (Learning in Future Environments) of the EAUC (UK) which aims to help universities to manage, measure, improve and promote their social responsibility and their sustainability performance; the AASHE (USA) STARTS (Sustainability Tracking, Assessment and Rating System) which also transparently helps universities to measure their sustainability performance; the THE, Times Higher Education Impact Rankings, which, based on research, stewardship, outreach and teaching, measures the contribution of HEIs to the SDGs; and the GreenMetric World Universities Rankings, more focused on campus sustainability, focusing its assessment on three areas, namely, environment, economy and equity [120].

The indicators just mentioned help with comparisons between institutions. LiFE can help publicly promote success both nationally and internationally; STARTS can help an institution gain recognition for leadership in sustainability; the THE Impact Rankings provide a broad view of the contribution of HEIs based on each of the SDGs; and finally,

the GreenMetric World Universities, which focuses more on sustainability issues and their teaching in a more targeted way.

Sustainability indicators can draw attention to a wide range of measures of institutional performance. Although there is an interest in having an institution participate in these rating systems, there is always the risk of it becoming just another institutional feature. It is not yet clear that such indicators allow for advancing the understanding of what sustainability means [59].

From all of the above, and in summary, it follows that in order to enhance the role of sustainability in the modernization of higher education, it is essential to combine and interact with all the dimensions discussed throughout the literature review carried out (Figure 6).
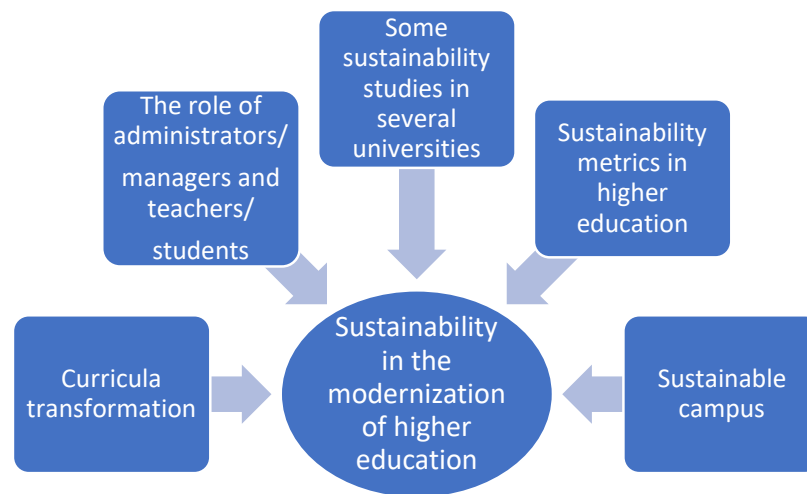
Figure 6. Dynamic role of the dimensions under analysis in relation to sustainability in the modernization of higher education. Own elaboration.

Indeed, although its isolated implementation is already a contribution to the implementation of sustainability practices in higher education, when interconnected, the underlying modernization potential acquires greater evidence, positively impacting the critical role that these educational institutions assume in a society that intends not only to be able to meet the needs of the present but above all to be committed to the creation and transmission of knowledge, skills, and abilities that will allow future generations to meet their own needs.

3. Conclusions

Sustainability is a relatively recent concept that has evolved over time and mainly combines environmental, social, and economic dimensions. The primary emphasis of this concept is placed on the environment. The United Nations has been the driving force behind the dissemination and implementation of the concept through the systematic organization of the most important international conferences. The last and largest conference, Rio +20 (UNCSD—United Nations Conference on Sustainable Development), took place in 2012, already in the midst of the financial crisis, and enabled the establishment of guidelines for economic growth, social justice, and environmental respect, meeting the result embodied in the document "The future we want". Subsequently, in September 2015, at the United Nations headquarters, at the Post-2015 Sustainable Development Summit, 193 world leaders agreed on a new agenda for the next 15 years, called the 2030 Agenda, which includes the 17 goals of sustainable development (ODS).

The science of sustainability emerged at the turn of the millennium, and we can say that it is a transdisciplinary science that is dedicated to investigating the relationships between natural and human systems and how these systems can be changed in a sustainable way. Sustainability science and sustainability education, which is an emerging field

within the educational sciences, constitute the scientific basis for sustainability education in higher education.

The association of HEIs around sustainability is a fait accompli, substantiated by the numerous associations that are organized and working. Scientific research around education for sustainability has grown strongly, especially since the turn of the millennium, with particular focus from 2015 to the present, as evidenced by the growing number of scientific articles and citations obtained from the most renowned science database, Web of ScienceTM (Thomson & Reuters©).

University administrators and managers point out, among other aspects, the scarcity of financial resources and resistance to change as the main difficulties for the implementation of sustainability at the university. Even with these limitations, university hierarchies must assume the needs of practices, processes, and resources for the environmental management of universities towards sustainability. Faculty leadership is very important, not only with regard to the environment but also to social entrepreneurship. The involvement of students is also of paramount importance for the implementation of sustainability at the university.

Studies carried out on the curricula of engineering and management courses show that the subject of sustainability, especially with an emphasis on the environment, has been carried out not only in curricular units but also through introductory courses or seminars. Sometimes, non-traditional forms of learning can prepare students for systemic organizational change quite effectively.

Universities can be seen as "small cities" due to their size, their population, and the various activities that take place on campus, which can have a negative environmental impact. To reduce this impact, the concept of a sustainable campus emerged. It is a complex system with interactions not only within the institution but also between the institution itself and the environmental and social contexts in which it operates. The sustainability plan tool proves to be of great interest in integrating all efforts aimed at sustainability on campus.

Education for sustainability is a topic on the agenda of a large number of higher education institutions in different parts of the world. From universities in the most industrialized and economically developed countries in the world (known as the G7) to the economically developing BRICS countries, education for sustainability is being considered a tool of crucial importance in the current decade of the 21st century.

Having presented the main conclusions arising from the different dimensions studied, it is important to highlight the main strengths of this study based on the fact that it is an important tool not only for practitioners and researchers who study sustainability in higher education but also for all those curious about this knowledge area. More specifically, being an in-depth literature review that aims to analyze and discuss the main milestones of sustainability in higher education, the main studies and authors who have been working in this field of research are highlighted here, thus contributing not only to increasing our knowledge but also to serving as a support and reference source for further studies.

Furthermore, for the practice of HEIs, this study is an important tool in alerting institutional leaders to the most relevant dimensions to work on with a view to promoting sustainability in the modernization of higher education.

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