Management and Industrial Engineering

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Higher Education for Sustainability

The Portuguese Case

Springer

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Preface

Higher Education Institutions (HEIs) are progressively asked to develop practices leading to adequate levels of sustainability. As entities where the dissemination and acquisition of knowledge, leading to the training of competent professionals, possessing the competences, skills, and knowledge necessary for the effective performance of the different functions performed in organizations, HEIs, at their different levels of education, are understood as key elements in the promotion of education for sustainability.

Indeed, the higher education sector assumes a critical role not only because it is seen as an important promoter of sustainability, but the different stakeholders expect it to also assume itself as a sustainable organization. The growing need to promote an effective knowledge and internalization of the goals of sustainable development in the construction of professional people of the future, leads these higher education institutions, to progressively integrate the different dimensions of sustainable development (economic, social, environmental, political, cultural, as well as institutional and educational) not only in their teaching programs, but also in their research and development activities, as well as in the operationalization of academic life that is increasingly felt on the respective university campuses. Higher education for sustainability presupposes the development of new forms of teaching, promoting more active learning, working as a team, using experimentation and consequent contribution to solving problems not only locally, but also globally. In other words, here we have the need to promote new ways of thinking and acting at the level of higher education capable of promoting the acquisition of a knowledge of knowing, knowing how to be, and knowing how to do that allow the training and education of more socially responsible professionals and promoters of a more sustainable society.

However, despite the concerns that issues associated with sustainability and sustainable development have been assuming in terms of higher education, what is the reality that is felt in terms of higher education for sustainability in the Portuguese context? In what concerns this issue, and although the number of studies that we have been observed in the field of higher education for sustainability around the world, the reality is that in what concerns Portugal, we don't have a global information

about the type of studies that have been developed in terms of higher education for sustainability.

Conscious of this reality, with this book, entitled *Higher education for sustainability: the Portuguese case*, we look to present the work that different educational institutions, with particular emphasis on higher education institutions, have been developing in order to contribute to a type of teaching that enhances sustainability, as well as to understand the role that these organizations are playing in order to foster sustainability in their governance, teaching methods and social life inside and outside the campus.

To this end, different experts from different higher educational institutions were invited who, throughout the various chapters that constitute this book, report on the strategies, models, and practices that these institutions have been developing in order to train graduates with greater awareness and sensitivity to the practices of sustainability and sustainable development of the organizations for which they will work, but also what types of actions have been implemented by higher education institutions with a view to becoming more sustainable.

Organized in eight chapters, *Higher Education for Sustainability: The Portuguese case* begins to present "The Portuguese Sustainable Campus Network: A Knowledge Collaboration for Sustainability Transformation in Higher Education Institutions"; following the discussion about "Global Academic Rankings. A Challenge or a Chance to Portuguese Higher Education Institutions". The focus then, goes to "UMinho's Seven Guiding Principles for Sustainability Strategies—*A Critical Assessment*"; to "Sustainability at the University of Madeira: A Cultural Transformation"; dealing then with "Sustainability and Student Motivation: Does the Campus Matter?". Then we speak about "Sustaining the Well-Being of University Students: The Role of Expectations on the Usefulness of Education"; as well as "The Contribution of Social Sciences and Arts to the Sustainable Development Goals in Higher Education". Finally, this book looks to discuss about "Higher Education for Sustainability in Portugal: A Glimpse About What Has Been Studied and Published".

Higher Education for Sustainability: the Portuguese case can be used by a variety of potential stakeholders, including academics/researchers, managers, engineers, practitioners, and other professionals in the different areas of business and management. Students from different undergraduate/graduate levels (undergraduate, masters, and doctoral/Ph.Ds), from the areas of management and industrial engineering, are also potential stakeholders in this book, who need to understand what contributions the area of higher education has been providing with a view to training professionals with the knowledge necessary to build more sustainable organizations, as well as a more sustainable society.

Thanks to the contribution of these different authors, this book contributes to stimulate the growth and development of each individual in a dynamic, competitive, global, and sustainable economy.

The Editors acknowledge their gratitude to Springer for this opportunity and for their professional support. Finally, we would like to thank all chapter authors for their interest and availability to work on this project.

Braga, Portugal
Aveiro, Portugal

Carolina Machado
J. Paulo Davim

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Carolina Machado received her Ph.D. degree in Management Sciences (Organizational and Policies Management area/Human Resources Management) from the University of Minho in 1999, Master degree in Management (Strategic Human Resource Management) from Technical University of Lisbon in 1994, and Degree in Business Administration from University of Minho in 1989. Teaching in the Human Resources Management subjects since 1989 at University of Minho, she is since 2004 Associated Professor (with Habilitation since May 2022), with experience and research interest areas in the field of Human Resource Management, International Human Resource Management, Human Resource Management in SMEs, Training and Development, Emotional Intelligence, Management Change, Sustainability and Higher Education for Sustainability, Knowledge Management and Management/HRM in the Digital Age/Business Analytics. She is Head of the Human Resources Management Work Group at the School of Economics and Management at University of Minho, Coordinator of Advanced Training Courses at the Interdisciplinary Centre of Social Sciences, Member of the Interdisciplinary Centre of Social Sciences (CICS.NOVA.UMinho), University of Minho, as well as Chief Editor of the International Journal of Applied Management Sciences and Engineering (IJAMSE), Guest Editor of journals, books Editor and book Series Editor, as well as reviewer in different international prestigious journals. In addition, she has also published both as editor/co-editor and as author/co-author several books, book chapters and articles in journals and conferences.

J. Paulo Davim is a Full Professor at the University of Aveiro, Portugal. He is also distinguished as honorary professor in several universities/colleges/institutes in China, India, and Spain. He received his Ph.D. degree in Mechanical Engineering in 1997, M.Sc. degree in Mechanical Engineering (materials and manufacturing processes) in 1991, Mechanical Engineering degree (5 years) in 1986, from the

University of Porto (FEUP), the Aggregate title (Full Habilitation) from the University of Coimbra in 2005 and the D.Sc. (Higher Doctorate) from London Metropolitan University in 2013. He is Senior Chartered Engineer by the Portuguese Institution of Engineers with an MBA and Specialist titles in Engineering and Industrial Management as well as in Metrology. He is also Eur Ing by FEANI-Brussels and Fellow (FIET) of IET-London. He has more than 35 years of teaching and research experience in Manufacturing, Materials, Mechanical, and Industrial Engineering, with special emphasis in Machining & Tribology. He has also interest in Management, Engineering Education, and Higher Education for Sustainability. He has guided large numbers of postdoc, Ph.D. and master's students as well as has coordinated and participated in several financed research projects. He has received several scientific awards and honors. He has worked as evaluator of projects for ERC-European Research Council and other international research agencies as well as examiner of Ph.D. thesis for many universities in different countries. He is the Editor in Chief of several international journals, Guest Editor of journals, books Editor, book Series Editor, and Scientific Advisory for many international journals and conferences. He has been listed in World's Top 2% Scientists by Stanford University study.

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The Portuguese Sustainable Campus Network: A Knowledge Collaboration for Sustainability Transformation in Higher Education Institutions

Manuel Barros, Sandra Caeiro, Antje Disterheft, Ana Carla Madeira, Vitor Manteigas, António Gomes Martins, Margarida Ribau Teixeira, and Aldina M. Soares

Abstract Networks are an important mechanism for systemic change towards sustainability in higher education institutions. In Portugal there is no formal law or regulation at governmental level pressuring for this change. Also, there was a need for action and a lack of collaboration between the Portuguese higher education community to allow an advanced sustainability implementation in higher education institutions. This chapter presents the activities that the Portuguese Network Sustainable Campus—Rede Campus Sustentável (RCS) has been undertaking. The

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history and organisation of the network are presented as well as a summary of its main initiatives, namely the results of the first survey report on the Implementation of Sustainability in Higher Education in Portugal, where the actual practices in the main dimensions are listed. This work aims to contribute to the studies about sustainability-oriented networks in higher education, addressing its current and future challenges.

Keywords Sustainable campus · Higher education institutions · Portugal · Sustainability network · Sustainable Development Goals · Higher Education for Sustainable Development (HESD) · Education for sustainability; university engagement · Cooperation · Bottom-up initiatives · Sustainability survey

1 Introduction

Higher education institutions (HEIs), considering their role in society, have the responsibility of being frontrunners in Education for Sustainable Development (ESD), as already stressed several years ago (Lozano, 2006). HEIs can act as agents of change to shape sustainability among society and empower individuals to put sustainability into practice (Findler et al., 2018);

The Agenda 2030 with the Sustainable Development Goals (SDGs), adopted by the United Nations in 2015 (UN, 2015) and in particular, SDG 4, are an additional driver for the implementation of sustainability at HEIs in an integrative way (UNESCO, 2012; Lozano et al., 2015a, b).

According to the UNESCO Roadmap, the implementation of ESD in the academic community should be based on (UNESCO, 2020): (i) Advancing policy, with academia having a central role in contributing to shaping educational policies (priority action area 1); (ii) Transforming learning environments through concrete plans for integrating a whole-institution approach, including governance and culture as well as facilities and operations being aligned with sustainability principles (priority action area 2); (iii) Building capacities of educators where educators should be facilitators to guide learners through the transformation towards a more sustainable future (priority action area 3). This implementation should be done in different dimensions according to a holistic and whole-school approach (UNESCO, 2012; Lozano et al., 2015a, b). Universities should therefore play a catalytic role in stimulating the response of potential contributors to sustainability and to the SDGs, and should themselves be role models of sustainability.

Different tools have been developed to assess and benchmark ESD implementation at HEIs. Well known and worldwide used tools are, for example, THE University Impact Rankings, University of Indonesia GreenMetric, or Sustainability Tracking, Assessment & Rating System (STARS) (Caeiro et al., 2020; Mapar et al., 2022), as well as quality standards like ISO. The thematic areas that are best addressed in these tools are education, research, management and planning, partnership and engagement, society and communities, waste, energy, water, climate and carbon reduction, and transportation (Mapar et al., 2022). Furthermore, all those tools stress

the importance of partnership and collaboration among HEI. In an international study on sustainability-oriented networks in higher education, Dlouhá et al. (2018) analyse in depth 25 networks and highlight that these networks have been contributing beyond individual institutional change towards the UN Decade for ESD (2005–2014) and conclude that networks are important mechanism for systemic change in higher education.

At national and international level, with the aim of promoting sustainability and cooperation in HEIs a great number of associations and networks have emerged (Table 1) that demonstrate the broad range of types of networks active in the field of sustainability, with different scopes and target groups.

According to Lozano et al. (2015a, b), there is a high level of interlinkages between commitment and signing declarations, charters and initiatives, which often

Table 1 Networks and Associations in Higher Education with a focus on Sustainability related topics

Network	Scope	Target groups	Website
Copernicus Alliance	Europe	Academia in general	https://www.copernicus-alliance.org
EAUC—The Alliance for sustainability Leadership in Education	Focus on Europe, but with global partners	Academia in general	https://www.eauc.org.uk/
UNICA—University Network of the Capitals of Europe	Europe	HEIs in capital cities	https://www.unica-network.eu/
Italian University Network for Sustainable Development (Italy)	National (Italy)	Academia in general	https://www.unive.it/pag/18359/
People & Planet (Student network in the UK)	National (UK)	Students	https://peopleandplanet.org
NRCS—Nordic Sustainable Campus Network	Nordic (European) countries (NOR, DEN, SWE, FIN, ICE)	staff from sustainability offices or similar	https://nordicsustainablecampusnetwork.wordpress.com/
GUNi—Global University Network for Innovation	Global	Academia in general	https://www.guninetwork.org/
Association for the Advancement of Sustainability in Higher Education (AASHE)	Focus on North America, but operating globally	Academia in general (Sustainability reporting)	https://www.aashe.org
The International Sustainable Campus Network	Global	Academia in general	https://international-sustainable-campus-network.org

(continued)

Table 1 (continued)

Network	Scope	Target groups	Website
CESAER—Task Force Sustainability	Europe	Academia in general	https://www.cesaer.org/
Foundation Environmental Education—Programme EcoCampus	Global	Sustainability related staff/Students	https://www.ecoschools.global/ecocampus-about
Network N (German, [Network S—Sustainability])	Germany	Students	https://netzwerk-n.org/
Alianza de Redes Iberoamericanas de Universidades por la Sustentabilidad y el Ambiente (ARIUSA)	Spain & Latin America (regional and national networks)	Academia in general	https://ariusa.net/

Note The table gives examples of some of the best-known networks, but does not provide an exhaustive overview

are promoted in such networks and associations as mentioned above in Table 1. However, Farinha et al. (2019) highlight the lack of incentives and lack of coordination as the most important reasons for the overall lack of local cooperation and support in running sustainability-related practices in HEIs and suggest the development of cooperation platforms based on national networks. Such difficulties apply also to Portugal, where legal directives regarding sustainability education exist for all education levels, except for higher education (European Commission, 2022).

The Portuguese Network Sustainable Campus—Rede Campus Sustentável (RCS) Portugal (from now onwards designated as RCS)—can be seen as an answer to previous calls for action and fills in the gap of connecting the Portuguese higher education community to similar-minded people and to thereby help to advance sustainability at their institutions and beyond. This chapter presents for the first time the work RCS has been undertaking to an international readership and aims to contribute to the studies about sustainability-oriented networks in higher education.

Next, a brief outline of the following sections is provided.

- The context of this chapter is expound in this current introduction (Sect. 1).
- Section 2 introduces the RCS network, with a focus on its beginning and the founding mission, explaining as well the current organisational structure.
- In Sect. 3, an overview of the RCS Working Groups is given, as they form an important pillar of the network's modus operandi.
- Section 4 explains then the main cross-cutting initiatives of the RCS network.
- Section 5 describes in detail the charter of commitment promoted by RCS, one of the network's main initiatives with the ambitious goal of making the highest possible number of HEIs in the country subscribe to the charter of commitment to sustainability.

- Section 6 elucidates one of RCS's main achievements, the First Survey Report on the Implementation of Sustainability in Higher Education in Portugal, with a focus on the collaborative process of the study and the main survey results.
- Section 7, links to future perspectives of the network.
- And finally, in Sect. 8, conclusions and final remarks are provided.

2 An Introduction to the RCS Network

2.1 RCS as an Organisation

The creation of a Sustainable Campus Network (RCS, as abbreviated in Portuguese) in Portugal was due to the will of a group of people from higher education institutions (HEIs) who gathered for that purpose on November 27, 2018, at the University of Coimbra (Fig. 1). The movement towards creating RCS actually started in June of the same year, when a virtual meeting was organised by the Energy for Sustainability (EfS) Initiative of the University of Coimbra (Martins 2019). This virtual meeting gathered persons from nine HEIs spread through six different locations in the country when videoconference was not as ordinary as it became during the Covid19 pandemic. The purpose of the virtual meeting was to exchange experiences from various HEIs known to have developed initiatives concerning sustainability issues. At the outset of this virtual meeting, a decision was made to promote an ordinary kind of meeting, convening persons from a larger number of HEI. An organising committee for the November meeting (Fig. 2) was set up with persons from several HEI, and the EfS Initiative was appointed as the local organiser.

Fig. 1 Founding members meeting (RCS, 2022)

Programa

10:00 - Receção dos participantes
10:30 - Abertura
10:45 - Sessão de trocas de experiências com apresentações de casos

	Oradoras(es)	Instituição	Tema
10:45	Joana Pereira Santos e Antje Disterheft	Universidade Nova de Lisboa - Fac. Ciências e Tecnologia	Co-criando uma estratégia de sustentabilidade para a FCT NOVA - etapas de uma visão a passos concretos
11:00	Mafalda Maria Cardoso Nunes	Escola Superior de Saúde - Inst. Politécnico do Porto	ESS-Eco: A sustentabilidade na Escola Superior de Saúde do Politécnico do Porto
11:15	Manuela Almeida e Paulo Pereira	Universidade do Minho	Campi sustentáveis – eficiência energética, mobilidade e inclusão
11:30	Luis Castanheira	Instituto Politécnico do Porto	O Plano de Ação para a Sustentabilidade do ISEP
11:45	Manuel F.M. Barros	Instituto Politécnico de Tomar	Medidas de Eficiência Energética no Campus do IPT
12:00	Luís Miguel Pires Neves	Instituto Politécnico de Leiria	Uma abordagem interdisciplinar em múltiplas instituições à consciencialização para a eficiência energética
12:15	Ana Sofia Rodrigues	Instituto Politécnico de Viana do Castelo	Campus Sustentável IPVC
12:30	Jorge Maia Alves	Universidade de Lisboa - Faculdade de Ciências	Sustentabilidade em Ciências: um percurso em permanente construção

Fig. 2 November founding meeting call (RCS, 2022)

Besides allowing for experience sharing among persons from the HEIs present, the founding meeting approved two documents. The first document is the *Sustainable Campus Network charter*, where the motivations, the network objectives and the governing model are set. The second document is a pledge to promote the signature of a charter of commitment by the highest number possible of HEI, whereby the signatories would compromise with several sustainability principles and with the will to cooperate for common projects and initiatives towards sustainability goals. Drafts of these documents were previously sent to the registered participants for the sake of a more fruitful debate and easier consensus, contributing to defining, right from the beginning, the stamp of internal democracy that would be characteristic of the Network.

The nature of RCS is of a network of persons that should, in principle, be members of HEI community, either as technical or teaching staff, researchers or students. The membership of institutions as such was not considered at this point, since that would require a more complex and lengthy process. RCS assumes a bottom-up perspective, as it aspires to influence HEIs governance structures through partnership and collaboration.

The objectives of RCS were defined in the founding meeting as:

- Identify areas of cooperation and promote joint actions in favour of sustainable development in and with HEI, both nationally and internationally;
- Organise events for the dissemination and sharing of knowledge and experiences on sustainability in HEIs;
- Foster the creation of advanced training courses related to sustainability;
- Foster the integration of sustainability in the courses of each HEI;
- Foster cooperation in research on sustainability;
- Foster the adoption of sustainability practices in the management of HEIs;
- Cooperate with society in general in initiatives within the scope of sustainable development.

An annual meeting of the members of the network has taken place since then. In 2019, a decision was made in the annual meeting to organise the network activity in thematic working groups (WGs) which have been a sound basis for the results achieved so far. The WGs are, as everything else in RCS, the result of voluntary participation and have wide decision autonomy and constant support and coordination of the Executive Commission, the only governing structure of the network, made up on a voluntary basis as well.

Since 2018, RCS has been developing a constant activity of dissemination of knowledge and best practices through in-person and online meetings and seminars, round tables and competitions, and has worked together with national and international organisations. Besides having organised a series of annual Sustainable Campus Conferences (CCS) since 2019, the network performed the first national survey of sustainability policies and practices in national HEIs (Madeira et al., 2022) and managed to include almost all public HEIs in the country as signatories of a charter of commitment towards sustainable development and cooperation, as well as some institutions of the private sector, too.

Table 2 RCS general data and contacts

Name	Rede Campus Sustentável—Portugal
Name in english	Portuguese Sustainable Campus Network
Acronym	RCS Portugal
Logo	See Fig. 3
Year of foundation	2018
Dimension (2022)	280 individual members
Geographical area	Portugal mainland and islands
Area of intervention	Higher Education Institutions (HEIs)
Objectives	Challenges of sustainable development at HEI
Status & legal basis	Informal association without legal personality
Financing	Not applicable
Contacts	
Address	Not applicable
Telephone	Not applicable
Email	geral@redecampussustentavel.pt
Website	redecampussustentavel.pt
Facebook	facebook.com/redecampussustentavel.pt
Instagram	instagram.com/redecampussustentavel2018
LinkedIn	https://www.linkedin.com/company/14813574
Community discussion group	https://groups.google.com/g/comunidade-campus-sustentavel

RCS, being a bottom-up platform, based on the voluntary participation of individual members of HEIs communities, is a democratic movement, where values such as working for the common good, proactivity, mutual trust and generosity are cultivated on a daily basis.

The RCS was founded with a non-bureaucratic stance, choosing to have a very simple, collective governing structure. The data provided in the Tables in this section, according to a usual approach to describe organisations, highlight many essential differences between these and the RCS.

The Network's general organisation data are presented in Table 2.

Since 2019, with the initial enrolment of 40 individual members, the network has been growing, accounting for a total of 280 members in November 2022. The map in Fig. 4 shows the geographic distribution of individual RCS members, represented in the respective HEIs across the country.

2.2 Individual Members and Internal Organisation

The RCS individual members' rights and commitments are presented in Table 3.

Fig. 3 Images used for branding: Facebook banner (top), RCS logo (bottom left) and the "Sustainable Campus Community" online discussion group (bottom right) (RCS, 2022)

Individual members can organise themselves and work in working groups on sustainability issues, as described in Sect. 3.

The internal organisation of RCS is based on voluntarism, democracy, and representativeness. The organisational roles and responsibilities are systematised in Table 4.

The permanent bodies of the RCS are:

- Annual meeting of RCS members
- RCS Executive Commission
- Working Groups

The RCS is managed by an executive commission (EC) consisting of members from different HEIs chosen in the "Sustainable Campus Network", on a rotating basis. Each commission performs functions for one year, with two of its members replaced in the following year by elements from other HEIs.

The Executive Commission operates organically, without hierarchies or positions. Functions and tasks are assumed by the members who are best able to carry them out at the moment, taking into account a balanced distribution of work. EC is organised in sectoral areas that distribute among themselves management and organisation tasks.

The Sectoral Areas hold meetings, decide and carry out the objectives autonomously, but bring the most strategic or difficult issues to the plenary of the Executive Commission.

As represented in Fig. 5, there are four sectoral areas (i) Operation and Representation, (ii) Support to the Working Groups, (iii) Support to the organisation of the

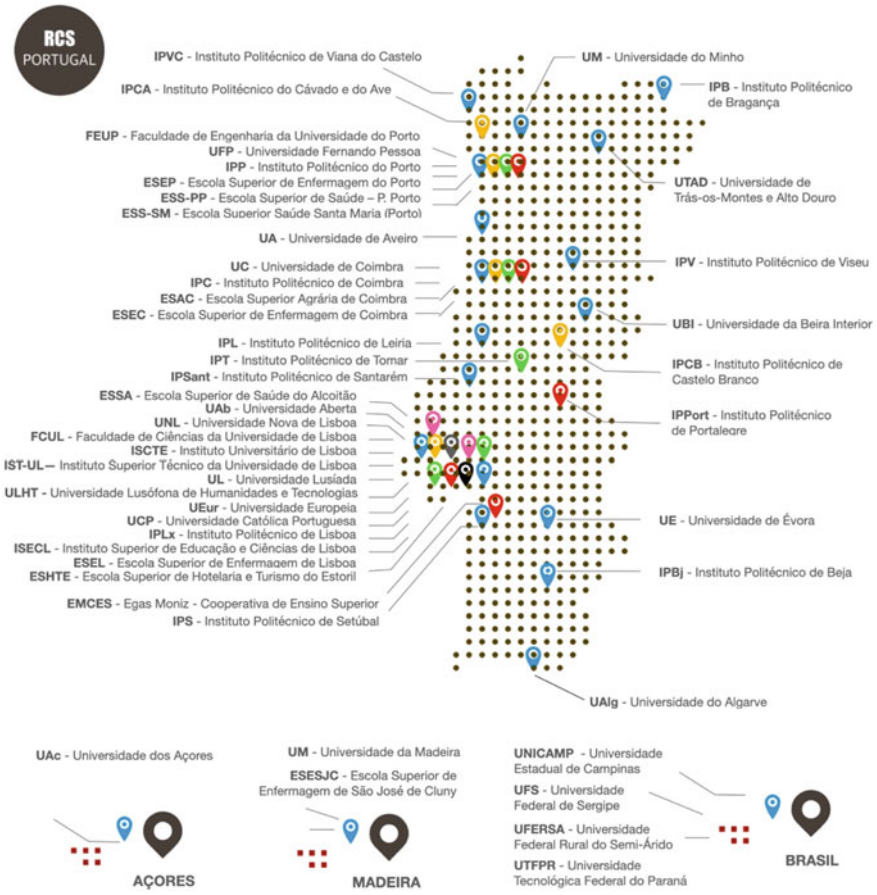

Fig. 4 Geographical origin of RCS members (RCS, 2022)

Table 3 RCS individual members rights and duties

Fee payable	None
Potential members	All affiliated members of any (Portuguese) HEI
Volunteer options	Cooperating in the working groups
Rights	• Participate at annual members meeting • Belong to the executive committee • Taking part in decision-making regarding the RCS
subscription	http://www.redecampussustentavel.pt/

Table 4 RCS internal organisation structure and operation

President	Not applicable
Secretary	Not applicable
Paid staff	Not applicable
Volunteers	All members
Executive Commission (EC)	At least 6 members partly replaced each year
Consultative board	Variable number of members
EC organisation	EC is organised in Sectoral Areas: • Operation and representation • Support to Working Groups • Support to the organisation of the annual conference CCS • Communication
EC meeting	Regularly meeting online
EC decisions	Decisions made by consensus
Dissemination of information on EC decisions among the Network members	Through the WGs and emailing service
Highest decision-making body	Annual general members meeting

annual conference, and (iv) Communication. Some of the functions and tasks of the Sectoral Areas are systematised below.

Sectoral area of Operation and Representation main functions:

- Day-to-day management (correspondence management, relationship with HEIs and, in general, with all external entities);
- Management of the associative movement (management of the members' database);
- Relationship with the Network members and HEIs;
- External representation of RCS;
- Elaboration of proposals of new initiatives;
- Planning the implementation of the proposals approved in the annual meetings of the RCS and of those defined in the other sectoral areas.

Sectoral area of Support to the Working Groups main functions:

- Ensure follow-up of the WGs;
- Support the WGs documentation file;
- Ensure the permanent existence of a facilitator in each WG;
- Detect potential for cooperation between WGs for joint initiatives, suggest and support their implementation;
- Support the dissemination of the WG's initiatives.

Sectoral area of Support to the organisation of the annual conference CCS main functions:

Fig. 5 The Executive Commission organisation in Sectoral Areas

- Assistance to the local CCS Organising Committee;
- Maintain close connection to the EC;
- Assistance in the definition of the CCS programme, in the choice of plenary speakers, as in contacts with potential speakers, and in contacts with HEIs and other entities.

Sectoral area of Communication main functions:

- Ensure a dynamic presence of RCS on the internet (website and social networks);
- Establish connection with the media whenever necessary;
- Screening and dissemination of news (initiatives and activities) on the sustainability in HEIs and RCS partner entities;
- Establish a network of contacts with HEIs;
- Publish and disseminate a newsletter to RCS members;
- Designing dissemination materials.

3 Engaging for Change

3.1 Working Groups

The RCS Working Groups (WGs) pursue the RCS mission of helping HEIs to adopt specific sustainability practices. The proposal approved at the RCS Annual Meeting in 2019 on the organisation of the Network's activity included the creation of different thematic working groups, with the following activities:

- "*Identify areas of cooperation and promote joint actions for the HEIs sustainable development, both at national and international levels,*
- *Organise events for the dissemination and sharing of knowledge and experiences on sustainability in HEIs,*
- *Foster the creation of advanced training courses on sustainability,*
- *Foster the integration of the sustainability theme in the courses of each HEI,*
- *Foster cooperation in research on sustainability,*
- *Foster the adoption of sustainable practices in the HEIs management,*
- *Cooperate with society initiatives with a sustainable development scope.*"

The WGs aim for broad participation of the network's individual members, promoting creative activities on education and research on sustainable development, and using collaborative activities among academic members of several HEIs. The WGs are organised in a large variety of themes related to sustainability that are proposed by the RCS individual members, currently 10 groups in total (see Figs. 6 and 7 an example of the WGs logos). WGs membership is voluntary and may vary in time depending on the member's interests. New WGs themes may eventually appear, or already existing themes may merge. The entry of new elements in WGs is possible at any moment.

The members of each WG are not necessarily specialists in the WG theme. These members are interested in working on the respective topic and implementing policies and actions for sustainability in higher education. Most groups have organised a range of activities such as webinars, round tables, competitions or worked on a specific question that in a few cases led to scientific publication. Furthermore, all WGs collaborated in a joint survey in order to assess the state of the art of sustainability implementation in Portuguese Higher Education (see Sect. 6).

Each group has the freedom to do what its members think is most appropriate, but most of them want to identify ways of measuring or achieving sustainability, working either on indicators or on collecting and disseminating good practices. Therefore, almost all the groups conducted webinars, and in 4 years of activity more than 20 webinars (Table 6) and seminars were held on the various themes. These events were not organised systematically according to each SGD but rather based on the thematic structure of the WG. Hence, each WG may address several SDGs along the history of the events it organises. This approach corresponds more closely to the demands of the 2030 Agenda in HE and leads to more engagement and higher enthusiasm of the WG's members.

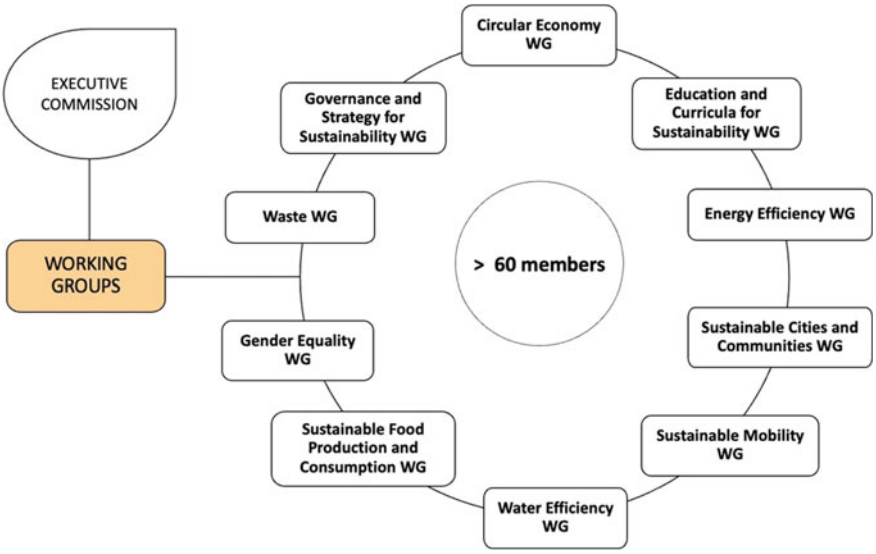

Fig. 6 RCS Working Groups organisation

Fig. 7 Governance and Strategy for Sustainability WG logo

Governança e Estratégia para a Sustentabilidade

WGs work collaboratively, sharing knowledge, and decisions are made by consensus. The work is voluntary. There is a cooperation among the members for the experiences exchange and tasks division to achieve the objectives proposed by the WG. Each WG has a facilitator who manages the meetings schedules and progress of the group's initiatives. The facilitator is usually temporary, replaced after some time in a revolving mode inside the WG. The WGs meetings are virtual, by videoconference, due to the dispersion of the WGs members across the country.

Each WG develops individual or joint initiatives with other WGs. As illustrative examples of initiatives, the following can be pointed out: thematic campaigns, inter-institutional thematic workshops, proposals for HEIs managers and surveys to support policy proposals.

The activities are summarised annually at the Sustainable Campus Conference and a summary of the RCS activities is presented, which synthesises the annual WGs initiatives. The working groups' initiatives are disseminated on the RCS website.

The Working Groups' organisation and principles are presented in Table 5.

Currently, there are the following ten working groups (WGs), with their own themes, mission, and objectives:

Table 5 Working Groups Organisation

Fee payable	None
Subscription	http://www.redecampussustentavel.pt/adesao-grupos-trabalho/
Potential members	All academy related members
Group theme	Chosen by group members
Group facilitator	One/two members Revolving replacement Ensures connection to the sectoral area Support to working groups
Working principles	Each WG decides autonomously how it operates
WG logo	See Fig. 7 for an example

WG on Education and Curricula for Sustainability

The main mission of this WG is to encourage the widespread integration of sustainability in the curriculum of higher education courses. In addition, the teaching contents of sustainability and teaching methodologies are also the focus of this WG, as well as the skills needed for sustainability, lifelong training, and teacher training.

The WG initiatives have been focussed on the debate and sharing examples and good international practices, diagnosis of the national situation, and development of indicators to monitor the integration of sustainability in HEIs teaching and curricula.

WG on Gender Equality

The Gender Equality WG is dedicated to the themes of gender equality and diversity in the academic community: teachers, researchers, managers, non-teaching staff, students, and suppliers. Based on the observation of existing inequalities, this WG is interested in the policies adopted and management methods related to gender equality, but mostly the practices and initiatives promoted by the HEIs to improve gender equality.

The members of this WG, not necessarily specialists in this theme, are united in the wish to learn and collectively reflect on this relevant issue. They feel the need for more awareness and policies to face inequality and are looking for the best ways of interaction on this topic.

WG on Energy Efficiency

The Energy Efficiency WG is dedicated to energy issues, mainly focusing on its good use. Its mission is to promote the debate and dissemination of efficient solutions for energy on campus: production, consumption, and control. It works on energy performance and management, monitoring and controlling consumption, and proposing new technologies and their potential on-campus use.

This WG has also been working on the definition of energy efficiency indicators, which may be of common use in HEIs. The energy consumption in teaching

and research laboratories has been of particular interest. Greenhouse gas emissions generated directly or indirectly on campus are also part of the concerns of this WG.

WG on Water Efficiency

The Water Efficiency WG is dedicated to water themes and the different forms of interaction with this resource, throughout its passage through the campus: catchment, collection, consumption, control, contamination, treatment, waste, and potential for exploitation.

WG focuses on the dissemination of new and good practices for water saving, monitoring, and control, as well as the potential for using water from different sources. WG has been dedicated to debating and sharing examples and good national practices, diagnosing the situation in Portuguese HEIs, and developing indicators.

WG on Sustainable Food Production and Consumption

Sustainable Food Production and Consumption WG's main mission is to bring to HEIs the idea that Food Production and Consumption are critical issues for sustainability and that HEIs can decisively impact society through training, research, internal practices, and partnerships.

The topics covered the entire food chain, from food production, purchases, food preparation, and service, as well as waste. In this way, it is a multidisciplinary group, where interests and knowledge are shared to disseminate and apply more sustainable eating habits in HEIs.

WG on Sustainable Mobility

The Sustainable Mobility WG is dedicated to the daily mobility of commuters to and from campus. Its main mission focuses on promoting solutions for more sustainable mobility, through the current diagnosis, identification of needs and available alternatives, and the potential to create more collective and soft mobility options. Its activity has also focused on surveying the mobility of various academic communities, debating mobility solutions, and sharing examples and good practices in HEIs but also the experiences of other communities.

WG on Waste

The topics around waste, in particular waste management on campus, are the focus of this WG. Participants discuss waste management policies by HEIs, sorting circuits, responsibility for waste destinations, and the necessary partnerships. They address the issue of minimisation, reuse, recycling, and routing of waste produced on campus, in particular new solutions and good practices. Procedures for hazardous waste streams, namely from laboratories, have been the focus of debate and dissemination. The flows of organic waste and the practices of collecting and forwarding or composting directly on campuses have also been worked on in the WG.

WG on Sustainable Cities and Communities

In recent decades, HEIs have been involved in regional strategies, forming ambitious partnerships in cooperation with companies, research centres and other civil society

partners with the aim of driving the sustainable transformation of a region, city, or communities. This WG approaches the Campus as a Community that, in turn, belongs to a wider community with which it interacts. Promoting greater integration of HEIs in this wider community is the main mission of this WG. Partnerships and joint projects are the main target for debate, dissemination, and action. Thus, the WG was created with the aim of promoting a participatory debate among members of the academic communities of various HEIs, which allows thinking about the role and influence of Higher Education in the sustainable development of cities and communities. Examples of this community are all stakeholders within the area of influence closest to the campus, including, for example, local authorities (municipalities), companies, other educational establishments, libraries, and associations, among others. Examples of good practices can be projects, activities and partnerships developed by HEIs that promote a more sustainable society and that are aimed at the local community. One of the WG's objectives is to answer the questions: "What is done (and can be done better) for Sustainable Cities and Communities in Portuguese HEIs?" and "How can this exchange of experiences positively influence my campus and other campuses?" Systematically, the WG proposes to survey a set of initiatives/actions that are being carried out (or planned to be carried out) at the HEIs and that contribute to a more sustainable city/community surrounding them, making them known and proposing a set of measures that can be replicated in other regions.

WG on Governance and Strategy for Sustainability

The WG's mission is to help HEIs to adopt sustainable management practices, focusing on the organisation of sustainability management.

The objectives are centred on promoting the discussion of policies for sustainability in Higher Education in Portugal and ways of implementing them in the HEI's management.

The activities promoted include debate and dissemination of the collaboration among HEIs to achieve common goals, how to better manage sustainability issues, strategic plans, action plans, and budgeting for sustainability in HEIs. Reporting activities, such as HEIs accountability, assessment, self-assessment, communication, and certification activities, are also discussed. The role of voluntary and inter-institutional organisations, such as RCS, in influencing sustainability management in Higher Education is also debated and reflected in this WG. WG members are not necessarily members of the HEIs' management, but somehow interested in the strategic orientation for sustainability.

WG on Circular Economy

The Circular Economy WG focuses on the concept of circular economy applied to HEIs, since these institutions are responsible for teaching, researching, but also managing large amounts of material and financial resources. The circular economy translates into management policies that involve (public) purchases, but also explore and apply internal reuse and recycling ideas, which can be applied by the academic community and in partnerships with the local community. In addition, the WG focuses on teaching circular economy concepts and principles, studying

and researching good practices, both at the undergraduate and master's level, with specific courses on this subject and on how this topic can be included in other courses.

The group promoted a contest of ideas that aimed to encourage students to develop projects that can be applied in HEIs and that promote circular economy within their HEIs. The competition also included some mentoring sessions, for a certain number of selected projects, which aim to increase students' knowledge in certain areas of the circular economy and improve their project proposals. This contest was open to the participation of all Portuguese-speaking higher education students and was highly participated. This initiative resulted also in a scientific peer-reviewed publication in the journal Sustainability. The WG also promotes debates on the subject, with the participation of companies, specialists, and entities active in the circular economy. As it is a very cross-cutting topic, there have been attempts to develop some debates together with other RCS-WGs.

4 RCS' Initiatives for Sustainability in HEI

The social importance of the role of HEIs in modern society implies that HEIs must assume the condition of role models, where the sustainability values they convey through teaching and research have to be cultivated in daily practices, and where interaction with society must be intense and based on the same values. Since the founding meeting, the RCS assumed its commitment to help and influence HEIs in their movement towards becoming sustainable institutions.

The first cross-cutting initiative of the network was achieved at the Sustainable Campus Conference in 2019, when the network was not yet one year old. Almost 90% of the public HEIs in the country signed a charter of commitment with several commitments to sustainability in a public ceremony during the Conference (see Fig. 8). This was an act of great relevance, as the network was an unknown organisation to the HEIs before the first contact towards this goal.

RCS has a presence on the Internet through a website and three social networks. This presence is used for the dissemination of events and initiatives, both of the network itself, the partnering institutions and other international networks. The website (Fig. 9) has a collection of resources aimed at helping members of the higher education community to find guidelines and examples of best practices to facilitate the design and implementation of sustainability projects and initiatives.

The first national survey of the current state of development of sustainability policies and projects in the higher education sector was carried out by the RCS. The design of the survey, as well as the data processing, were made with the active participation of the network thematic working groups, iteratively coordinated, and finally wrapped up by the executive commission. The results were published in an e-book (Madeira et al., 2022), and several dissemination initiatives were promoted (see Sect. 6 for more details). The grounds are created for a continued assessment of sustainability in HEIs and its evolution towards the accomplishment of the 2030 Agenda goals.

Fig. 8 Charter of Commitment signature ceremony—Faculdade de Engenharia da Universidade do Porto

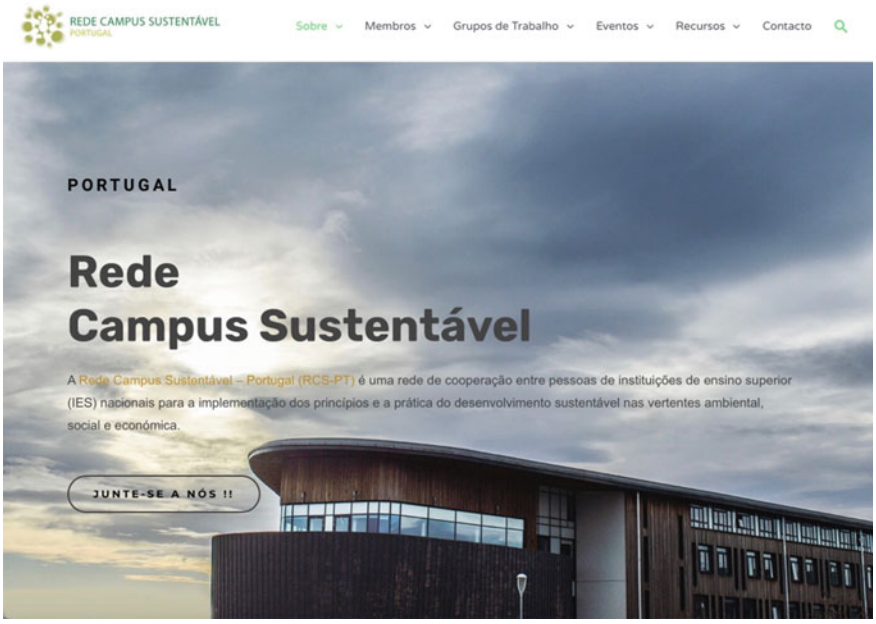

Fig. 9 RCS, Portugal website homepage (RCS, 2022)

The annual Sustainable Campus Conference has become a regular event since 2019, where the higher education community meets to share the latest developments, either in outreach activities, research, and education or in internal projects and community mobilisation towards sustainability initiatives (see Fig. 10 for an overview of the annual conferences). A call of manifestation of interest is launched every year by the executive commission to all institutional members of the network in order to choose the HEI which will host the following Sustainable Campus Conference. The conference planning is closely supported by the executive commission. A member of the local organising committee is always chosen to be a member of the network executive committee for a swift relation with the preparatory works of the conference.

Profiting from the annual conference gathering, an annual meeting of the RCS members takes place at the end of each conference to review the activities carried out during the preceding annual period and define guidelines for the following year. Both the working groups and the executive commission issue brief reports and the executive commission elaborates proposals which are disseminated in the preceding weeks for appraisal and debate by the network members.

Thematic events take place frequently, organised by the working groups, usually inviting specialists to stimulate discussion. A wide range of themes is covered, as a result of the thematic orientation of the working groups. Selected graphical examples of some of the thematic events organised by the RCS-WGs teams are shown in Fig. 11.

Furthermore, each year a specific theme is voted by the network members that shall guide the development of further initiatives and events.

Partnerships happen as a result of invitations made to RCS by other organisations, either for lasting cooperation in disseminating good practices or for participation in outreach projects.

Table 6, presents a summary of the main WGs achievements since its beginning from 2018.

In addition to the events organised by RCS, the network was also invited to several national and international meetings (e.g. on policy-making, sustainability reporting, conferences) where members of the executive commission contributed as guest speakers on diverse topics.

5 Charter of Commitment to Sustainability

Statements of commitment are instruments to define common objectives among a set of signatories. In the majority of the occurrences, statements of this kind do not include the specification of some form of verifying compliance (Bekessy et al., 2007). Nevertheless, they have the effect of creating a public notice of the commitment assumed by the signatories and the corresponding moral obligation to comply (Lozano et al., 2013). The public image of the signatories plays a relevant role as well, since public scrutiny is likely to happen. Moreover, according to Lozano et al. (2015a,

Fig. 10 Overview of the annual Sustainable Campus Conference (RCS, 2022)

b), those HEIs more strongly committed to the implementation of sustainability have all signed some kind of charter or declaration.

In its founding meeting, immediately after the approval of the network charter, the RCS defined the goal of making the highest possible number of HEIs in the country subscribe to a charter of commitment to sustainability. Although being an ambitious goal, it was achieved less than one year later.

Fig. 11 Selected graphical examples of some the thematic events organised by the RCS' working groups (RCS, 2022)

Table 6 Main achievements of RCS—2018–2022

Type of initiatives	Number
Conferences	4
Members meeting	6
Thematic working groups	10
Webinars	23
Workshop	1
Contest	1
Studies	2 (1 concluded; 1 in progress)

The contents of the charter document were specified in the text approved in the network founding meeting. They included the assumption by each signatory of a commitment to contribute to the Sustainable Development Goals, as defined by the UN, as well as a commitment to collaboration with other HEIs for exchanging information on successful experiences, sharing best practices, promoting

common projects and initiatives, attracting funding, and promoting common missions involving staff from various institutions.

The process towards the public ceremony where the HEIs would sign the document was specified in detail in the text of the corresponding meeting decision. This specification, which was carefully respected, included the following steps:

1. A first draft of the charter should be elaborated by a writing committee composed of three persons chosen by those present in the founding meeting.
2. The first draft should be subjected to public electronic discussion among all the network members.
3. Comments and suggestions gathered during the public discussion would be used by the writing committee to produce a second draft.
4. The second draft would be subjected to electronic voting by all the network members.
5. If approved, the document would be considered as the basis for the contacts that the executive commission would make with the HEIs towards their signatures.

Due to the bottom-up nature assumed by the RCS, the goal of making the HEIs subscribe the charter was assumed with two perspectives: on the one hand, it was a concrete way of exerting influence on the HEIs governing structures towards campus sustainable development; on the other hand, independently of the number of signatory institutions, the RCS assumed that its activity was not dependent on the outcome of this process. The network activity is justified in itself and many of its goals can be pursued even without the commitment of this or that institution.

In the first phase of this initiative, the network contacted all the public HEI, considering it a first step that, if successful, would eventually become a useful example to the other institutions in the private sector. This represented a total of thirty-five institutions.

Steps 1 through 4 above followed seamlessly and strictly, resulting in a version of the charter (see Annex 1) ready to be proposed to the HEI. The accomplishment of step 5 was a lengthy process, involving bilateral contact with every institution in several iterations. Given the novelty of the RCS existence, the contact with each institution required an explanation of the context of the network, identifying its aims. Additionally, the importance of the existence of a charter as the one proposed, with a high number of HEIs signatories, had to be demonstrated before making the formal invitation to adhere.

After taking a first inventory of all the required institutional contacts, hundreds of messages were exchanged with the HEIs during this process. In some cases, addresses had to be changed to contact the right person for the purpose. A big majority of the institutions adhered to the proposal, which was finally signed in a public ceremony on October 31, 2019, during the first Sustainable Campus Conference, held in the Faculty of Engineering of the University of Porto. The signatories on this occasion were twelve universities, twelve polytechnic institutes, and four higher education schools not integrated in universities or institutes.

The expected effect of this initiative serving as an example to other institutions actually happened, since several other institutions showed interest in subscribing to

the charter. After this major step in the RCS short life, the executive commission decided to define a process that would enable the formality of an institution becoming a signatory of the charter after the October 2019 public event. It consists of an annex to the charter, signed by each interested institution, in which it states its commitment to the contents of the charter. Seven other HEIs have so far subscribed to this type of document, four of them belonging to the private sector.

The contents of the charter were adapted from the COPERNICUS charter (COPERNICUS Alliance, 1994) and cover the following topics: institutional commitment, promotion of ethics for sustainability, sustainability training offer, transdisciplinarity, dissemination of knowledge, collaborative networks, partnerships and technology transfer.

6 Higher Education and Sustainable Development—A National Perspective

6.1 First Survey Report on the Implementation of Sustainability in Higher Education in Portugal

In a 2-years-long collaborative effort of all WGs, and led by the executive commission, RCS carried out a first assessment of this kind on the position of Portuguese Higher Education Institutions (HEI) in relation to sustainability (Fig. 12). A joint questionnaire survey was applied in 2021, using the open-source software "SurveyMonkey", and sent to all HEIs in Portugal by the RCS' executive commission.

The survey consisted of 86 questions in total, divided into eleven thematic sections (A to K), that could be completed and submitted separately and independently:

A. Summary characterisation of the Higher Education Institution (10 questions);
B. Governance and Strategy (9 questions);

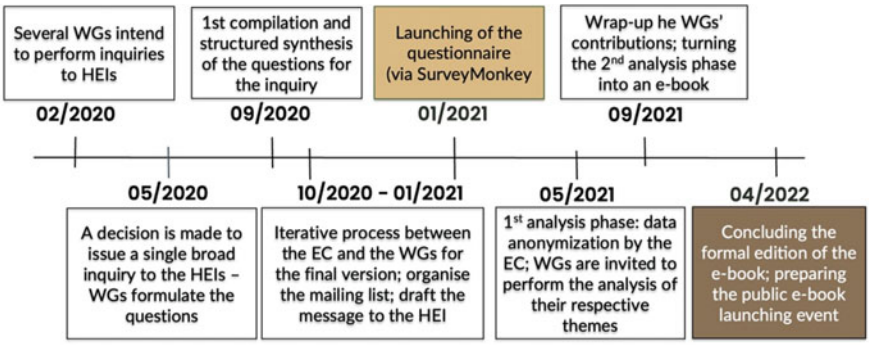

Fig. 12 The survey Collaborative Process timeline

C. Education and curricula (7 questions);
D. Gender Equality (5 questions);
E. Food Production and Consumption (8 questions);
F. Sustainable Cities and Communities (6 questions);
G. Sustainable Mobility (9 questions);
H. Energy Management and Energy Efficiency (10 questions);
I. Water Efficiency and Rational Use of Water (8 questions);
J. Waste Management (9 questions); and
K. Circular Economy (5 questions).

In January 2021, an email was sent to the Rectors and Presidents of all the HEI explaining the purpose of the study, as well as the instructions for completion, the link to access the questionnaire, and the guarantee of non-disclosure or use for other purposes. The data requested should cover the period between 2017 and 2019. The provision of this information was assumed by RCS as a permission to use it for the purpose described in the introductory text of the questionnaire.

After anonymization, the data received was sent, in a spreadsheet, to the voluntary members of the WGs, who accepted the invitation to carry out the analysis. Each WG was responsible for the data analysis of the section of the questionnaire corresponding to the WG theme. The answers were verified regarding their consistency with the questions, and the type of data to be reported, and, in case of doubt, were not considered. Answers considered valid were still coded, whenever necessary. The partially answered questionnaires were considered valid if, at least, one section was fully completed.

Thirty-eight HEIs responded to the survey, of which five were considered invalid for this study, because the answer was unintelligible or did not answer any question of the survey, so 33 sets of answers were considered valid in general.

The results were published in an e-book called "*Rede Campus Sustentável, First Survey Report on the Implementation of Sustainability in Higher Education in Portugal*" (Fig. 13). Next, a brief summary of this survey is made, where the main results will be highlighted.

6.2 The Survey Results—An Overview

The survey analysis has shown that although there is no specific legislation for higher education concerning the implementation of sustainability in Portugal, the HEIs leaders begin to show some awareness of this issue, even reporting considerable advances in some themes. For instance, of the 29 HEIs that have answered the survey, 72% have a strategic plan related to sustainability; 69% report sustainability performance; 23% stated that sustainability is integrated into other departments; 19% have a Sustainability Office or Committee; 12% have management bodies dedicated to sustainability (Fig. 14).

Fig. 13 Book cover of the First Survey Report on the Implementation of Sustainability in Higher Education in Portugal e-book (Madeira et al., 2022)

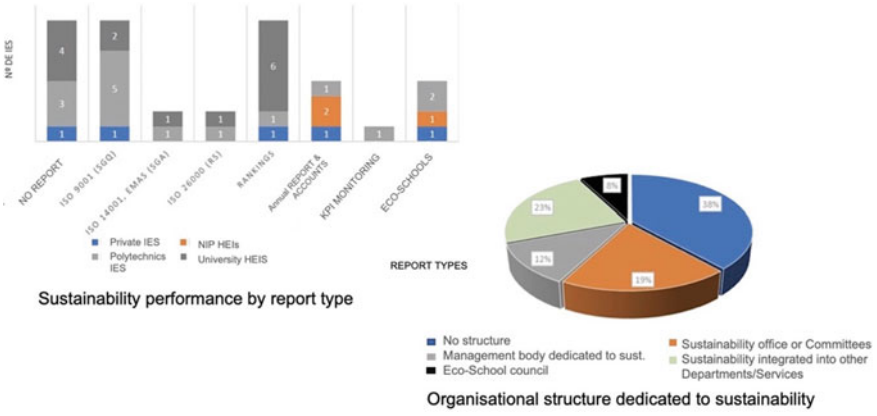

Fig. 14 Governance and strategy for sustainability—main results

Within the ***Governance*** section, the answers related to planning and strategy for sustainability were positive. However, those related to the budget dedicated to sustainability denote that there is a poor investment in this area. Only seven HEIs reported having this type of budget, three of which indicated having an annual budget lower than or equal to 1%. The lack of budget can be a critical factor for the implementation of consistent and integrated sustainability-related policies.

Concerning the ***education and curricula*** section, it was found that the responding HEIs provide formal and lifelong learning courses exclusively dedicated to sustainability issues, 87% being master, bachelor, and Ph.D. programmes. It should be highlighted that the approach to sustainability is carried out in different ways, for instance using an approach to only one of the sustainability pillars, or even in an integrated manner, the latter being the common way. However, formal education is not the only way to promote sustainability. Most of the HEIs have stated that they are promoting sustainability issues through non-formal education, such as transdisciplinarity studies/projects, using green spaces, organic vegetable gardens, and the canteen.

As far as ***gender equality*** is concerned, some practices in this domain are adopted, with the most commonly mentioned being the commitment to gender equality in the calls for tenders (51.7%), collection and publication of statistical data by gender (42.9%) and family support (42.9%). The promotion of some initiatives, such as seminars and lectures (67.9%) and training and awareness-raising activities (57.1%) was also mentioned by the responding HEI (Fig. 15). Despite the practices and initiatives reported, it is worth noting that only three HEIs have a service, an office, or a commission dedicated to gender equality.

Concerning the ***food production and consumption*** section, experiences in various domains were reported, mostly focused on the relationship between food and health and the pressure for low-cost offers of balanced and healthy meals. The results show that despite having substantial food production and consumption-related research, there is no connection with the development of initiatives related to this topic within the HEI. Management initiatives are frequent and appear in this sample as not generically incorporated and integrated into strategies, but rather as singular actions in response to new demands from society and the academic community.

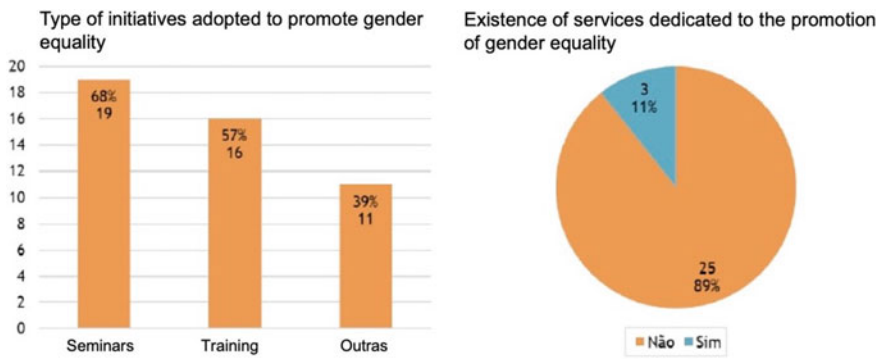

Fig. 15 Gender equality main results

Most of the HEIs have mentioned their involvement in many initiatives or projects that promote ***sustainable cities and communities***. Some key themes were identified to be developed in the future, namely the implementation of actions to promote the local production of food, and the involvement of citizens in activities related to sustainability. On the other hand, most of the Portuguese higher education institutions do not develop or apply consistent and integrated policies of ***sustainable mobility***, highlighting only isolated practices related to bicycle and electric vehicle parking places. The majority of HEIs responding to the survey (77%) do not regularly monitor mobility profiles. The results also show that about 1/3 of the HEIs charge a parking fee.

From the analysis of the collected data, it was found that Portuguese HEIs have procedures for monitoring ***energy and water consumption***. However, those procedures are often carried out in a disaggregated and non-integrated or optimised way, with small investment or funding in efficiency measures. Also, the results show that the main source of final energy is the electricity from the public service electricity grid. The renewable energy locally produced represents only a very small percentage of the Portuguese HEI's facilities.

The investment in water efficiency measures in the facilities was mostly funded by the HEI's internal budgets, with governmental support funds being required.

Regarding ***waste management***, 22 HEIs reported the existence of awareness/training actions for the academic community or suppliers, the installation of bins, or the existence of organisational measures for waste management. About 90% of the HEIs have already adopted procedures for the collection and selective waste disposal, including special flows such as hazardous laboratory waste, printer cartridges, or electrical and electronic waste.

Although most of the HEIs surveyed do not have monitoring procedures for ***circular economy***, they have several actions aiming at its implementation and promotion. Different kinds of procedures are taking place at HEI, such as administrative actions (material and financial), awareness-raising of the academic community or training actions. HEIs seem to be, in general, aware of the concept of circular economy, identifying the main challenges in its promotion, the lack of awareness among the various stakeholders, and the difficulty of compatibility with the constraints associated with procurement procedures.

6.3 Survey Final Remarks

This survey is a first enquiry of the current state of the Portuguese HEIs path towards sustainability, identifying topics for improvement and future recommendations in the different themes. The results indicate a scenario, albeit preliminary and in need of further studies, revealing that HEIs are in general aware of sustainability issues and have implemented several practices, although in a fragmented way and without major investments. The lack of external funding is considered a critical factor for the advances in sustainability. It is also worth noting that the institutions that answered

the questionnaire are probably the most aware of this issue, which may, in some way, reveal an optimistic scenario.

It is expected that this study will contribute to the promotion of sustainable policies and practices in Portuguese HEI, as well as to the pursuit of the United Nations Development goals for 2030. The analysis of the current situation of HEIs with regard to sustainability is expected to inspire debate and act as a catalyst for their commitment to a more sustainable society and future. In fact as the United Nations highlighted HEIs must put in contact students with real-word problems and immersive experiences to allow sustainability becoming a core practice and purpose through their structures, educative programmes, and activities (UNESCO, 2022) but for that it is fundamental to know what is the actual diagnosis of the implementation of Sustainability in Higher Education in a particular context.

7 Future Perspectives for RCS

With its continuous growth of members and increasing volume of initiatives and tasks, the network members felt the need to reflect deeper on perspectives for the future and possible lines of actions. For this reason, RCS organised an extraordinary meeting of a whole day before the summer break (July 1st, 2022), in addition to the annual meeting usually taking place at the end of the RCS conference, in order to have sufficient time for reflection and discussion. Following a dynamic, interactive, and participatory format with previously shared topics that were then discussed further in smaller groups and in a World Café session, the approx 50 RCS members participating in the meeting advanced proposals in three fields:

i. options and formats of institutional partnerships (since so far RCS is an informal network of people, see Sect. 2);
ii. Stimuli for the promotion of further inter-institutional cooperation via common interests and objectives, called “Meeting Points”;
iii. Reflections on the possibility of creating a type of “Observatory for Sustainability Monitoring in Portuguese Higher Education”, in order to continue and deepen the work initiated via the survey report (see Sect. 6).

In the following step, members of the Executive Commission integrated the feedback received during the extraordinary meeting and presented updated versions of the proposals during the 4th annual meeting (Oct 27, 2022), which were approved by the participating RCS members through in-person and online voting. RCS’ future perspectives build on these proposals, which are outlined below.

Table 7 Partnerships rights and duties

RCS partnerships	
Fee payable	Not applicable
Potential partners	All Portuguese HEIs Academic entities Other entities
Duties	Sign the partnership agreement Promote joint initiatives Participate in studies that RCS promotes
Rights	Publish about the partnership for communication purposes

7.1 Institutional Partnerships

After four years of informal membership by individual persons only, the network intends to enlarge the memberships by creating more formal options for institutional participation in RCS. Partner entities, which can be academic institutions or associations (e.g. students associations or research centres), can sign a mutual partnership agreement that defines responsibilities for each partner, making public the formal link between RCS and the partner. These responsibilities can include, among others, (i) support in communicating sustainability initiatives, (ii) availability for promoting joint actions, (iii) carrying out studies related to sustainability in Higher Education (Table 7).

7.2 Fostering Inter-Institutional Cooperation Through "Meeting Points"

In order to enhance and strengthen the cooperation between HEIs that are linked to the network, RCS' Executive Commission can annually propose topics and fields in which effective cooperation among several HEIs can be carried out. To facilitate the beginning, the executive commission can meet with representatives from diverse institutions in order to jointly define approaches for working together on the selected topics. Such topics can, e.g. tackle (among many others):

- teacher training for faculty members to guarantee that students can learn and acquire relevant sustainability capacities as specified in SDG target 4.7;
- organising a testing scheme for sustainable public purchases in HEIs;
- improving access to cycle lanes and better reachability of the campi by bike.

The Meeting Points shall facilitate knowledge exchange and promote cooperation as well as mutual learning on an institutional level.

7.3 Supporting Sustainability Monitoring in Portuguese HEIs

There is a lack of systematic sustainability monitoring in Portuguese HEIs, as revealed by the first survey report on sustainability implementation (Sect. 6). In order to continue the work started, the network is discussing the creation of an observatory or similar cooperation to assist with creating specific sustainability indicators that allow better monitoring of sustainability advancements in Portuguese academic institutions and that can contribute to the development of higher educational policies.

8 Conclusions and Final Remarks

By sharing the experience of the Portuguese Network Sustainable Campus (RCS), this chapter aims to inspire and to be useful for possible replications in other regions and contexts. RCS, the Portuguese Sustainable Campus Network, has started to fill in the gap for the lack of a platform that connects Portuguese HEIs in pursuit of advancing sustainability. Started as a network of people and with currently over 280 members, RCS is preparing their future lines of action via fostering and enhancing institutional cooperation. At the same time, the network continues to share and create knowledge in the ten working groups and annual conferences, with increasing visibility and impact. With having carried out manyfold initiatives, being the survey report on the implementation of sustainability in Portuguese HEIs one of the biggest joint efforts of the network so far, RCS is committed to continue strengthening HEIs role in sustainability transformation and striving for a liveable future for all.

Annex 1

Final Document of the Charter of Commitment Promoted by RCS

The final document was adapted from the Copernicus Charter (COPERNICUS 1994) during a collaborative writing process in 2019 by RCS members).

Commitment of Higher Education Institutions to Sustainable Development

The anthropogenic pressure exerted on the environment today reaches limits that are difficult for the biosphere to bear, making the challenges of sustainable development

increasingly visible throughout the world, on a daily basis. Since Higher Education Institutions bring together a unique combination of competences that allow them to play a key role in the areas of education, scientific research, social responsibility and the defence of the common good, they must be particularly active elements in the global movement in search of paths that allow humanity to learn to satisfy its present needs without jeopardising the possibility of future generations also doing so.

In this context, the Higher Education Institutions signatories to this document are firmly committed to playing a central role in the evolution towards a sustainable, free, fair, solidary and tolerant society, characterised by respect for nature and the human-being, integrating across all its activities the Agenda 2030 to achieve the Sustainable Development Goals and committing themselves to develop the set of actions described below.

Principles for Action

1. **Institutional Commitment**

The signatory Higher Education Institutions will demonstrate, through their daily practice, a true commitment to the principles and practice of sustainable development, in all its relevant aspects—environmental, social, and economic, following a holistic approach.

2. **Promotion of ethics for sustainability**

The signatory Higher Education Institutions will promote literacy in the area of sustainability ethics among their academic communities and the general public, seeking to contribute to the conscious adoption of socially responsible attitudes, improved environmental practices and sustainable consumption standards.

3. **Sustainability Training**

The signatory Higher Education Institutions commit to incorporate a perspective of sustainability in all their work and to offer to all their students and employees, regardless of their area of knowledge, training and spaces for experimentation and debate that address the issue of sustainable development, thereby promoting practices for active and responsible citizenship directed towards sustainable development.

4. **Transdisciplinarity**

The signatory Higher Education Institutions commit to promote collaborative transdisciplinary education and research in all its aspects of sustainable development—environmental, social and economic—at the service of society and the common good.

5. **Dissemination of knowledge**

The signatory Higher Education Institutions will disseminate, as widely as possible, all their initiatives and good practices related to the area of promoting sustainable development, both internally and externally, in order to maximise the impact of these initiatives by raising the awareness of different target audiences, including the business world, government agencies, non-governmental agencies and the media.

6. **Collaborative networks**

The signatory Higher Education Institutions will promote and support interdisciplinary networks of experts and specialists in the field of sustainability at local, regional, national, and international level, with the aim of collaborating in research and/or educational projects, promoting, for this purpose, student and staff mobility (teachers and non-teachers).

7. **Partnerships**

The signatory Higher Education Institutions will promote the establishment of partnerships with other sectors of society, with the objective of planning and implementing concerted intervention strategies in the area of sustainable development.

8. **Technology transfer**

The signatory Higher Education Institutions will promote the transfer of technology and/or advanced management methods with potential impacts in the area of sustainable development.

This set of principles for action is of general and open nature, and since they have to be included in the mission of the signatory Higher Education Institutions, each institution and all its members have the obligation and freedom to interpret and implement them in the way that best matches institutional and local circumstances.

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Global Academic Rankings. A Challenge or a Chance to Portuguese Higher Education Institutions

Teresa Nogueiro and Margarida Saraiva

Abstract In the era of the globalization and internationalization of higher education, there has been an international trend for global university rankings. World university rankings, which reflect the global competition of universities and depict their relative statuses, have attracted the attention of many universities. Global rankings considered to be one of the mechanisms—and not the only one and far to be perfect—for evaluating higher education, even if they are a crucial tool for comparing and measuring the accomplishments of Higher Education Institutions (HEIs) by specific metrics. The Times Higher Education—World University (THE-WU) and Times Higher Education—Impact Ranking (THE-IR) methodologies and the rankings were analyzed, as well as the Portuguese Higher Education Institutions under the framework of these both rankings. As a major result, it is possible to see that there are advantages for HEIs to be part of a ranking such as THE-WU or THE-IR if they want to promote themselves. Admission in a ranking will be both a challenge and a chance for the promotion of HEIs, which should always be considered while bearing in mind the limitations they present (e.g., lack of justification of the weightings of the 4 SDGs and the possible double counting of a publication in SDG 17 and another selected SDG, both in THE-IR.

Keywords Global Academic Rankings · Higher Education · Portuguese Higher Education Institutions · World University Ranking · Times Higher Education Impact Ranking · THE-WU · THE-IR

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1 Introduction

Global Academic Rankings exist for a long time and are having a greater impact on higher education institutions (HEIs). International university rankings are growing and becoming more specialized by focusing on research performance or institutional reputation. According to Hou and Jacob (2017, p. 29) "…world university rankings, (…), are considered by many to be a means of representing academic excellence and increasing prominence of HEIs in both local and global contexts".

Hazelkorn (2014) states that in order to gain more awareness and funding from various stakeholders, universities actively pursue higher rankings and engage in global ranking initiatives. As a result, international rankings are frequently seen as a tool of agenda setting (Lo, 2011) with soft power and an essential element of [the] status culture of higher education competitiveness (Marginson, 2014). Higher ranked HEIs typically benefit from greater visibility and opportunity both domestically and internationally (Hou and Jacob, 2017).

To increase their status in the most important global rankings, numerous higher education institutions all around the world are working to become "world-class" schools (Salmi, 2009). However, there is debate over the impact of these rankings on higher education (De Wit, 2017).

The methodological frameworks and metrics of the rankings are frequently criticized (Federkeil et al., 2012), nevertheless, many continue to use them as a tool for determining the degree of internationalization at specific higher education institutions (Hou & Jacob, 2017).

The main of this paper is to make a reflection on global academic rankings and understand the importance and impact they might have in HEIs, especially on the Portuguese institutions. It's relevant to comprehend if the participation in a ranking is seen as a challenge or a chance to HEIs.

This chapter presents the following sections: History and importance of University Rankings; Higher Education Major Global Rankings; Methodology; The Portuguese Higher Education Institutions versus the World University Ranking and the Times Higher Education Impact Ranking, and Final Considerations.

2 History and Importance of University Rankings

2.1 Brief University Ranking History

The United States Bureau of Education commissioner started releasing an annual report of statistics in 1870. Every year, the volume of data grew, and it progressively shifted toward a ranking by separating out a few universities. The Association of American Universities (MU) encouraged the bureau to create a classification once more in 1910 despite the fact that this process was discontinued in 1890. For a variety of reasons, Kendric Charles Babcock's classification scheme was unsuccessful as a

stratification and never progressed into an actual ranking (Stuart, 1995). This author also mentioned that the first true ranking, American Men of Science, based on the identification of famous scientists and the institutions from which they had received degrees or at which they were employed, was published in 1910 by psychologist James McKeen Cattell.

A period of high academic standards during the middle of the 1980s and the 1990s was marked by a focus on undergraduate education and some consideration of student outcomes. Initially, graduate student applications, state legislators, federal agencies, and higher education academics made up the audience for these rankings (Stuart, 1995).

Grewal et al. (2008) stated that nearly a century after they were first used, rankings achieved widespread acceptance in 1983 when U.S. News issued its first rankings of undergraduate academic quality based on a survey of university presidents. In 1987, U.S. News introduced the multidimensional system that is still in use today, combining more objective criteria with evaluations made by academic leaders of similar schools. The top 25 national universities and top 25 national colleges were ranked in the first U.S. News university ranking issue. The top 50 universities were included to U.S. News' rankings of the nation's universities in 1998. Three categories—national doctoral universities, regional master's universities, and colleges—were established by U.S. News for the 2004 ranking. The most recent edition—the 2006 issue—ranks 104 national liberal arts schools and 120 national doctorate universities.

In reality, every year since it started ranking schools and institutions, U.S. News has revised its methodology. U.S. News increased the weight for its graduation variable four times between 1991 and 1995. It added Alumni Satisfaction to its approach in 1993 and Value-Added in 1996. When scores were rounded off in 1997 to the nearest whole number, national universities had an average improvement of one full rank over their 1996 results. As a result of the adjustments U.S. News makes to its methodology each year, the rankings themselves vary, which generates news coverage, boosts magazine sales, and keeps college presidents, employees, alumni, students, and faculty wondering, "How did we do this year?" (Machung, 1998).

The four broad elements that make up the USN ranking are faculty resources, selectivity, placement, and reputation. Rankings have undergone minor alterations, but their fundamental structure has not changed. Selectivity (25%), placement (20%), faculty resources (15%), and reputation account for the remaining 40% of a school's final score. The score for each school is standardized to create the ranking. Then, these scores are weighted, added up, and rescaled so that the top institution receives a score of 100 and the other schools receive a portion of that score (USN, 2005).

Mentioning several authors Espeland and Sauder (2007) refer that since the late 1970s, a huge variety of quantitative performance indicators have proliferated, with rankings being only one example. Rankings are one example of the numerous attempts being made to control public institutions and increase public access to them (Espeland & Sauder, 2007).

Rankings provide a generalized account for interpreting behavior and defending judgments inside schools, and they assist to organize the "stock of knowledge" that

participants frequently employ. In general, rankings are reactive because they alter how people view events (Schutz, 1970 cited by Espeland & Sauder, 2007).

Although it seems that university officials occasionally criticize publicly released rankings, it is obvious that they view these rankings as open performance scorecards (Grewal et al., 2008).

When setting objectives, reviewing performance, assessing peers, admitting students, hiring teachers, distributing scholarships, conducting placement polls, implementing new initiatives, and developing budgets, administrators take rankings into account (Espeland & Sauder, 2007). Espeland and Sauder (2007) also refer that rankings are designed to reduce complex information; they represent judgments that render a substantial quantity of additional information—often qualitative knowledge that is difficult to translate into this form—inapplicable. Respondents frequently criticized rankings for oversimplifying school quality and omitting crucial elements including cost, social climate, teaching, scholarship, and location.

2.2 Importance of Rankings in Higher Education

According to Merisotis (2002)higher education institutions, enterprises, students, parents, and governments now have a greater stake in the "status" of certain universities, colleges, and other higher education entities due to the massification of higher education and its increasingly market-based orientation around the world. Over the past 20 years, higher education league tables and rankings have come from a variety of sources, including government agencies, professional organizations, and the private, media-based sector. Rankings, which classify universities according to criteria and dimensions considered relevant, have gained importance in the last decade (Cabello et al., 2019).

Higher education academic rankings are becoming increasingly common and well-known on the international, national, and local scenes, which makes their influence on institutional governance at universities and, more broadly, on the transnational governance of this level of education, unquestionable (Thiengo et al., 2018).

Rankings begin by providing a quick and straightforward comparison of national production and educational achievement across international borders. Second, rankings have developed into a crucial instrument for assessing quality and educational achievement by bringing attention to the traits and accomplishments of the world's top universities. This holds true for both countries and higher education institutions. Third, rankings are frequently understood as a measure of a country's global competitiveness due to the significance of higher education for social and economic progress and prosperity, especially in these challenging circumstances (Hazelkorn, 2019). Still according to the author, academics use rankings to enhance their own reputation and professional status, politicians frequently use rankings as a benchmark of their nation's strength and economic aspirations, universities use them to

help set and define targets that map their performance against various metrics, and students use them to aid in their decision-making about where to study.

Ranking position has a significant effect on an HEI's reputation because it can either increase domestic support for funding for higher education or, in the opposite scenario, contribute to (or even create) serious difficulties and anxiety within its most prestigious institutions. The institution may become a more desirable partner, place to study or work internationally, attracting and keeping research talent and financial resources for the partner university. Furthermore, it can facilitate the interchange of good governance practices by providing insightful comparisons with worldwide counterparts on a range of topics (Axel-Berg, 2018).

All Higher Education Institutions (HEIs) are impacted by the rankings because they draw attention to reputational inequalities, including those that were previously shielded by history, mission, or governance. Whether well positioned or not, with an international or regional focus, the HEI is constantly challenged to either maintain the position already attained or to achieve better placements, which prompts reflection on institutional policies and tangible or potential benefits for the core activities of the institutions (Cabello et al., 2019).

Hazelkorn (2013) refer that according to experts in higher education, rankings help institutions develop, preserve, or improve their reputation and profile on the national and international academic scene; they are used by high-achieving students to choose institutions, particularly for postgraduate studies; they have an impact on stakeholders' decisions regarding funding, sponsorship, and employee hiring; and they offer a variety of other advantages and benefits. Higher education rankings also encourage discussion on the caliber and effectiveness of colleges, and they have had a significant impact on society and the internationalization of institutions.

From the standpoint of public policy, academic rankings can inform nations about the relative performance of their higher education institutions on particular indicators, encouraging the allocation of resources to enhance those measured aspects that are interesting or important to the nation's progress and development. Rankings make an effort to condense institutional performance into a narrow range of criteria that are intended to evaluate the quality of institutions (Ganga-Contreras & Rodríguez-Ponce, 2018).

3 Higher Education Major Global Rankings

3.1 Major Global Rankings

According to the International Association of Universities, there are more than 16,000 HEIs in the world (IAU). With certain exceptions, rankings, however, often only disclose data for a small portion of this amount (e.g., QS publishes data for 700, and webometrics for over 2,000 HEIs). In spite of this, the media, university leaders,

other HE stakeholders, and politicians frequently highlight the accomplishments of the top 100. This corresponds to less than 1% of HEI globally (Hazelkorn, 2013).

The Shanghai Jiao Tong Academic Ranking of World Universities, which was released in 2003, and the Times Higher Education-QS University Ranking, which was released in 2004, both posed challenges to the perception of the reputation and excellence of European universities, particularly when compared to the goals of the Lisbon Strategy. The *Exzellenzinitiative* (Initiative for Excellence) was introduced by the German government a year later in June 2005. This was followed by a French Senate report that claimed its researchers were underutilized in favor of English-speaking institutions. A conference defending a new ranking by the EU was held in 2008 under the auspices of the French presidency of the European Commission. The European Union's document expresses the need to improve the performance and international competitiveness of European higher education institutions and raise the general quality of all levels of education and training within the EU (Hazelkorn, 2019).

Table 1 summarizes several global classifications.

The question then arises as to what the rankings measure. The rankings, despite the criticisms, are popular, apparently due to their simplicity. By analyzing them generically, it can be seen that they compare HEIs based on different criteria and indicators that are aggregated and translated into a score that is assigned to the institutions. Thus, the scores are listed according to a ranking table. This process ignores the fact that HEIs are complex organizations, grounded in very different national contexts, underpinned by different value systems, meeting the needs of demographically, ethnically and culturally diverse populations and responding to complex and challenging political-economic environments.

Hazelkorn (2019) has systematized what rankings measure and what they do not measure. According to this author rankings measure quantity and intensity as a proxy for quality, research, publications, student and faculty characteristics, internationalization and reputation. On the other hand, rankings do not measure the quality of research or teaching, impact of research on teaching, technology transfer or impact, regional or civic engagement and students experience.

3.2 The World University Ranking and the Times Higher Education Impact Ranking

Although the Times Higher Education World University Ranking (THE-WU) and the Times Higher Education Impact Ranking (THE-IR) are university rankings they have differences in terms of methodology and objectives that need to be noted. The various rankings are analyzed below, considering 2022 as the period of analysis.

Table 1 Global rankings

Global rankings	Origin date	Website
World's Best Colleges and Universities (US News Rankings)	Since **1983**	https://www.usnews.com/rankings
Academic Ranking of World Universities (ARWU) (Shanghai Jiao Tong University)	First published in June **2003** by the Center for World-Class Universities	https://www.shanghairanking.com/rankings/arwu/2022
Times Higher Education World University Rankings (THE-WUR)	Since **2004**	https://www.timeshighereducation.com/world-university-rankings
Webometrics Ranking of World Universities/ (Spanish National Research Council)	Started in **2004** and published twice a year	https://www.webometrics.info/en
QS World University Ranking	Launched in **2004** with annual publication	https://www.qs.com/rankings/
Performance Ranking of Scientific Papers for Research Universities/NTU Rankings	It was first published in **2007** by Higher Education Evaluation and Accreditation Council of Taiwan (HEEACT) on an annual basis	http://nturanking.csti.tw/
Leiden Ranking (Center for Science & Technology Studies, University of Leiden)	First edition was produced in **2007**	https://www.leidenranking.com/
SCImago Institutions Rankings	Since **2009**	https://www.scimagoir.com/
Round University Ranking	Since **2010**	https://roundranking.com/
U-Multirank (European Commission)	First U-Multirank ranking was the **2014** edition	https://www.umultirank.org/
Times Higher Education Impact Ranking (THE-IR)	First edition in **2019**	https://www.timeshighereducation.com/impactrankings

Source Own elaboration

The Times Higher Education World University Rankings 2022 are the largest and most diversified university rankings to date, including more than 1,600 universities from 99 nations and territories. According to THE-WU website the performance of an institution in four areas—teaching, research, knowledge transfer, and international outlook—is measured by the table's 13 meticulously calibrated performance indicators. Over 108 million citations from over 14.4 million research publications were analyzed for this year's ranking, which also includes survey responses from nearly 22,000 global experts. Overall, more than 2,100 institutions provided them with more than 430,000 datapoints. This year's league table, which is relied upon by students, professors, governments, and industry professionals everywhere,

shows how the Covid-19 pandemic has started to change the performance of higher education around the world.

Considering what is mentioned in the THE-IR website the Times Higher Education Impact Rankings are world performance charts that compare universities to the Sustainable Development Goals of the United Nations (SDGs). To enable thorough and impartial comparison across four major areas—research, stewardship, outreach, and teaching—we employ precisely calibrated indicators.

The fourth edition of the 2022 Impact Rankings features 1,406 universities from 106 countries and regions in the overall rating.

Higher education institutions submit their data for analysis according to the criteria measured by each ranking.

The Times Higher Education World University Rankings 2022 Methodology. There are five categories under which the performance metrics are broken down: teaching (learning environment), research (volume, income, and reputation), citations (research influence), international outlook (staff, students, and research), and industry income (knowledge transfer) (Table 2).

Table 2 Areas and performance indicators for THE-WU Ranking

Areas	Total (%)	Performance indicators	Weight (%)
Teaching | learning environment	**30**	Reputation Survey—Teaching Academic Staff-to-Student Ratio Doctorates Awarded/Undergraduate Degrees Awarded Doctorates Awarded/Academic Staff Institutional Income/Academic Staff	15.00 4.50 2.25 6.00 2.25
Research | volume, income, and reputation	**30**	Reputation Survey—Research Research Income/Academic Staff Publications/Staff (Academic Staff + Research Staff)	18.00 6.00 6.00
Citations | research influence	**30**	Field Weighted Citation Impact	30.00
International outlook | staff, students and research	**7.5**	Proportion of International Students Proportion of International Academic Staff International co-authorship (International Publications/Publications Total)	2.50 2.50 2.50
Industry income |knowledge transfer	**2.5**	Research income from industry & commerce/Academic Staff	2.50
		Total	**100**

Source Made by the authors, based on information obtained in https://www.timeshighereducation.com/world-university-rankings/world-university-rankings-2022-methodology

Here the subject tables use the same set of 13 performance indicators as the overall World University Rankings and combine their scores with those under the same five criteria: teaching; research; citations; international outlook; and industry income.

In the context of this ranking, the questions are adjusted in accordance with the subject in order to more accurately reflect the culture of research on each topic, reflecting various publishing habits. As an example, the editors give less weight to citations in articles in the arts and humanities, because the range of results extends significantly beyond periodicals reviewed by peers. As a result, the weight given to "citations: Influence of Research" is reduced by half, dropping from 30% in the overall classification to only 15% for the arts and humanities. Other research indicators, such as the Academic Reputation Inquiry, are given more weight. Likewise, they have increased the weighting assigned to the research influence in those fields where the vast majority of research outputs are published in journal articles and where there is a high degree of confidence in the strength of citation data (up to 35% for the physical, life sciences, psychology, and the clinical and health tables).

The Times Higher Education Impact Rankings 2022 Methodology. This ranking employs a complex technique made up of a variety of measures and composite indicators. The purpose of this ranking is to measure the contribution of universities against each of the 17 Sustainable Development Goals under the Agenda 2030 of the United Nations. "The methodology consists of a micro level (scores for each SDG) and a macro-level (creation of an overall score)" (Bautista-Puig et al., 2022, p. 215). Each SDG strives to capture the contribution of universities in four broad categories at the micro level: research, teaching, stewardship (universities serving as custodians of major resources, including both physical and human resources), and outreach (work that universities undertake with their local, regional, national and international communities). Each SDG is given a set of measurements in order to achieve this. Based on the characteristics and goals of each statistic, these metrics are divided into three groups: research metrics, continuous metrics, and evidence metrics (Table 1). While continuous and evidential metrics are produced from institutional data voluntarily and directly submitted by the HEIs to the ranking publisher, research metrics are derived from an external product (Scopus).

According to this layout, each SDG is divided into many measurement groups. Always included in the first group, research metrics account for 27% of the total SDG score. Each SDG affects the remaining groups, which are made up of continuous and evidence metrics. Each SDG receives a final score (ranging from 0 to 100) at the end. Only four SDGs are weighted to create the total score at the macro-level. The remaining three SDGs were chosen based on the top three SDGs for each university (26% each), with the exception of SDG17, which is measured for all institutions (22% of the overall score) (Table 3).

For the evaluation of the Evidence Metrics, it is used a straightforward calculation method. When a metric calls for evidence, a set of questions are posed, and points are given based on the responses. When evidence is presented, THE determine if the evidence fully, partially, or inadequately addresses the question. This receives one, fifty percent, or no points, respectively. Higher Education Institutions receive a score

Table 3 Areas and performance indicators for THE-IR

Metrics	Source	Score
Research (metrics that assess the impact and production of research)	Scopus	27%
Continuous (metrics that track data that fluctuate over time throughout a range)	Higher Education Institution	Variable
Evidence (Metrics that assess the availability of regulations or programs that demand supporting data)		3 points (max)

Source Made by the authors, based on information obtained in https://www.timeshighereducation.com/world-university-rankings/world-university-rankings-2022-methodology

of 0 for any metrics for which they are unable to provide data. Figure 1 presents the scheme for the evaluation of the evidence metrics.

Each SDG includes a number of distinct questions, therefore the range of scores may change. SDG 8's greatest possible score is 76.3, while SDG 4's highest possible score is 89.2, and its lowest possible score is 15 against 7.2 of SDG 8. Therefore, the scales are scored in order to get the overall rating, and the range for the totality of SDGs is 0–100. This influences the choice of the SDGs in which a university has excelled; hence, the three in which the scaled score for that university is highest were utilized. The university may not, however, be ranked first or have received the highest unscaled scores in all three of these categories.

To calculate the overall score the proportions of 22% for SDG 17 and 26% for each of the top three SDGs were assigned, as shown in Fig. 2.

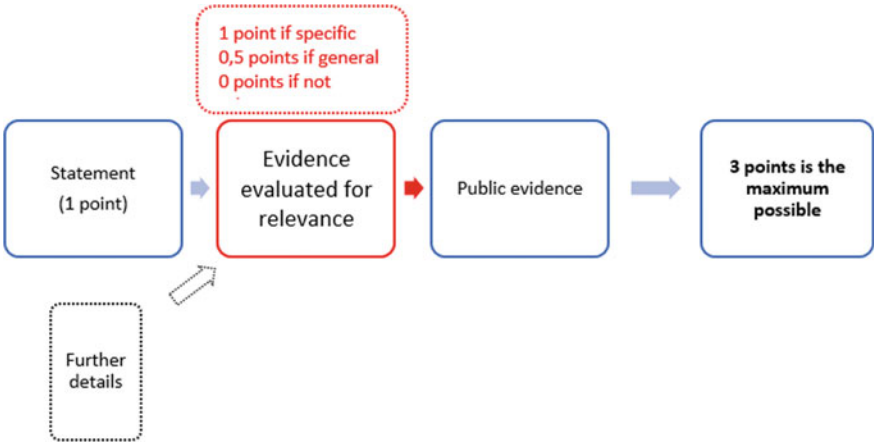

Fig. 1 Evaluation scheme of evidence metrics. *Source* Made by the authors, based on information obtained in https://www.timeshighereducation.com/world-university-rankings/world-university-rankings-2022-methodology

Fig. 2 Calculation of overall score. *Source* Made by the authors, based on information obtained in https://www.timeshighereducation.com/world-university-rankings/world-university-rankings-2022-methodology

The methodology used in this study will be presented in the next section, as well as the analysis of the Higher Education Institutions, in the light of the rankings presented in this section.

4 Methodology

The research is exploratory and documentary based on information from the THE ranking and on bibliography on the subject of higher education rankings. For this study, the institutions that have been represented in the THE Impact ranking in 2022 were selected. Thus, and to answer the research objective, the data presented in the THE World University Ranking was compared with the data of the THE Impact Ranking in this year regarding Portugal and the HEIs under analysis. Then, these institutions were analyzed, according to the indicators of both rankings.

Next, the literature and official documents of the institutions themselves were analyzed in order to identify possible political, social, and administrative factors determining the placement of the best HEIs in each of the selected indicators.

5 The Portuguese Higher Education Institutions Versus the World University Ranking and the Times Higher Education Impact Ranking

5.1 Results and Analysis

In 2022, the THE-WU ranking evaluated 2,112 universities in 99 countries and regions around the world and the THE-IR assessed 1,410 higher education institutions in 106 countries and regions. Universities submit their data for analysis according to the criteria measured by each ranking (Table 4).

Table 5 presents the Portuguese Higher Education Institutions that were analyzed by the ranking promoters in 2022, corresponding to around 0.7 and 0.9% of the total per each ranking, respectively.

As can be seen, the Portuguese HEIs registered in THE-WU do not correspond exactly to those in THE-IR; nor does there exist a correspondence between the

Table 4 Portuguese Higher Education Institutions in THE-WU and THE-IR

THE-WU		THE-IR	
HEIs	Score	HEIs	Score
Catholic University of Portugal	351–400	University of Coimbra	26
Nova University of Lisbon	401–500	University of Trás-os-Montes e Alto Douro	78
University of Porto	401–500	Nova University of Lisbon	101–200
University of Lisbon	501–600	University of Algarve	201–300
University of Beira Interior	601–800	University of Aveiro	201–300
University of Coimbra	601–800	University of Minho	201–300
ISCTE-University Institute of Lisbon	601–800	Catholic University of Portugal	301–400
University of Algarve	801–1000	University of Beira Interior	401–600
University of Aveiro	801–1000	ISCTE-University Institute of Lisbon	401–600
University of Minho	801–1000	Nursing School of Coimbra	401–600
University of Trás-o-Montes e Alto Douro	801–1000	Universidade Aberta	601–800
Polytechnic Institute of Porto	1001–1200	Escola Superior de Enfermagem do Porto	801–1000
Lusophone University of Humanities and Technologies	Reporter	Polytechnic Institute of Setúbal	801–1000
Polytechnic Institute of Setúbal	Reporter		

Source Made by the authors, based on information obtained in https://www.timeshighereducation.com/world-university-rankings/2022/ and https://www.timeshighereducation.com/impactrankings#!/

Table 5 Results of Portuguese Higher Education Institutions in THE-WU

Rank	Name of HEI	No. of FTE students	No. of students per staff	International students (%)	Female:Male ratio	Overall	Teaching	Research	Citations	Industry income	International outlook
351–400	Catholic University of Portugal	11,233	22.8	21	59:41	44.1–46.0	19.0	14.5	98.3	36.6	62.0
401–500	NOVA University of Lisbon	20,396	17.9	21	51:49	40.9–44.0	25.3	29.5	70.4	49.7	63.6
601–800	University of Beira Interior	7,417	16.2	20	52:48	32.0–37.9	18.6	19.6	52.6	37.5	57.4
601–800	University of Coimbra	21,845	18.4	20	57:43	32.0–37.9	24.5	32.0	45.4	47.0	60.0
601–800	ISCTE-University Institute of Lisbon	9,118	23.0	15	51:49	32.0–37.9	27.8	28.8	39.6	40.8	53.8
801–1000	University of Algarve	8,264	13.7	21	57:43	27.2–31.9	17.4	16.1	40.3	36.1	68.1
801–1000	University of Aveiro	12,068	14.8	10	53:47	27.2–31.9	23.3	23.8	42.4	37.5	50.0
801–1000	University of Minho	19,246	19.0	15	55:45	27.2–31.9	24.0	22.8	38.6	52.3	57.1
801–1000	University of Trás-os-Montes and Alto Douro	6,687	11.5	6	57:43	27.2–31.9	20.6	28.1	33.6	34.8	43.4
Reporter	Polytechnic Institute of Setúbal	7,346	16.8	7	44:56	N/a	N/a	N/a	N/a	N/a	N/a

Source Made by the authors, based on information obtained in https://www.timeshighereducation.com/world-university-rankings/2022/

positions of the same institution in one ranking and in the other. In both there are 10 common HEIs that belong to the Portuguese university and polytechnic education system. As regards to these 10, the results of the rankings obtained in 2022 are presented in Tables 5 and 6.

Catholic University of Portugal is the best ranked in THE-WU, but is ranked 7th in THE-IR out of the 10 selected institutions. In last place in both rankings is the Polytechnic Institute of Setúbal. In THE-WU, regarding the "Teaching" pillar, the best ranked institution is ISCTE, with 27.8. Regarding "Research", the best ranked institution is the University of Coimbra with 32.0 points. In the "Citations" pillar, with 98.3 points, the Catholic University of Portugal is again the top ranked institution. In the area of "Industry Income" the University of Minho leads with 52.3. The University of Algarve leads the ranking in the "International Outlook" pillar with 68.1 points.

The five pillars that are the basis for the evaluation and classification of the institutions have different and sometimes quite distinct scores among Portuguese institutions. Table 7 shows the maximum and minimum values for each pillar and the respective institution.

From the 10 HEIs previously selected, the following information can be obtained. The Catholic University of Portugal manages to have the maximum score in the area of "Citations", but also manages to have the lowest value of all institutions in the area of "Research" with only 14.5 points. Nevertheless, it is the first Portuguese HEI in the ranking. The University of Algarve manages to have a similar situation to the previous one, but in the pillars of "International Outlook" with a maximum of 68.1 points and a minimum of 17.4 in the area of "Teaching". This institution is in 8th place among the Portuguese HEIs in the ranking. Curiously, the University of Trás-os-Montes e Alto Douro, among the Portuguese HEIs, has the lowest values in the areas of "Citations", "Industrial Income" and "International Outlook", and is in 11th position among the Portuguese HEIs.

Table 8 presents the statistical values of some key elements of each HEI, namely the number of FTE students, the number of students per staff, the percentage of international students, and the Female:Male ratio.

As for the statistical elements, the University of Coimbra stands out with 21.845 FTE students, as the maximum value among the 10 Portuguese HEIs and 6.687 for the University of Trás-os-Montes e Alto Douro. As for the number of students per staff, the maximum number is 23.0 for ISCTE—University Institute of Lisbon and 11.5 for the University of Trás-os-Montes e Alto Douro. Between 20 and 21% of international students are the Universities of Beira Interior and Coimbra and the Universities Catholic of Portugal, NOVA of Lisbon, and Algarve. With the lowest value of 6%, it is once again the University of Trás-os-Montes e Alto Douro. As for the Female:Male ratio, the HEIs with the most balanced figures are NOVA University of Lisbon and ISCTE-University Institute of Lisbon with 51:49. With the exception of Polytechnic Institute of Setúbal with a ratio of 44:56, all the other Portuguese HEIs have a ratio in which the number of women in the institution exceeds the number of men.

Table 6 Results of Portuguese Higher Education Institutions in THE-IR

Rank	Name	SDG	Best scores by rank	Overall
26	University of Coimbra	9	99.9	94.1
		2	85.6	
		11	85.5	
		17	92.6	
78	University of Trás-os-Montes and Alto Douro	15	95.1	89.9
		2	82.0	
		6	79.0	
		17	83.1–90.6	
101–200	NOVA University of Lisbon	9	90.8	82.1–88.5
		5	73.0	
		16	71.3–78.4	
		17	92.4	
201–300	University of Algarve	5	70.5	76.9–82.0
		16	79.5	
		7	70.6	
		17	70.3–76.6	
201–300	University of Aveiro	11	69.2–78.6	76.9–82.0
		1	75.5	
		13	69.8	
		17	76.7–83.0	
201–300	University of Minho	9	98.0	76.9–82.0
		5	59.6–65.9	
		4	67.7–73.1	
		17	58.8–70.2	
301–400	Catholic University of Portugal	16	90.2	72.0–76.7
		11	60.1–68.9	
		3	53.3–63.6	
		17	58.8–70.2	
401–600	University of Beira Interior	3	73.9–79.6	65.0–71.9
		12	54.0–64.2	
		11	60.1–68.9	
		17	76.7–83.0	
401–600	ISCTE-University Institute of Lisbon	10	62.5–72.5	65.0–71.9
		4	58.1–61.9	
		5	53.5–59.5	
		17	70.3–76.6	

(continued)

Table 6 (continued)

Rank	Name	SDG	Best scores by rank	Overall
801–1000	Polytechnic Institute of Setúbal	4	58.1–61.9	50.3–57.2
		5	48.4–53.4	
		3	41.5–53.2	
		17	50.2–58.7	

Source Made by the authors, based on information obtained in https://www.timeshighereducation.com/impactrankings#!/

Table 7 Maximum and minimum results of Portuguese Higher Education Institutions in THE-WU per area

Rank	Name of HEI	Overall	Teaching	Research	Citations	Industry income	International outlook
351–400	Catholic University of Portugal	44.1–46.0	19.0	14.5	98.3	36.6	62.0
601–800	University of Coimbra	32.0–37.9	24.5	32.0	45.4	47.0	60.0
601–800	ISCTE-University Institute of Lisbon	32.0–37.9	27.8	28.8	39.6	40.8	53.8
801–1000	University of Algarve	27.2–31.9	17.4	16.1	40.3	36.1	68.1
801–1000	University of Minho	27.2–31.9	24.0	22.8	38.6	52.3	57.1
801–1000	University of Trás-os-Montes and Alto Douro	27.2–31.9	20.6	28.1	33.6	34.8	43.4

Source Made by the authors, based on information obtained in https://www.timeshighereducation.com/world-university-rankings/2022/

THE-IR has to do with assessing the HEIs' impact on the 17 United Nations Sustainable Development Goals. Analyzing Table 7 that presents the Portuguese HEIs that had their application for this ranking approved, it can be seen that the best classified HEIs are the University of Coimbra, which is in 26th position in the ranking with a global score of 94.1 points and the University of Trás-os-Montes e Alto Douro, in 78th position with a score of 89.9.

As a result of the rules established by the editors of THE-IR, only SDG 17 (Partnerships for the Goals) is mandatory for all applicant HEIs. Thus, the remaining 3 SDGs per institution are variable. The sustainability focus of the University of Coimbra is on promoting zero hunger (SDG 2), industry, innovation and infrastructure (SDG 9) and sustainable cities and communities (SDG 11). The University of Trás-os-Montes e Alto Douro focuses its sustainability needs on zero hunger (SDG 2), clean water and sanitation (SDG 6), and life on land (SDG 15). NOVA University of Lisbon intends to present itself as sustainable in the areas of gender equality

Table 8 Key Statistics of Portuguese Higher Education Institutions in THE-WU

Rank	Name of HEI	No. of FTE students[1]	No. of students per staff	International students (%)	Female:Male ratio	Overall
351–400	Catholic University of Portugal	11,233	22.8	21	59:41	44.1–46.0
401–500	NOVA University of Lisbon	20,396	17.9	21	51:49	40.9–44.0
601–800	University of Beira Interior	7,417	16.2	20	52:48	32.0–37.9
601–800	University of Coimbra	21,845	18.4	20	57:43	32.0–37.9
601–800	ISCTE-University Institute of Lisbon	9,118	23.0	15	51:49	32.0–37.9
801–1000	University of Algarve	8,264	13.7	21	57:43	27.2–31.9
801–1000	University of Aveiro	12,068	14.8	10	53:47	27.2–31.9
801–1000	University of Minho	19,246	19.0	15	55:45	27.2–31.9
801–1000	University of Trás-os-Montes and Alto Douro	6,687	11.5	6	57:43	27.2–31.9
Reporter	Polytechnic Institute of Setúbal	7,346	16.8	7	44:56	N/a

Source Made by the authors, based on information obtained in https://www.timeshighereducation.com/world-university-rankings/2022/

(SDG 5), industry, innovation, and infrastructure (SDG 9), and peace, justice, and strong institutions (SDG 16). The only difference between the University of Algarve and NOVA University of Lisbon is to focus on affordable and clean energy (SDG 7) instead of industry, innovation, and infrastructure (SDG 9). The University of Minho, in relation to NOVA University of Lisbon, instead of focusing on peace, justice, and strong institutions (SDG 16), focuses on quality education (SDG 4). The University of Aveiro is sustainable in no poverty (SDG 1), sustainable cities and communities (SDG 11), and climate action (SDG 13). Catholic University of Portugal shows to be sustainable in the following areas: good health and well-being (SDG 3), sustainable cities and communities (SDG 11), and peace, justice, and strong institutions (SDG 16). University of Beira Interior only differs in relation to Catholic University of

[1] FTE student: At the tertiary level, an individual is considered full-time if he or she is taking a course load or educational program considered requiring at least 75 per cent of a full-time commitment of time and resources. Additionally, it is expected that the student will remain in the program for the entire year (Education at a Glance, OECD, Paris, 2002, Glossary).

Portugal in SDG 16 since it shows to be sustainable in SDG 12 regarding responsible consumption and production. ISCTE-University Institute of Lisbon and Polytechnic Institute of Setúbal show to be more sustainable in quality education (SDG 4) and gender equality (SDG 5), differing in SDG 10 reduced inequalities and in SDG 3 good health and well-being, respectively.

Having presented the THE-WU and THE-IR rankings, the results and the analysis of the Portuguese HEIs in these rankings, are going to be discuss in the next section.

5.2 Discussion

It is through accreditation, control, and quality assurance processes, in addition to the certification that an educational institution presents acceptable standards, that there is a need for the creation of supranational accreditation systems. Among several national structures associated with these processes, the Agency for Assessment and Accreditation of Higher Education (A3ES) emerges in Portugal, by force of the Decree-Law No. 369/2007, of 5 of November, created with the purpose of promoting and ensuring the quality of higher education, as well as monitoring the development of the systems associated to quality assurance. The Agency's mission is to ensure the quality of higher education in Portugal, through the assessment and accreditation of higher education institutions and their study cycles, as well as performing the functions inherent to the insertion of Portugal in the European higher education quality assurance system.

Even though there are more objective and standardized tools for quality assessment, such as ISO 9001:2015, from the perspective of system quality management, the European Foundation for Quality Management (EFQM) or the Common Assessment Framework (CAF), the rankings continue to be widely used by HEIs as a way of presenting themselves and their qualification's quality in international terms. Although they can be criticized in terms of the criteria they present, the evidence required for validation, and the weightings chosen by the editors, the rankings continue to be quite popular among HEIs from the most varied countries, as can be seen by the number of HEIs registered both in THE-WU and in THE-IR.

It is highlighted again that THE-IR is the first ranking worldwide, which values the contribution of HEIs to the SDGs, in an attempt to measure Sustainable Development. However, as stated, it is not absent of criticism.

The analysis indicated discrepancies in the weight distribution and their suitability to the research measures employed, which may jeopardize their alignment with the anticipated contributions to the SDGs. On the other side, the lack of a methodological design that results in a reliable categorization structure increases unfavorable effects including getting inconsistent results, making less wise decisions, and sometimes engaging in opportunism (Bautista-Puig et al., 2022).

The facts presented justify that it is not possible to repeat the final assessment of each SDG and that the final scores and ranking positions should be interpreted under this circumstance. The condition of a minimum data provision to be integrated into

the ranking cannot be an admissible option, since the 2030 Agenda has an integrative and one-size-fits-all nature. Thus, it might be useful to consider increasing the number of mandatory SDGs in order to provide greater stability and consistency in future editions of this Impact Ranking. Another option could be to make it mandatory to submit an application where all 17 SDGs are considered. HEIs would then present the evidence they had and all SDGs would be assessed, making the comparability between institutions congruent in the respective SDGs.

It is difficult to understand how HEIs can be compared and ranked when the SDGs submitted are completely different, with the exception of SDG 17. Another question is how institutions that submit the minimum application can be compared with others that submit an application with more SDGs.

According to Bautista-Puig et al. (2022) each of the four SDGs has been given a weight, but these weights are arbitrary and not formally justified. It is unjustified for SDG17 to have a higher weight in the final score because it is a more general and contentious goal. These arbitrary weights violate Berlin Principle 9 of the Berlin Principles on Ranking Higher Education Institutions, which specifies that make the weights assigned to distinct indicators [if applied] conspicuous and limit changes to them. Other issues raised by the authors refer that given the wide variety of results for the four SDGs taken into consideration, it is unclear how the overall score is determined. Another contention point is introduced by the variety of measures used to assess each SDG. The score for each SDG combines metrics measuring "the sustainability of the university as a whole institution" and indicators measuring "research on topics related to the sustainable development objectives." Furthermore, just because one university conducts research on subjects connected to those objectives does not mean that the researchers there are necessarily aiding in the implementation of the SDGs or doing sustainable work.

Data ranges for a significant number of universities are included in the final scores. While the use of ranges is generally a good idea to reduce the use of inflexible scores and to tolerate margins of data error, using ranges that are too wide can have other unintended consequences. Bautista-Puig et al. (2022) give the example of the THE-IR's 2021 edition that reveals 103 universities with an overall score of 9.2–36.4, which the authors consider that makes the indicated value useless.

With the exception of SDG 17, all the other SDGs include an indicator related to productivity namely Publications, which, according to Iskandaryan (2020), are tailored to each SDG using topic-based surveys in Scopus.

Each SDG (from 1 to 16) includes a productivity indicator (referred to as Publications in Table 1), which is tailored in each SDG by using topic-based queries in Scopus (Iskandaryan, 2020). Although this strategy is topic-sensitive and indicates a significant effort, Armitage et al. (2020) defend that using Scopus queries could spark debate because various query strategies can change the final national rankings. It should be noted that SDG17 includes both this indicator and all publications, despite of the topic, therefore as a result, it can be possible for the same publication to be measured against at least two SDGs (Bautista-Puig et al., 2022). Additionally, these authors refer to the size of the university is not taken into account to normalize this indicator.

Beyond research measures, inconsistencies revealed provide additional insights that reinforce Gadd's work (2022), demonstrating that the absence of a reliable ranking system (methodological design) may have unfavorable effects (unrealistic results, incorrect decision-making, and opportunistic behaviors).

The application to the THE-IR is voluntary-based so all applicants are admitted if they correspond to the minimum required for admission. On the other hand, not all applicants are admitted to the THE-WU since the criteria for admission are based on performance. Therefore, several HEIs might not correspond to the minimum standards.

Gadd (2021) enumerates the four main problems concerning the construction of global academic rankings, on which THE-WU is included, namely:

- the indicators they choose are a weak substitute for the topic they are trying to assess (for instance, using staff-to-student ratios as a substitute for teaching effectiveness).
- they are not evaluating topics that are fundamental of the work produced by all universities (societal impacts are not captured at all).
- they greatly favor the global north in their choice of data sources.
- they frequently conduct poor reputation-based opinion surveys. The worst part is that they use arbitrary weightings to combine the indicators, meaning that even a small change might have a big effect on a university's ranking.

THE-WU among other rankings, including Academic Ranking of World Universities (ARWU) and QS World University Ranking, believe that they can identify the "top" universities (despite using different methods for reaching their different conclusions). However, none of these well-known rankings specifically state what their "best" universities are supposed to be top at, considering the wide global existing variety of higher education institutions. The 'top' universities are, in reality, mostly distinguished by their age, size, richness, English-speaking institution, emphasis on research, and geographic location, especially in the global north (Gadd, 2021).

Considering the universe of Portuguese HEIs, 99, according to information from the Direção-Geral do Ensino Superior,[2] there are really very few those that are present in both rankings.

The challenge to integrate these academic rankings seems to be enormous for Portuguese HEIs. The reduced number of Portuguese institutions in the THE-WU and THE-IR rankings leads to an understanding that it seems to be more of an opportunity than a challenge to present themselves in a competitive way in the international market. When the participation of Portuguese HEIs in both rankings is verified, it is not clear whether or not there was any alignment between the two applications. Considering the data presented by the rankings, the participation of the HEIs in only one of these rankings does not allow us to assess whether the application was presented to the other or whether, if it was, it was not approved.

[2] Portuguese Higher Education in Numbers: https://www.dges.gov.pt/pt/pagina/ensino-superior-em-numeros?plid=371.

Although the year 2022 was evaluated, the fact is that in the case of THE-IR there is no consistency on the part of HEIs in the presentation of SDGs from one year to another. This fact leads to the fact that in different years the SDGs are different and their position in the ranking may vary radically. As an example, ISCTE-University Institute of Lisbon, which has been presented in this ranking since 2019, and not exactly with the same SDGs (except for SDG 17), appears in 2019 and 2021 in position 201–300, in 2020 in position 301–400 and in 2022 in position 401–600. Upon reflection, the analysis of the positions of HEIs in the rankings should be made taking into account the observations already presented and the criticisms of the various authors.

Although there is a widespread concern about sustainability, the several stakeholders (leaders, faculty, staff, students, and external stakeholders), according to the results obtained in the study by Aleixo et al. (2018) suggest that, although they are aware of the concept of sustainability, they are not familiar with the concept of sustainable higher education institutions. The integration of Portuguese HEIs in Education for Sustainable Development (ESD) varies considerably and some of these institutions are already looking more into the SDGs to develop a Sustainable Development culture (Aleixo et al., 2020). To these authors (2020, p. 348) "Sustainability is a new political agenda, but it is also crucial for all institutions to fulfill their responsibility to promote proactive dynamics between institutions, agents and individuals". This study offers insight into how the SDGs have been implemented in HEIs and emphasizes how urgent curriculum reform is for a sustainable society. The SDGs and the 2030 Agenda provide a framework for HEIs to collaborate on curricula and other Sustainable Development-related projects.

A study carried out by Farinha et al. (2019) showed that universities implemented sustainability through actions that were often not exclusive to a single institution. The authors analyzed one hundred and thirty-nine documents from fourteen universities, concerning the period 2005–2014, for a better understanding of the progress regarding ESD implementation in Portuguese public universities and to find the main commitments and practices. In the period 2004–2015 it could seem that HEIs would not be committed to sustainability, however, the implementation of sustainable actions in public universities was found in the documentation. Nevertheless, results demonstrate that the movement has advanced at the university level, with positive examples and projects at some Portuguese universities, despite the lack of sufficient national combined ESD strategies or policies. Currently, and with greater awareness of the need for greater sustainability at various levels, HEIs have adopted practices and measures leading to greater sustainability regardless of the area (economic, environmental, or social), converging toward an effective contribution to the 2030 Agenda and the SDGs.

These facts could be enhancing factors for the promotion of the HEIs themselves regarding their sustainability, and the admission in a ranking can make the difference at the time of being chosen by a stakeholder (student, employer, etc.). The promotion of HEI may be the reason why they apply for the rankings. Rankings are therefore, an opportunity and also a challenge for HEIs, and the Portuguese HEIs were no exception.

6 Final Considerations

Although independent, the THE-WU and THE-IR rankings should be complementary given the current and general sustainability needs of organizations, and HEIs are no exception. Increasingly, this sustainability factor is something students look for when selecting a higher education institution. Environmental, as well as social and economic issues are more pressing and it is urgent to find a path that leads to a legacy of quality for the following generations, leaving no one behind.

Both rankings are subject to criticism that should be seen in their respective contexts.

Although the rankings have limitations such as those presented in this work, they are an essential tool for HEIs to present themselves and demonstrate some of their characteristics and capacities to attract more and better students and to retain or keep the best talent. Employers, parents, society, and other stakeholders are also increasingly awake and aware of realities such as the planet's sustainability, of which HEIs are part, having an increasingly relevant role in preparing future generations and modernizing and updating current ones.

Universities are much more than what the rankings show, but not participating in them could be harmful to the HEIs since they are the most visible mirror and an advertising medium already quite rooted at a global level. It is through the rankings that the most varied stakeholders (students, employers, entrepreneurs, society in general, among others) seek information about the institutions.

Several Portuguese HEIs already participate in the rankings and what can be seen, especially in the THE-IR, is that the ranking seems more like a promotional and marketing channel than an effective presentation of the sustainability they seem to have. The weights assigned to the defined criteria are not justified, nor is the reason why only 4 SDGs are presented, with SDG 17 being the only mandatory objective common to all HEIs in the ranking. It is also not fully justified how the comparison is made between HEIs that present SDGs that are completely different from each other. The fact that there are scientific publications addressing the topic of the SDGs is counted for the definition of the HEI ranking, and may be counted twice (in SDG 17 and in another specific SDG), biasing the data. On the other hand, the fact that the publication relates to a particular SDG is not in itself a guarantee of any contribution to the SDG in question or to the sustainability of the HEI.

There is no justification for the key statistics of the HEIs presented by THE-WU, which makes it impossible to know for what purposes they are mentioned and the possible influence on the institution's position in the ranking.

From all the analysis carried out, and due to the fact that HEIs are much more than what the rankings reflect, these should be seen within the scope of the very contexts of promotion and not in terms of the quality of the courses and training they offer, the quality of the teaching staff, research practices, technology transfer to society and added value achieved, excellence of research centers, real contribution to sustainable development through student training and development actions for the society in which it is inserted, among others. To assess the quality of higher education and the

respective institutions there are other more consistent and more congruent tools that allow the quality assessment in the various dimensions that define the three pillars of higher education (teaching, research and extension). To measure the true quality of HEIs we can use tools such as the EFQM, ISO 9001:2015 or even the CAF, and institutions such as A3ES in Portugal that will give a real image of what the real institution is and of its valences and activities.

Having said this, we can finally conclude that there are advantages for HEIs to be part of a ranking such as THE-WU or THE-IR if they want to promote themselves and if they consider that the effort invested in the preparation of the application has a return in terms of an increase in the number of students, better teaching staff, retention and attraction of internationally renowned researchers, etc. Consequently, which should always be considered while bearing in mind the limitations they present, the admission in a ranking will be both a challenge and a chance for the promotion of HEIs.

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UMinho's Seven Guiding Principles for Sustainability Strategies—*A Critical Assessment*

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Abstract The University of Minho, in 2009, published her first sustainability report. It was, at the time, the first Portuguese University to do so. This publication grew out of a voluntary and informal group of faculty members from diverse scientific areas. The commitment with sustainability reporting, and most fundamentally to the sustainability quest, was constant until 2017. During these 9 years UMinho's public report on sustainability, based on the Global Report Initiative, was deepened, translating a wider perspective on sustainability, and the development of institutional procedures for information provision. Since there was a change in the methodology for sustainability reporting in 2016, the questions that arises are "how did the seven guiding principles, based on the 2009–2017 period, evolved in UMinho's sustainability policies" and "whether or not these same principles were included in other sustainability strategies case studies".

1 Introduction

Although sustainability is increasingly proving to be a subject of enormous interest, the incorporation of sustainability values and the path to practice is diverse and depends on individual choices and institutions strategies. Thus, the options and experiences that have been followed and tested by front runners have served as a primary influence to other institutions, which follow, adapt and transform them, promoting a virtuous circle of knowledge that can promote faster incorporation of sustainability values.

In Portugal, the University of Minho (UMinho), a Higher Education Institution, was the first to implement a sustainable strategy at the university level and to, since 2010, publicly report its sustainability indicators separately in a report.

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The Minho's experience, through its Sustainability Strategy between 2009 and 2017, led to the proposal of a framework based on *Seven Guiding Principles for the implementation of Sustainable Strategies* and related policies, that were presented and described by Ramísio et al. (2019).

This chapter intends to critically assess the implementation of sustainability policies in UMinho between 2017 and 2021 and is structured in 7 sections. Following this introduction, a revision of the actions prior to 2017 is presented together with a review of the seven guiding principles for the implementation of sustainability strategies derived in Ramísio et al. (2019). Next, the state of sustainability actions and reporting in the UMinho and in the literature is critically assessed. To finalize a comparison between the application of the seven guiding principles at UMinho and in the reviewed literature is provided. The chapter concludes with the formulation of recommendations for the future development of sustainability strategies in HEIs.

2 UMinho's Sustainability Strategies (2009–2017)

The University of Minho, that was founded in 1973, has the mission "*to generate, disseminate and apply knowledge, based on freedom of thought and plurality of critical thinking, promoting higher education and contributing to the construction of a model of society based on humanistic principles that has knowledge, creativity and innovation as keys to growth, sustainable development, well-being and solidarity*".

The University governance is based on the principles of participation, democracy, decentralization, autonomy and public accountability. The bodies that are responsible for the strategic analysis and decisions, and the management of the university are the General Council, the Rector and a Financial Board.

The Rector and the General Council are supported in the performance of their duties by the Academic Senate and the Cultural Council, which are consultation bodies of the University, responsible for issuing opinions in accordance with the current statutes.

The university's mission is accomplished by four types of differentiated units, that have their unique objectives, structure, nature and degree of autonomy. Each unit has their own managing board and personnel, through which the university affirms its mission in a certain area of knowledge.

While research units, and teaching & research units, embrace the interaction between higher education and the creation and spread of new knowledge, cultural units promote the cultural legacy as an interdisciplinary and inclusive vector. Service units provide a transversal support to the previous units, and to all other stakeholders.

There are 12 organic teaching and research units, consisting of 9 schools and 3 institutes: Architecture, Art and Design; Arts and Humanities; Economics and Management; Education; Engineering; Law; Medicine; Nursing; Psychology; Sciences; and Social Sciences.

UMinho 2009–2017 Strategic Plan

The development of UMinho's mission is based on a strategic medium-term plan, elaborated by the Rectorate, that proposes a Comprehensive and Inclusive university, providing integral education and excellence in research, interacting with society, through participative and decentralized decision processes, through the efficient and effective use of resources, toward the construction of a Sustainable and Internationalized university.

These strategic goals were sustained by two short-term complementary action plans.

UMinho 2009–2013 Action Plan

The 2009–2013 action plan was based on both strategic and structural challenges, and additional conjunctural challenges, that were based on a hierarchical operational program, aimed at directing and mobilizing UMinho around seven strategic vectors.

The first three vectors aimed to mobilize the academic community around UMinho's mission, by focusing on research, education and interaction with surrounding society.

The harmonious and sustained development of the University was addressed by other four vectors. These vectors aimed to improve the organizational environment and the working conditions, by strengthening quality assessment and management, promoting academic ethics, promoting decentralized management and ensuring financial balance, but also assuming sustainable options and practices.

This last supporting vector was the trigger for the implementation of a sustainable oriented strategy, by focusing on sustainability criteria and good practices as a reference for campi life, as part of the University's policies, for students, teachers, researchers and staff.

The initial objectives were to increase the quality of life in the campi, and to start promoting a culture of sustainability. The starting point was to evaluate the university infrastructures, and associated fluxes, that are transversal to all, and to collect environmental and operational information, that would support and integrate future actions.

At this stage, the plan implementation followed a top-down approach, as centralized interventions, leaded by the Rectorate, demonstrating their interest and engagement.

UMinho 2013–2017 Action Plan

This new action plan build on previous experience and results. Also, and from a organizational point of view, an institutional commitment to Sustainability was established by designating, for the first time, a member of the Rectors team for "Infrastructures and Sustainability", which was responsible for the management of the investment plan, the coordination of Sustainable Policies, and to improve working conditions and quality of life at UMinho's campi.

This plan widened the previous scope in the areas of health and safety, and new infrastructures based on sustainability policies and actions. The defined targets aimed simultaneously to develop a built-in and built-on strategy for teaching, to reinforce research in the area of sustainability, and to value knowledge.

While the first plan was centered at improving the quality of life on campi, by improving comfort, environment and working conditions, the second Action Plan scaled the ambition and scope, proposing a sustainable university that contributes to smart growth and global challenges. The target vectors were included in this strategy, by promoting differentiating teaching, strengthening research and valuing knowledge.

The goals promoted by this last plan depended on the broader mobilization of the academic community and diversifying funding sources, which constituted two strategic vectors that needed local and global interaction.

The development of all these vectors presupposed the continuous adaptation of campi infrastructures and the progressive improvement of the services and institutions that depend on a supporting vector: Live and work on the campi.

3 UMinho's Seven Guiding Principles for Sustainability Strategies

Based on the experience of the 2009–2017 strategic medium-term plan, and the results on the implementation of the short-term action plans for the 2009–2013 and 2013–2017 periods, the seven guiding principles that supported the university strategy, were discussed and presented, and can be resumed as:

Principle 1 Mixed Bottom-Up and Top-Down management model

The implementation of top-down initiatives demonstrated to promote the kind of leadership that is fundamental to synergize the entire academic community and to promote an integrated strategy. But, as soon as sufficient critical mass was developed, or adequate financial conditions were met, individual or group initiatives should be encouraged, under the aggregation and support of the Rectorate, that coordinate sustainable policies, and support the integration of sustainability practices in mission and support areas, reinforcing the strategic relevance of sustainability.

Therefore, a transition from a Top-Down initial approach to the promotion of Bottom-up initiatives, under an integrated management for the entire academy ensured not only the implementation of sustainability actions, but also the implementation of the Institutional Investment Plan.

Principle 2 Transversality of all sustainability policies

Since sustainability is a strategic vector that supports all the University mission areas, it should be included and linked through all programs and actions. The process should start with common denominators, to support the integration of different academic cultures and areas of knowledge.

Principle 3 Specific programs focused on the efficient use of resources

Common infrastructures and services demonstrated to be an inclusive and integrated platform to bring together all stakeholders under the same objective. The optimization and rationalization of resources and the implementation of efficiency

measures also provided significant impacts at the economic, social, cultural and environmental levels, that were understood by all. Due to their importance, these actions started by focusing on strategic resources: energy, water, paper and ink cartridges.

Principle 4 Continuous monitoring and communication

The elaboration of an Institutional Sustainability Report served not only as a public statement of the universities compromise to sustainable actions, but also as an internal tool to monitor performance and progress, from an economic, environmental social and cultural point of view. Through this report, the academic community was able to link their behavioral changes to the results obtained.

Principle 5 Integration of collaborative networks

Being part of international reference sustainability networks is of strategic importance, since it represents a platform to share information, and to learn from different experiences and realities, acquiring knowledge on new perspectives or trends. These networks induce the aggregation of "local reference nodes" in a "global network" that is formed under sustainability.

Principle 6 Commitment to stakeholders

The path to sustainability has to be built on a common ground. Listening to the entire community demonstrated not only to enrich the managements vision, but and powerful instrument to align and prioritize actions and investments, bringing the institution managers close to stakeholders desires.

Principle 7 Institutionalization of the sustainable policies

The institutions commitment to sustainability must be present in strategic documents, and the sustainability strategy should be leaded by a "champion". This institutionalization allows to increase the resilience to internal and external changes. Also, decentralized actions push the managements actions and centralized leadership synergizes collaboration between stakeholders and promotes coordinated actions.

4 The Seven Guiding Principles: Internal Evolution (2017–2021)

The main purpose of this section is to present the sustainability strategy implemented in UMinho in this period, and analyze associated action plans, in order to identify which sustainability indicators are considered an to evaluate observed changes. The methodology is therefore dependent on the study of these documents, and presented indicators.

UMinho 2017–2021 Action Plan

Under the terms of the 2017–2021 Action Plan, the fulfillment of the University's mission is carried out within an international framework of reference, through the pursuit of four strategic priorities:

- On **Education**—to provide high quality higher education, deepening the nature of UMinho as a "complete university", through innovative and socially relevant projects, in a wide number of training areas, in different training modalities and methodologies, oriented toward different audiences;
- In the area of **Research and Innovation**—to consolidate the scientific research carried out at UMinho in the national and international panorama, ensuring its excellence, impact and openness and making quantitative and qualitative progress in the results of its activity in all areas in which it operates;
- Regarding **Interaction with Society**—to actively participate in the cultural, social, economic development of people, territories and the country, valuing talent and contributing to the construction of a more developed, fairer and more sustainable society;
- On **Internationalization**—to deepen its quality, reinforcing UMinho's presence in international networks, consolidating strategic partnerships and intensifying its activity, especially within the framework of the European Higher Education Area (EHEA).

The success on these priorities depends on the configuration of the areas that frame the University's mission, for which **strategic priorities** are also established:

- **Institutional Quality** promotes new guidelines, devices, initiatives and methodologies relating to the institution's organization and management, combating bureaucratizing practices;
- **Quality of Life on campi and Infrastructures**, making UMinho's campi as places of well-being, assuming the values of inclusion and environmental and energy sustainability as priorities;
- **Financial Sustainability** as means to expand UMinho's strategic investment capacity, increasing its revenues and levels of efficiency.

Practice and Evolution of UMinho's Seven Guiding Principles

In the next paragraphs, and based on the analysis of the reported actions and strategies present in official documents, the practice of actions related to sustainability will be analyzed, in order to evaluate if there was an evolution or update on the key factors that promote sustainability strategies.

It is important to denote that in the period analyzed there were strong external conditions that compromised the universities status-quo.

Following the World Health Organization (WHO) confirmation, on January 2020, that a novel coronavirus was the cause of a respiratory illness, with a much lower fatality ratio than SARS of 2003, but with the significantly greater transmission, the Portuguese government declared the highest level of alert because of COVID-19 in March of 2020. Between this date and the end of 2021, the Portuguese territory has been in a national or regional "State of Emergency", "State of Alert" or "State of Contingency", with different periods of lock-down.

These unprecedented factors changed the way institutions deliver their mission, and interact with society at large. The UMinho demonstrated a very dynamic

response, changing from in-person lectures to online teaching. Also, many congresses and seminars were canceled or transformed on online events, and research projects schedule was adapted. These changes transformed the way the academic community interacted, within UMinho's mission, but also in other interactions.

Therefore, no direct comparison can be performed with the results obtained in the previous period. Even so, it is possible to evaluate the path on the Seven Guiding Principles in this particular period.

Principle 1 *Mixed Bottom-Up and Top-Down management model*

Based on the document analysis, the actions related to sustainability denote the continuity of some previous actions, coordinated by the Rectorate, in a top-down model. But, there are no records of the empowerment of decentralized actions, or projects proposed by students or other groups within the university.

Principle 2 *Transversality of all sustainability policies*

In the past the transversality of sustainable policies was embraced by the designation of a member of the rectors team—a pro-rector, that depended directly from the rector, to coordinate sustainability actions. In this period, a pro-rector was maintained, but the designation of the area of responsibility was changed from "*Infrastructures and Sustainability*" to "*Quality of life and Infrastructures*".

Principle 3 *Specific programs focused on the efficient use of resources*

The analyzed reports present the continuity on monitoring environmental indicators, but no indication of active and specific efficiency programs were found. Also, the reported indicators are related to energy, water, sanitation, paper, toners, biodiversity, waste and GHG emissions.

Principle 4 *Continuous monitoring and communication*

The reporting of sustainability strategies and actions is of utmost importance. The presence in international rankings not only fulfills this desideratum, but also promotes an international benchmark of global efforts.

UMinho continued its participation in the UI GreenMetric World University Ranking, which was initiated by Universitas Indonesia in 2010, which ranks green campus and environmental sustainability through 39 indicators in 6 criteria.

As a result of the previous action plan, in 2017 UMinho ranked 48th (between 619 candidates), being the 1st in Portugal and 99th in Europe.

In 2018, 2019, 2020 and 2020 UMinho ranked the 68th, 55th, 89th and 88th positions, respectively, continuing to lead the national representation.

The Times Higher Education Impact Rankings is described as the only global performance framework that assess universities performance on the United Nations' Sustainable Development Goals (SDGs). This ranking uses calibrated indicators to provide comprehensive and balanced comparison across four broad areas: research, stewardship, outreach and teaching.

In 2019 UMinho ranked the 83th global position (between 467 applications), being the first in Portugal.

Table 1 UMinho sustainability indicators

2009–2017 *Sustainability report (GRI)*	Sustainability indicators	2017–2021 *Non-financial report*
✓	Economic performance	×
✓	Market presence	×
✓	Indirect economic impacts	×
✓	Procurement practices	×
✓	Materials	✓
✓	Energy	✓
✓	Water	✓
✓	Emissions	✓
✓	Effluents and waste	✓
✓	Student body	×
✓	Employment	×
✓	Health and safety at work	✓
✓	Occupational health and safety	✓
✓	Training and education	✓
✓	Diversity and equal opportunity	✓
✓	Labor practices grievance mechanisms	✓
✓	Investment	×
✓	Non-discrimination	✓
✓	Local communities	×
✓	Anti-corruption	✓
✓	Events	×
✓	Events distribution	×

In 2020, between a higher number of applications (766, from 85 countries), UMinho ranked between 101th and 200th position. The same position was obtained in 2021, between a higher number of candidacies—1115 HEI from 94 countries. In these years UMinho ranked in the 3rd and 5th place in Portugal, respectively.

When analyzing the best scores, it becomes clear that Innovation and Infrastructure and Industry (ODS 9), Quality Education (ODS 4) and Partnership for the goals (ODS 17) are always in the top four groups.

The Sustainability Report (SR) that has, since 2010, been the integrated way of publicly reporting sustainability indicators and actions has given place to a chapter of Non-Financial chapter in the UMinho's activity and account report. A comparison of these indicators is present in Table 1.

Principle 5 *Integration of collaborative networks*

Following previous participation in global networks, in this period, UMinho was part of the steering Committee of the UI GreenMetric World University Ranking, which coordinates the ranking on green campus and environmental sustainability through 39 indicators in 6 criteria.

UMinho was also a member of the Advisory Committee of the International Sustainable Campus Network (ISCN), whose mission is to provide an international forum to support higher education institutions in the exchange of information, ideas and best practices for achieving sustainable campus operations and integrating sustainability in research and teaching.

Principle 6 *Commitment to stakeholders*

No actions to align strategies between all stakeholders have been found.

Principle 7 *Institutionalization of the sustainable policies*

In 2017 a global curricular unit (CU) on sustainability was proposed. This unit is lectured by the school of Engineering, the School of Science, the School of Economic and the Institute of Social Sciences and any student, from all the offered courses can apply. This CU has continued to grow in number and interest of students. Furthermore, students that have taken this class have contacted the teachers to ask how they can contribute and participate in sustainable actions.

The Rector presents sustainability as a transversal area, maintaining the previous political leadership but most references are from administrative reporting, which denotes a change from the previous engagement.

5 The Seven Guiding Principles: International Indirect Impact

Since the publication of the sustainability strategies followed by UMinho (Ramísio et al. 2019) several papers have addressed the HEI quest for sustainability, either reporting case studies or reviewing published papers. In this section we propose to summarize the most relevant papers with respect to the application of the Seven Guiding Principles.

5.1 Sustainability in HEI

The revised papers can be organized either as literature review papers or case studies. Amaral et al. (2020) report on an extensive literature review on sustainable practices in Universities worldwide, and identify **barriers and drivers** of sustainability implementation. Most frequently, the barriers are fundamentally lack of funding, leadership, resources, staff, and interest; while drivers are: funding, community and academic engagement, and administration support. The authors also identify the

most common areas of intervention: energy, buildings, water, waste, transportation, grounds, air and climate, and food. In the same line Hueske and Guenther (2021) propose a multilevel analysis of barriers and drivers to relate with the external, organizational environment, group and individual levels. The article intends to ascertain how does multilevel barrier and driver analysis contribute to understanding change toward sustainable operations in HEIs. One interesting finding of the study is the complementary nature of barriers and drivers. The authors identify three steps to achieve sustainability transformation: sustainable innovation characteristics; identification of barriers and drivers for sustainable innovation; and implementation strategies for sustainable innovations.

Barriers and drivers are complementary.

Niedlich et al. (2020) examine the role of organizational culture in sustainability governance in HEI. Cultural dimensions of sustainability governance in HEIs can be defined as: (1) Responsibility of sustainable development-how it is perceived and attributed; (2) Purpose of HEI-how the vision and the mission are defined. Sustainability may constitute a fourth mission (being the first three: teaching, research and outreach); (3) Conception of sustainability-how higher education institutions conceive sustainable development must be considered as an important aspect of organizational culture with direct bearing on sustainability governance; (4) Relevance and scope of organizational change-although some sustainability actions have been successfully implemented, the introduction of the sustainability paradigm into management has been difficult. The study focuses on 11 HEIs in Germany. The data was collected through interviews. They find that sustainability on the one hand is a topic of central administration (in a top-down perspective), while on the other is also a bottom-up endeavor—an open and co-creative process. The authors conclude that HEIs

> "need to be 'ambidextrous', learning to recognize sustainable development as a multidimensional issue affecting the whole institution while simultaneously changing their conception of how organizational learning can be accomplished. Doing so is an important step toward sustainable development in higher education institutions, as ongoing organizational learning and innovation, over time, might lead from a predominantly rationalistic self-conception of the institution toward a cultural governance approach." (p. 386/7)

Figueiró et al. (2022) focus on management schools in Brazil, stressing the importance of contextual elements and the need to have structural and organizational incentives.

Omazic and Zunk (2021) provide a semi-systematic literature review on sustainability in HEIs analyzing the dissemination role they can play. Sustainability in HEIs can be categorized into 7 areas: institutional framework, campus operations, education, research, outreach and collaboration, SD in campus, and assessment and reporting. They conclude that most articles focus on institutional framework, research and assessment, and reporting. They stress organizational change and communica-

tions. Interestingly the authors find few examples of assessment and measurement of SDs integration in operations, and in education and research. However, the topic of sustainability-oriented HEI networks is analyzed in a small number of papers.

Co-creation, organizational culture and the cultural dimensions of sustainability are essential for success.

The institutionalization of sustainability policies as referred rests on the existence of leadership. Högfeldt et al. (2022) refer to the importance of intermediate leadership. They examined sustainability in a technical university identifying as success factors the existence of a sustainability office, a vice-chancellor in charge of the sustainability policies, and also mechanisms for auditing and progress evaluation.

In the same vein, Ezquerra-Lázaro et al. (2021) also conclude for the importance of leadership at the group level (being an intermediary between institutional and individual levels). They examine the concept of "readiness to change" which together with adoption and institutionalization, constitutes phases of organizational change. Asif et al. (2021) analyze the relationship between leadership behavior (visionary, team oriented and servant), and sustainable leadership, concluding that visionary leadership is the most related to sustainable leadership. They argue that organizational changes depend on the incentives provided, the relationships and the spaces (also referred by Högfeldt et al. (2022)), and that resistance to change is affective, cognitive and behavioral. The authors conclude that when the change results from a co-creation process, which is a mixture of top-down and bottom-up approaches, there are fewer difficulties implementing the changes, and these turn into norms quicker. When changes become norms, they are institutionalized.

Sanchez-Carrillo et al. (2021) refer to the importance of the mixed bottom-up, top-down approach in their policy recommendations. In addition, they advise the inclusion of sustainability in the institutional missions, the explicit formation and training of educators, managers and employees, putting the community in the center of sustainable practices and collaborating with other HEI.

Mixed strategy bottom-up and top-down, intermediate leadership, and readiness to change are frequently referred as success factors.

Leal Filho et al. (2022) provide a review of sustainability reporting (SR) practices in HEIs, including that of UMinho. Articles are categorized according to the composition of the Sustainability reporting team, the frequency of reporting, the experience, whether SR was independent or integrated in other documents, the reporting methodology, the issues covered, and whether SDGs were reported. Regarding the composition of the team it varied greatly, although sustainability offices within the university predominates. Most institutions published their reports yearly and did it in

an independent document. With respect to the methodology used, institutions in the US and Canada use the STARS-Association for the Advancement of Sustainability in Higher Education, while European universities use the GRI—Global Reporting Initiative. The issues most covered were energy, followed by climate action, sustainable mobility, and waste (very close was the frequency of topics such as water and sustainable building). Surprisingly, most reports do not mention the SDGs.

Several methodologies exist to report sustainability, most often STARS and GRI are used. In practice, campus operations are most frequently reported.

Case Studies

The relevance of considering HEIs as mobilizing agents in society is interestingly addressed by Leon et al. (2020) in the context of the University of Basque Country. The paper compares the environmental impact of the university with that of a city (Victoria) in two dimensions: energy efficiency and mobility. The results confirm the relationship between city and campus, and the applicability of the strategic analysis in both contexts.

Giovanelli et al. (2021) analyze the integration of sustainability in Italian public universities, reflecting on HEI business models. The paper finds that HEI has a predominant mission (teaching) and a prevalent driver (top-down), contrary to other papers that find a mixed approach. Using a cluster analysis, they identify the following business models:

- the **unsustainable**: low integration of SDGs in the university strategy, and low reporting, low integration in the curricula and research, deficient integration in partnerships;
- the **community service model**: includes universities that perform well with most indicators, the exception being the speed of implementation of voluntary managerial activities;
- the **collaborative model**: in this model, the implementation of sustainability is voluntary and follows a planning and reporting system aiming at creating strong relationships, namely with foreign members of collaborative networks;
- the **formal sustainable model**: includes universities with very low levels of integration of sustainability, except for structure. Thus, sustainability is part of the mission and goals of the university but has not translated into action.
- the **model of sustainable value proposition**: includes universities that perform relatively well in all indicators, but perform extremely well in incorporating sustainability in academic degrees and research.
- the **widespread sustainability model**: it is characterized by exhibiting a balanced performance in all indicators.

With regard to performance, this last model outperforms the others.

Di Nauta et al. (2020) examines sustainability application in Italian public universities. They evaluate four areas: education and learning, research, operations and governance and external leadership, concluding that operations and governance is the most frequent area.

Pizzutilo and Venezia (2021) examine the integration of social responsibility, a particular dimension of sustainability, in HEIs. By focusing on social responsibility, the paper addresses motivation for change, focusing on three dimensions of culture (governance, strategy, inclusive context, reporting), mission (curricula, research, outreach, funding) and people (identification, consultation, involvement, co-creation). It is argued that sustainability on HEI is more than campus operations and should include education, infrastructure, research and involvement of stakeholders. Klein et al. (2022) compare lean processes between universities in Portugal and Brazil and evaluate its influence on sustainability initiatives. Using a survey, the authors conclude that there is a strong connection between lean practices and sustainability, and that country played a moderating effect. It is interesting to note that the social dimension of sustainability was most relevant in Brazil, which has significantly more important social problems. Geng and Zhao (2020) and Geng et al. (2020) propose two alternative frameworks for evaluating sustainability in HEIs in China. The framework comprises 6 and 7 principles, respectively (Expenditure, Existence, Efficiency, Effectiveness, Economy, Equity and Equality), and it is divided into 28 specific and quantitative indicators. The paper makes major contributions for the design of monitoring and reporting tools.

Chuvieco et al. (2022) analyze environmental sustainability education at a Spanish University (Alcalá, Spain) and conclude that a very small part of the courses contain subjects related with sustainability, and those that exist are more concentrated in environmental sciences, biology, economics, tourism and pharmacy, and few in education and health sciences. Corrêa et al. (2020) also analyzes the introduction of sustainability in courses in Brazilian Universities and concludes that the inclusion of sustainability subjects in undergraduate courses is still in their infancy, which is evident by the small number of events, programs and research groups dedicated to the topic. Bedoya-Dorado et al. (2021) analyze the case of Colombian Universities and conclude that the social dimension of sustainability is the least important, and the environmental dimension (mainly climate change) is the most pronounced. Priyadarshini and Abhilash (2022) examine HEIs in India as a complex adaptive systems, capable of adaptation and evolution as demanded and motivated by society. The ability of universities to change and adapt to a constantly changing environment allows them to easily integrate sustainability into their plans and actions.

Abubakar et al. (2020) discuss the role of the institutional framework in attaining SD in HEI: The focus of the paper is HEI in Saudi Arabia and how SD is integrated there. The paper reviews five alternative metrics for sustainability reporting: sustainability tracking, assessment and rating system (STARS), AASHE, 2017; adaptable model for assessing sustainability (AMAS); the Green Plan; assessment instrument for sustainability in higher education (AISHE); and sustainability assessment questionnaire (SAQ).

Cottafava et al. (2022) examines SDGs research in HEIs using an entropy-based indicator within an Italian Public University. The authors found that departments with more research in SD are also more interdisciplinary, and that most initiatives are bottom-up, and conclude that behavioral change needs to be more incentivized by institutions.

Aldulaimi and Abdeldayem (2020) examining the case of universities in Bahrain, emphasize the role of leadership behavior which is more participatory in HEIs than in other institutions. Easter et al. (2022) tries to explain persistence and suspension behaviors in implementing sustainability in HEis in the US. Their model shows the existence of 3 coping mechanisms: community building, resourcefulness and vision, and explains that encouragement and hope are the responses to persisting in the implementation of SDG when the environment is unresponsive.

In Sum,

Reviewing the literature published after Ramísio et al. (2019) and citing the article, it is clear the predominant relevance of guiding principles 1-**Mixed bottom-up and top-down management model** and 7-**Institutionalization of the sustainability policies** in the first place, having principles 4-**Continuous monitoring and communication** and 5-**Integration of collaborative networks** a second order of relevance. Examining case studies also reported, it is very clear the importance of the organizational culture, business model and the integration of sustainability in the vision and mission of universities.

6 A Critical Assessment to the Seven Guiding Principles Outcomes

Although the reporting of sustainability in an autonomous document halted in 2017 in UMinho, some indicators have been included in the institution annual report of its activities. This modification in practice translates a change in the seven guiding principles derived previously. In particular, the University ceased to examine the alignment of its mission, values and priorities with stakeholders, it decreased the number of monitored dimensions, it abandoned the mixed approach, assuming a top-down perspective with however less relevance as the pro-rector for sustainability has given place to now quality of life and infrastructure. In addition, the principle of commitment to stakeholders is no longer applied.

It is interesting to compare the evolution of UMinho's sustainability action with the actions and strategies reported in papers citing Ramísio et al. (2019). As reported in Fig. 1, the 1st, 6th and 7th principles are the most referred in the literature (Mixed Bottom-up Top-down approach, Commitment to Stakeholders and Institutionalization of the sustainable policies, respectively). A comparison between the principles that the literature has mostly stressed with those that the UMinho maintained reveals a clear divergence. While the Institutionalization of policies is emphasized in the literature, UMinho decreased its institutional commitment, as evident by the designation

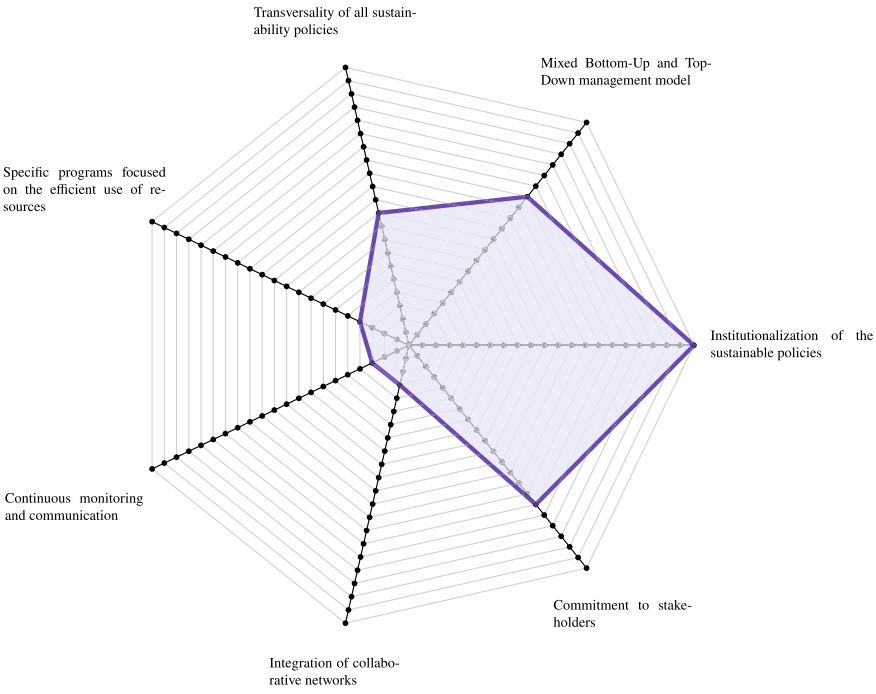

Fig. 1 Distribution of seven guiding principles in literature review. Own calculations based on: Abubakar et al. (2020), Aldulaimi and Abdeldayem (2020), Fernández Álvarez (2020), Amaral et al. (2020), Asif et al. (2021), Azizi (2022), Baptiste et al. (2022), Bukhari et al. (2021), Ceballos-García et al. (2020), Chuvieco et al. (2022), Corrêa et al. (2020), Cottafava et al. (2022), de Queiroz Machado et al. (2022), Di Nauta et al. (2020), Easter et al. (2022), Etse et al. (2021), Ezquerra-Lázaro et al. (2021), Figueiró et al. (2022), Feng et al. (2021), Geng and Zhao (2020), Geng et al. (2020), Giovanelli et al. (2021), González-Torre and Suárez-Serrano (2022), Högfeldt et al. (2022), Hueske and Guenther (2021), Klein et al. (2022), Kørnøv et al. (2020), Kucharcikova et al. (2019), Leon et al. (2020), Mac-lean et al. (2020), Macheridis and Paulsson (2021), Nasrudin et al. (2020), Niedlich et al. (2020), O'Neill and Sinden (2021), Omazic and Zunk (2021), Owusu-Agyeman (2021), Pizzutilo and Venezia (2021), Priyadarshini and Abhilash (2022), Sanches et al. (2021), Sanches et al. (2022), Sanchez-Carrillo et al. (2021), Sezen-Gültekin and Argon (2020), Vargas et al. (2019)

of the pro-rector for *quality of life and infrastructure* instead of *sustainability and infrastructure*. Moreover, the connection and involvement of stakeholders together with the mixed approach (top-down/bottom-up approach) was discontinued. These are dimensions that the most recent literature has stressed as very important.

It should, in addition, be underlined that relegating sustainability to individual actions and concentrating in specific campus activities overrides past efforts to scale up individual or group activities into institutional policies and to develop an imitation effect in society.

7 Remarks and Conclusions

Sustainability in HEI is, as extensively reported, of the utmost importance not only for the institutions future but also for society at large.

This chapter describes the road traveled by the UMinho since 2007, the year first reported in a sustainability report following GRI guidelines, to 2016, when autonomous sustainability reporting was interrupted, and from 2017 to 2021, a period characterized by an institutional change accompanied by the definition of new practices. The evolution of UMinho sustainability practices is compared to the trend observed in the published literature. It is clear from our analysis, that UMinho's perspective evolved from a holistic, integrated approach, comprehending campus operations, the involvement and consultation of stakeholders, based on a mixed "bottom-up" and "top-down approach", accompanied by the institutionalization of associated policies, to an operation oriented approach prioritizing resource efficiency.

Although not undervaluing the merits of the current approach, namely, with respect to cost savings, this perspective does not include economic and cultural indicators. Therefore, it neglects the positive effect of these areas in the academic community and surrounding territory, and their influence in the transformation of the organizational culture and, with that, the behavior of its stakeholders, and their ability to mold society's behavior.

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Sustainability at the University of Madeira: A Cultural Transformation

Hélder Spínola

Abstract The University of Madeira is a small and young higher education institution (HEI) located in an insular, autonomous, and outermost region. As others Portuguese HEI's, in recent years it has been involved in a process of transformation towards environmental sustainability, and present work intends to characterize the main aspects of that approach. The mission and vision of the University of Madeira, expressed in its statutes, are aligned with environmental sustainability, but none of its organizational structures was pointed out with that responsibility. Nevertheless, much have been done in the past few years due to a bottom-up mobilization of the academic community, with interesting results on greening the campus and redirecting research to sustainability. Additionally, environmental indicators seem to be very promising, comparing with other national and even international HEIs, and the academic community had shown a good level of environmental literacy. In the light of a cultural transformation towards environmental sustainability, the University of Madeira has a great potential and is well positioned, needing to adapt and reorient its curricular plans and create a sustainable office.

Keywords University of Madeira · Sustainability · Environmental literacy · Environmental culture

1 Introduction

Sustainability is a concept that has been used with a wide scope of meanings and focus, but considering its most spread definition, the one presented on the report 'Our Common Future' of the World Commission on Environment and Development, it means a development "to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987, p. 24). Despite some authors considers a fourth (Hawkes, 2001; Lozano, 2018;

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UCLG, 2010), sustainability is a concept with three main dimensions or pillars: environmental, social, and economic (Fischer et al., 2020). Despite sustainability has been represented with a Venn diagram, with only a small part of each pillar overlapped to each other, our goal should be to full integrate the three dimensions, a scenery better represented by concentric circles with the outermost being the environment (Lozano, 2008). In fact, environmental dimension is the basis for a sustainable society and economy since it provides the resources needed and its renewal along time, defining a limit that should not be over past. As so, it is not surprising that greater attention is given to the environmental dimension in approaches to sustainability, and that the way society and the economy function must adapt to the environmental limits of the Planet.

As we live in a sole Earth, achieving sustainability to all humanity seems a difficult and complex task to be achieved. Since insular communities also depends on a limited environment comparable, in a certain way and in a much smaller scale, to a planet, their efforts towards sustainability could go far beyond the contribution to reduce global ecological footprint. Insular communities could be living labs to test the processes of cultural transformations needed to achieve the environmental balance and sustainability. Additionally, due to their small dimensions and lack of resources, sustainability is a must and urgent need since the global environmental disequilibria are here in exacerbated.

Madeira Archipelago is constituted by two populated islands (Madeira and Porto Santo) and located in the Atlantic Ocean 900 kms southwest of the mainland Portuguese coast and 700 kms from the northwest coast of Africa. It is populated with about 250,000 inhabitants (mostly in Madeira Island) and it is a Portuguese Autonomous Region highly dependent on the tourism. The University of Madeira is a public institution of higher education established in 1988 in the city of Funchal (Madeira Island- Portugal), with its teaching and research activities concentrated in a single pole, the Penteada Campus. Besides classrooms, laboratories, offices, and parking lines, Penteada Campus is provided with a library, a canteen, a bar, and a garden in a side property. The University of Madeira assumes itself as a centre for the creation, transmission and dissemination of culture, science, and technology at the service of the humanity, and aims to prepare its students to be technically and scientifically competent, cultured, and innovative citizens, acting on the basis of the values of transparency, justice, equality, fraternity and to the sustainable development of the Planet. The University of Madeira is made up of 4 faculties (Arts and Humanities, Exact and Engineering Sciences, Social Sciences, and Life Sciences) and 2 higher schools (Health, and Technology and Management), involving around 3500 students distributed over 20 degrees, 23 masters, 8 doctorates and 16 Professional Higher Technical Courses. The teaching staff is made up of more than 230 professionals and the institution's operation is supported by the involvement of 138 non-teaching staff. Despite its universal mission, the University of Madeira assumes a special commitment with the insular region where is located and from where comes the big majority of its students.

The purpose of present work is to characterize the path towards environmental sustainability that has been followed at the University of Madeira, focusing on its governance, campus, curriculum and research.

2 Framework for a Cultural Transformation

Before characterizing the approach to sustainability that has been followed at the University of Madeira, we believe it is important to present our vision on how this path could be crowned with success. After a few years experiencing environmental education and studying the promotion of environmental literacy, some conclusions have emerged to help in the definition of a framework that could boost the approach to promote sustainability. Considering that sustainability will only be achieved with a cultural transformation, we believe that on the need to migrate from the consumerist culture to an environmental culture. Author previous work state environmental culture as "a complex system of codes, standards and forms of organization shared by a society, or a social group, learned through education and socialization, and that contributes to the maintenance of environmental balances. It manifests itself through norms, beliefs, values, attitudes, concepts, knowledge, habits, practices, behaviours, technologies, expectations, lifestyles, institutions, and models of social and economic organization that, as a whole, ensure the environmental sustainability of a community" (Spínola, 2021, p. 988). Alongside with this concept, a conceptual framework was proposed to build an environmental educating community that could drive environmental culture and sustainable communities. In short, the framework is based in a holistic and sociocultural approach to build an environmental educating community that could promote its own environmental culture. Along the proposed conceptual framework, three stages need to be covered to reach its goals and, finally, a feedback loop to provide a continuous improvement cycle. First stage is a lead-off step to trigger the process but also to maintain and fuel it, so it should be sustained alongside the next two stages. It constitutes the driving force of the process and is based on the implementation of mechanisms that could promote environmental best practices and environmental education programs in all the community. These mechanisms may, for example, be of a mandatory nature or based on systems of incentives and penalties, and for them to arise there must be a certain level of political and social will, which, in turn, will depend on the general sensitivity to mitigate the current ecological crisis. Second stage constitutes the transformation of the sociocultural context through the implementation of environmental best practices and environmental education programs, along public and private places and organizations in a close relationship with the community and its social groups and individuals, as well as with the adaptation of its management and organization models. Finally, the third stage represents oncoming of the environmental sustainability with the establishment of an environmental educating community that is, by themselves, able to develop and maintain environmental culture, which, in turn, will reinforce political and social will that, at the first stage, feed the driving force of all

system, improving its effectiveness (Spínola, 2021). The proposed framework could be applied to an entire community but also to an organization, such as a Higher Education Institution, for example, the University of Madeira.

3 Sustainability Institutionalization at the University of Madeira

The University of Madeira is a young and small higher education institution located in an insular and Autonomous Region that as its own statutes and mission. Its governance is assured by a rector and a rectorship, that lead the Institution, a general council, with teachers, researchers, students, staff, and external members, that supervise the Institution and defines its strategic development, a management council, that conduct the administrative, property and financial management, and a senate as an advisory body. Directly dependent from the management council there are several services that assure the daily operation of the University of Madeira, each one coordinated by a team leader. The University of Madeira does not have a sustainability office or any other service with the same or similar function, and neither a person in charge.

To address the extent to which the sustainability has been institutionalized on the governance of the University of Madeira, we considered the following factors identified previously by others (Temel, et al., 2021): vision and mission, policies, reporting, communication, boards of directors, sustainability department and person in charge.

The statutes of the University of Madeira (Despacho normativo nº 14/2015 published in the Diário da República, 2.ª série, Nº 132 on 9 July 2015, pp. 18394–18408) define its mission, strategic areas, and vision. Energy, Environment and Climate Change is one of the four strategic areas identified, making it clear that environmental sustainability is one of the strong pillars of its mission. Additionally, as its vision, the "University of Madeira aims to prepare its students to be technically and scientifically competent, cultured, innovative citizens, acting on the basis of the values of transparency, justice, equality, fraternity and on the sustainable development of the planet" (Article 2ºA of the University of Madeira Statutes).

Looking at its most recent strategic plan (2022–2024), we found that, as part of the promotion of transversal skills, the University of Madeira proposes to encourage environmental responsibility (alongside cultural, heritage and social) by increasing student participation in volunteering activities. Also, it intends to energize students and teachers from each course in the implementation of the Sustainable Development Goals through an active participation in internships and companies' activities. As a measure of its scientific project, this Higher Education Institution is willing to promote environmental education practices and improve waste separation and energy savings through projects as the Eco-Schools. One of the five major strategic axes of its strategic plan (2022–2024) are the 'interinstitutional relations, communication and

internationalization', on which the Institution wants to increase its cooperation with the Regional Government in several areas of mutual interest, such as the environment and the sea. In addition to mentioning the orientation towards sustainability present in its mission and values, the Quality Manual of the University of Madeira establishes in its objectives the intention to promote the adoption of measures to protect the environment and reinforce its contribution to Biosustainability. Also, the Manual select nine principles and values to conduct the activity of the University of Madeira, two of them related to environmental sustainability: Rationality- to promote the effectiveness of objectives and efficiency in the sustainable management of resources; and Social Responsibility- to foster collective awareness of commitment to social well-being in its different dimensions (social, environmental, and cultural). Since 2010, Conduct Code (Regulation nº 575/2010. Código de Conduta da Universidade da Madeira. Diário da República, 2.ª série, Nº 127, 2 July 2010, pp 36205–36208) was established in this university to serve four purposes, one of them is the promotion of social responsibility, respect for the environment and the judicious use of resources. To that, it demands that the members of the academic community must respect the environment in the development of their activities to minimize the negative impact, contribute to the conservation of natural resources and spaces of ecological, scenic or cultural interest. In accordance, the Code establishes that, in order to maintain the quality of the environment and preserve the University's physical resources, the members of the academic community must, among others, promote the efficient use of resources and avoid wasting them. Also, teachers should never deviate from good research practices, especially when doing so may put people, animals, facilities or the environment at unnecessary risk. It is noteworthy that, since 2022, the University of Madeira has a Plan for Equality, Diversity and Inclusion that attends, has is mentioned in the document introduction, the United Nations Sustainable Development Goal number ten: the reduction of inequalities.

Looking at the last six activity reports (2016–2021), a marked increase in the reporting of activities in the area of environmental sustainability is evident. The words 'environment' and 'sustainability', associated to the meaning considering in this work, went from a mentioning of only 5 times in 2016 to 39 in 2021, an increase of 780%. This increase on the reporting of the sustainability is mostly related to the research projects, but also new courses and conferences offered. However, considering the same period, the University of Madeira activity plans only refers to environmental sustainability to mention the goals set at the strategic plan, not adding anything about the way it intends to reach them or about how to enhance the dynamics that grow in this area. On the financial reports nothing has been said about environmental sustainability. Until 2022, no sustainability report has been developed for the University of Madeira.

Since 2018, the Eco-School programme has been run permanently at the University of Madeira through the Higher School of Technology and Management and has been awarded with the Green Flag. This is a sustainable schools programme from the Foundation for Environmental Education that in Portugal is run by the European Blue Flag Association. Its methodology includes seven steps: the constitution of a Committee that brings together representatives of students, teachers and staff, under

the presidency of the program coordinator; carrying out a Sustainability Audit to identify environmental and social impacts; set up an Action Plan; Monitor and Evaluate; linking the programme with the school Curriculum; Inform and Involve; and produce an Eco Code.

4 Sustainability on Campus

One of the most relevant aspects that influence the environmental performance of the University of Madeira is the way its campus is managed and function, also with implications on moulding the academic community behaviours and attitudes. As we have seen above, this Higher Education Institution doesn't have a formal structure to deal with sustainability but, fruit of the good will of several actors (amongst teachers, students, and staff), several environmental best practices have been implemented on campus along the past few years. The development of several curricular activities and some projects, as 'Recycle More at the University of Madeira', 'Eco-Schools', 'You Print, We Plant', 'Greening the Curriculum', and 'One Family, One Planet', together with different investments from the Students Union, have conducted to a visible boost on the sustainability practices on campus since 2018. Let's characterize them considering the four most central themes: wastes, water, energy, and biodiversity.

4.1 Wastes

Since the beginning of the University of Madeira, wastes produced have been managed at least accordingly to the basic principle of being collected and forwarded to final destination (landfill until 2004, and incineration since then). Even on the first decades, some special wastes (as medical waste from research laboratories or WEEE- waste from electrical and electronic equipment) have been diverted to proper destinations. After continuous improvement and complying with the new regulations, the University of Madeira campus became today a facility integrated on the modern demanding wastes management best practices. Besides sorting for recycling, or for proper destination, wastes as WEEE, batteries, medical waste, cooking oil and fats, a network of recycling bins (with detailed sorting information) is available to be used by the academic community (Fig. 1).

Considering the production of municipal solid waste in 2019 (does not include special and hazardous waste) at the main Campus of the University of Madeira, the average value per day per person is only 43 g (for a total of 152 kg per day). As a comparison, this value is much lower than the 266 g for the Wageningen University & Research in the Netherlands, the top ranked at the UI GreenMetric World University Ranking (Veiligheid & Milieu, 2019).

Since 2019, when an annual characterization started to be done, until 2021, a reduction of 18.8% on waste production was registered, and the percentage of sorting

Fig. 1 A network of recycling bin islands with detailed sorting information for glass, paper/cardboard, and plastic/metal packaging is available to be used by the academic community of the University of Madeira

for recycle grew from 35.6% (2019) to 41.3% (2021). At the canteen and bar services, recycling rate grew from 26% (2019) to 83% (2021) due to the implementation of the organic waste composting, for which a set of ten composter units were installed nearby (Fig. 2). Also, a substantial improvement on the quality of plastic and paper waste sorting were visible. Checking the number of items wrongly placed in each recycling bin (paper/cardboard, plastic/metal, glass, and unsorted waste), each one was classified as Good (without contamination), Sufficient (with one or two contaminants) and Bad (with three or more contaminants). Considering Good plus Sufficient classifications, plastic/metal bin grew from 88.4% (2019) to 95% (2021) and paper/cardboard bin from 34.2% (2019) to 81% (2021). However, the sorting quality for glass (83.3% in 2019 and 53,4% in 2021) and on unsorted waste bins (58.6% in 2019 and 50% in 2021) did not improve.

Since 2019, the University of Madeira participates in the Paper for Food Campaign, by the Food Bank Against Hunger and in partnership with the Municipality of Funchal, a campaign in which the value of the paper sent for recycling is used to supply food for needed families.

In addition to investing in improving recycling, some measures were also implemented to reduce its production. Noting that the paper towels used in the bathrooms to dry hands, despite being made from recycled paper, constituted around 12% of

Fig. 2 A set of composters associated to the canteen and bar of the University of Madeira allows to recycle the organics produced

the composition of waste in the main building, a campaign was initiated to adopt individual reusable cloth tissues. Between 2019 and 2022, more than 300 handkerchiefs were distributed in the academic community among those who expressed the intention to use them. Additionally, 12 electrical hand dryers were installed in the bathrooms as an alternative to the use of paper towels (Fig. 3). Also, to reduce the use of writing paper, the Students Union promote digitalization of documents doing it free of charge for students, and boxes for sharing reusable scratch paper have been placed next to some printers.

Another important source of waste production identified was coffee cups from vending machines. In addition to replacing disposable plastic cups with paper cups in 2019, the promotion of the use of reusable cups was initiated. First, the coffee price reduction (minus 5 cents) for the no-cup option was implemented, and, together with an environmental education campaign, more than 200 reusable cups were freely distributed among those that manifested intention to use them. Additionally, a pilot project for dispensing and reusing glass cups was developed during the month of May 2022. It consisted of a device with a tube for dispensing clean glasses and another to collected dirty ones, and it was associated to one of the 8 coffee vending machines existing in the building (Fig. 4). Dirty glasses were sent at the end of the day to be washed and made available again the next day. With this pilot project, 24 reusable glass cups were made available and used daily, which avoided the disposal

Fig. 3 As an alternative to the use of paper towels, 12 bathrooms were equipped with electrical hand dryers

of 504 cups in the trash during the entire period in which the initiative took place (21 working days). The cup return rate was 79%, which meant that, on average, 5 of the 24 cups made available daily were not returned. Since the available glasses were all used, running out long before the end of the day, it was concluded that such a system is well accepted at the University of Madeira. However, for a generalized and permanent implementation, it is essential to include a way to control the return of cups, as the losses of 21% are not affordable. The system is currently being improved through the incorporation of a mechanism for identifying users and recording returns.

To prevent waste produced from plastic bottles, in 2019, the University of Madeira Students Union installed a refill station for reusable water bottles (Fig. 5), which has been such a success that, in 2022, an additional station was installed. Since then, in the context of an environmental education campaign, more than 350 reusable water bottles were freely distributed on the Academic Community.

To prevent food waste, environmental education campaigns have been developed at the canteen and some specific measures were taken: prior sale of vouchers to adjust the preparation of meals to the needed quantities; forwarding of the few leftover meals to the students at the university residence; and reuse of some food scraps for animal feeding. In the canteen of the University of Madeira, the assessment of food waste from leftovers from the plate of students started to be, on average, from 3.6 kg per

Fig. 4 In May 2022, a pilot project was implemented at the University of Madeira for dispensing and collecting reusable glass cups for use in the coffee machines

day in 2020 to 2 kg in 2022, the results being very variable and dependent on the number and type of meals served.

Cigarette butts are, since a long time, the mostly common kind of waste that people usually toss away around on campus outdoor places. Since 2018, a systematic campaign against cigarette butts has been developed with the installation of community ashtrays, exhibitions, cleaning actions, personal contacts, and ashtrays distribution for individual use. Results have been scarce, but when a small vegetable garden was created in a local very affected by this problem, there was a surprising respect and, in that place, cigarette butts were no longer abandoned. This made us think that a different approach should be taken on this issue, and, since 2022, an intervention to enhance and improve the spaces through the development of gardening, horticulture and leisure activities began with the special contribution of the Students Union.

4.2 Water

The University of Madeira uses potable water mostly for toilets (more than 60 facilities), canteen and bar services, cleaning, and for irrigation of a few garden beds. In

Fig. 5 To prevent waste produced from plastic bottles, two refill stations for reusable water bottles are available at the University of Madeira

average, a potable water consumption of 20,000 m^3 per year (considering 2017, 2018 and 2019) is registered for all the University, including other builds and proprieties besides the main campus, which gives an average of 15 L per student per day. Considering other campuses worldwide and in mainland Portugal this could be considered a very good value. For example, in mainland Portugal, at the Instituto Superior Técnico of the University of Lisbon only after careful measures for water conservation and efficiency it was possible to goes from a value of 33 L per day per student in 2010 to 14 L per day per student in 2018 (Ferreira et al., 2021). On the Santa Barbara campus of the University of California, the water consumption reaches 98 L per day per person after a reduction of 23% since 2008 (UCSB Sustainability, n.d.). In the Warsaw University of Life Sciences the average consumption of water is of 26.6 L per day per student (Wichowski et al., 2019) and even considering the two first Universities on the UI GreenMetric World University Ranking, the values are higher: the Wageningen University and Research in the Netherlands with 36.8 L per day per student (Veiligheid & Milieu, 2019); and the University of Nottingham in the United Kingdom with 65 L per day per person (University of Nottingham, 2018).

The measures put in place to allow an efficient use of water include the installation of automatically closing faucets on the hand washing sinks of all the toilet facilities, also with flow restrictors and a substantial reduction on the water pressure, and

Fig. 6 A demonstrative and functional dry toilet is available at the University of Madeira since 2021

the use of non-potable irrigation water for most of the garden area. Additionally, a few demonstrative facilities were installed to contribute for water sustainability and, specially, to promote those approaches among the academic community. The University of Madeira has a dry toilet in place (Fig. 6) since 2021, in which no water is used. The dry toilet, with a capacity of 50 L, was installed by substituting one of the classic toilets, and works by composting on place, with the dejects being covered by wood sawdust. In another toilet, a greywater reuse system was installed (Fig. 7). It consists of a hand washing sink from which the water used flows into the toilet flush. Another demonstrative installation is a system of collecting and reusing the raining water (Fig. 8). In this, a gutter collects the rainwater from the roof of a study room and stores it in a tank with a capacity of 500 L. The water collected is reused for a drip irrigation system on a garden bed nearby.

4.3 Energy

The energy needed at the University of Madeira facilities is mostly electricity. Considering the period of 2017–2019, in average, the University of Madeira used 1,095,533

Fig. 7 To show how to easily reuse greywater, the water from a hand washing sink fills the toilet flush at one of the University of Madeira bathrooms

Fig. 8 At the University of Madeira, the rainwater from the roof of a study room is stored to be reused in the irrigation of a garden

kWh of electricity per year, which means only 0.86 kWh per person per day. This value is much lower than the one obtained in 2018 at the Instituto Superior Técnico of the University of Lisbon, 2,35 kWh per person per day, after a reduction of 16% with the implementation of the "Sustainable Campus" project since 2011 (Ferreira et al., 2021). If compared with the performance of the University top ranked at the UI GreenMetric World University Ranking, the Wageningen University & Research (7.9 kWh per person per day consumption of electricity), the value is nine times higher than in the University of Madeira (Veiligheid & Milieu, 2019). For gas (butane) consumption, considering the years 2018 (42,000 kWh) and 2019 (33,700 kWh), the average is only 0.03 kWh per person per day, mostly for cooking at the canteen. If we take together electricity and gas consumption, we will get the total amount of energy consumption on campus (except for mobility), 0.89 kWh per person per day, again much lower than the 16.8 kWh per person per day in the above cited Wageningen University & Research.

Since the University of Madeira started to be located at the Penteada Campus, in the end of the XX century, the lamps were already fluorescent, the better available technology that time. However, along the past decade a big change has been done on the illumination. First, the lamps unnecessarily switched-on on the corridors during the daylight were switch-off. Then, energy-efficient fluorescent ballasts were installed and, since the past few years, as they reach the end of their lifetime, have been gradually substituted by LED lamps, much more efficient. Additionally, an environmental education campaign has been developed to sensitize teachers and students to take advantage of natural light in classrooms. Another environmental education campaign that has been developed along the past five years to save energy is on the use of stairs instead of the elevators. Regarding the use of renewable energies, the University of Madeira only has demonstration facilities for educational purposes, namely photovoltaic panels and wind turbines.

The campus is served by public transport by a set of bus lines that allow the connection to the city center, and from this to the rest of the city and the island. The campus has 237 covered parking spaces for cars whose access is paid through a monthly subscription, and about 200 outdoor spaces with free access. A parking line for motorcycles with twenty places is available and also two places for charging electric cars. A survey from 2012 at the University of Madeira showed that 48.6% of students had a sustainable mobility (41% on public transportation and 7.6% walking), but 48% travels by car and 3.4% by motorcycle (Spínola, 2012). To insist on a sustainable mobility, besides environmental education campaigns, the bus lines that serves the campus were improved along the past ten years and the prices for student bus passes have been reduced. An informative screen with real-time information regarding the passage of buses was placed at the main entrance of the University of Madeira, and the Student Union started to provide the ticket loading service.

4.4 Biodiversity

The total area of the Penteada Campus of the University of Madeira is 75000 square meters, with more than half of which are gardens and green spaces (45,000 m^2), including an organic vegetable garden. These green areas are places that promote the local biodiversity, with native plant species planted and naturally occurring, together with countless animal species, namely from birds, reptiles, bats, spiders, and insects. These surrounding gardens have been used for field classes that introduce students to some species, and where curricular activities are promoted, for example in the application of methodologies for the study of biodiversity. To enhance the knowledge and sensitivity of the Academic Community in relation to biodiversity, the plant species existing on the Campus have been identified through the placement of small signs.

The Student Union of the University of Madeira implemented the 'You Print, We Plant' program, whose objective is to return to nature the number of trees equivalent to the total amount of paper used in the autonomous copying service—You Print. Bringing together dozens of volunteers several times a year in the Ecological Park of Funchal, besides planting activities, plant nursery activities, control of invasive species, garbage collection and maintenance of walking paths have been carried out.

5 Sustainability at the Curriculum

Until 2022, there was no specific plans or orientations to greening the curricula at the University of Madeira. Nevertheless, the perception that more training in environment and sustainability was needed led to the emergence of some new courses in this area and the incorporation of the theme into pre-existing ones. As the degrees have a higher stability, the new courses that emerged along the past decade and that could be categorized among sustainability were only masters and Higher Professionals Technical (HPT). Energetic and Environmental Management, Biological Agriculture, Nature Guides, and Energetic Rehabilitation and Building Conservation, are, among the 16 HPT Courses available in 2022 at the University of Madeira, the four that contributes directly to sustainability. However, the success of such courses was very limited since, after a few years, in the school year 2022/2023, none of these courses have opened due to a lack of registered students. The same happened to the master in Ecotourism, that was active only between 2015 and 2019. Other courses, among HPT, degrees, and masters, have curricular units that contributes to promote sustainability. Besides the four HPT courses mentioned above, only six of the other 14 offer some curricular units that contribute to sustainability, namely the HPT courses in Civil Protection (Biogeodiversity at the Madeira Archipelago; Territorial Planning), in Construction (Safety, Hygiene, Health and Environment), in Tourism Information and Marketing (Natural and Cultural Heritage), in Electronic Systems and Electrical Installation (Renewable Energies), in Agri-Food Technology (Waste Conversion Technologies), and in Family

and Community Service (Ethics in Intervention to the Person, Family and Community). Among the 21 degrees offered by the University of Madeira, only 4 of them include curricular units that contribute directly to the promotion of sustainability: Civil Engineering (Hydrology, Water Resources and Environment; Regional and Urban Planning), Educational Sciences (Education and Citizenship; Environmental Education; Inclusion and Social Reintegration), Basic Education (Study of the Environment; Environmental Education), and Biology (Conservation Biology; Ecology; Macaronesian Flora). Regarding the 26 masters offered by the University of Madeira, seven offer at least one curricular unit related to sustainability: Regional and Local Studies (Geodiversity and Heritage), Applied Biochemistry (Biochemistry of Natural Products), Electrical Engineering (Electric Machines and Renewable Energies), Education Sciences-Educational Administration (Education and Local Community Development), Preschool and Primary School Education (Teaching of Environmental Studies), Education and Community Development (Education and Environmental Sustainability; Education and Gender Equality; Civil Protection and Risk Management; Development and Territory Cohesion), and Applied Biology (Policy, Legislation and Biodiversity; Introduction to Biodiversity; Community Ecology; Terrestrial Biodiversity; Marine Resources; Biodiversity Conservation).

6 Research for Sustainability

Scientific research activity at the University of Madeira is organized into 14 research centres, of which 8 are Research and Development Units (R&D Units) evaluated and financed by the Foundation for Science and Technology (FST) of the Government of the Portuguese Republic. Among the 8 research centres evaluated by the FCT, 2 are owned (Centre for Research in Education and Madeira Chemistry Research Centre) and 6 shared, having obtained ratings ranging from Good to Excellent.

Several ongoing and past research projects that contributes to sustainable development have been developed at the University of Madeira. The Centre for Research in Education is developing the projects "Assessing and Promoting Environmental Culture in Higher Education", and since 2012 several publications have been done on the characterization of the environmental literacy of students from Madeira Island (Spínola, 2012, 2015a, 2015b, 2016). The Madeira Chemistry Research Centre is implementing the Project "Industrial application of biomass generated by invasive plant species from Macaronesia" and finished since 2019 the "BLUE (marine) biotechnology as a platform for innovation in Atlantic Area towards the smart and sustainable growth of Europe on human's health and well-being", "Eco-sustainable valorisation of invasive plant species from Macaronesia to obtain industrial fibres", and "MARINEBLUEREFINE- recovery of waste from the fish industry".

The University of Madeira branch of the Center for Tourism Research, Development and Innovation (CiTUR) is participating in the project "OLIVE4ALL—Olive Heritage for Sustainable Development: Raising Community Awareness of Living Heritage", and had finished until 2020 the "Slow-Tourism and E-Tourism:

Prepare to Change for the Close Future" and the "Tourism Project: Characterization, Impact and Sustainability of Madeira's Tourism" projects. The Madeira Botany Group had been running several projects with positive impact on sustainability, namely "MACFLOR—Macaronesian Atlas of Reproductive Biology and applications to conservation", "Towards a mechanistic model of invasiveness in oceanic islands: determinants of the establishment and invasion success in alien plants", "LAUREL- Reading wood to assess the vulnerability of Macaronesian laurel forests to global change", and "eAZFlora—Electronic Flora of the Azores for Smartphones and Tablets". Isoplexis- Centre of Sustainable Agriculture and Food Technology is a research unit of the University of Madeira whose mission is to contribute with knowledge and technology to the development and sustainability of the agri-food sector and bioeconomy. Besides a seed bank that supports agriculture, research and the development applied to the agri-food sector, Isoplexis research unit has been developing several projects on sustainability, as "Biostimulants nanoencapsulation to increase yield under drought stress", "DIGIAqua- Digitizing aquaculture", "MADEIRA-OPUNTIAS: Plan of action for the development of the Opuntia culture in Madeira, aiming at its recovery and preservation, and the valorization of the production and two of its derivatives in the regional market", "AHIDAGRO- Contribution to water saving in strategic crops for the primary sector of the Canary and Madeira Islands through the application of bioactive natural products and extracts with osmoprotective properties", "Agrodiversity, genetic resources and regional production in the Autonomous Region of Madeira", "VERCOCHAR: Vermicompost, compost and biochar, tools for adaptation to climate change, prevention and mitigation of the effects derived from natural risks in the agricultural and forestry environment", "FRUTTMAC: Transfer of Research, Development and Innovation for the sustainable development of tropical fruit trees in Macaronesia", "Characterization and conservation of the main traditional and strategic plant genetic resources of Madeira", "CASBio—Assessment and Monitoring of Agrobiodiversity and Sustainability of Agrosystems in New Climate Scenarios", "Life Recover Natura—Recovery of terrestrial species and habitats from the Natura 2000 Network sites in Ponta de São Lourenço and Desertas Islands", among many others.

OSEAN is the most recent (2022) research unit of the University of Madeira, formed by a network of interdisciplinary researchers that act as a single organic body, with special intervention in the areas of green and blue economy, eco-entrepreneurship, green accounting and sustainable finance, digital innovation, sustainability, and social inclusion.

7 Environmental Literacy of the Academic Community

Over the past decade, some surveys were applied at the Academic Community of the University of Madeira, allowing some characterization of their levels of environmental literacy. Along the implementation of the 'One Family, One Planet' environmental education project (in 2021), we found that 85% knows what does mean

'Circular Economy', 76% knows at least one way to contribute to it, and 85% agrees that it is important (unpublished data). Regarding food waste, 80% were able to identify its correct definition, with 79% of respondents motivated to prevent it, but only 49% knowing how to do it. Knowing what are biowaste was dominated by 64%, the majority identifying the most appropriate destination (67%) and revealing sensitivity to the importance of valuing it (73%). More than 80% were able to identify at least one of the environmental implications resulting from the abandonment of waste, and 93% expressed concern about these situations. In identifying ways to reduce waste production more than 77% identify 2 ways (more than 70% identify 3), and more than half are motivated to do so (54%). Knowledge about how to sort for recycling is very high for the main waste, such as glass packaging (93%), paper/cardboard (93%), plastic packaging (90%), metal (80%), and organic (78%), but needing improvement regarding certain specific waste, such as the disposable paper cups from the coffee machine (45%), broken tea cups (54%), broken glass cups (17%), broken mirrors (39%), aluminium foil (39%) and paper napkins (34%). More than 80% are aware of the implications of discarding waste in sanitation, showing sensitivity to this issue (84%). The recognition that water resources are scarce or just sufficient on the Madeira Island is not yet very widespread (42%), but 85% show concern about water scarcity, managing to identify the most serious threats to water resources (66%) and identifying the measures necessary for a more efficient use of water (80% identify at least 2 measures). Regarding behaviours, 58% say they separate waste for recycling 'always' or 'often', 75% guarantee that they save food leftovers for the following meals 'always' or 'often', 34% separates bio-waste for recovery, 73% say they never throw garbage on the floor, 72% never discard garbage in the toilet, and, among coffee machine users, 43% already use reusable cups and, among smokers, 18% say never throw cigarette butts on the floor. Regarding purchases, 48% prefer regional products. A large majority (75%) assume they keep the tap turned off 'always' or 'often' while brushing their teeth, 37% say they drink 'always' or 'often' water from the tap instead of buying it bottled, 91% opt for quick showers, 'always' or 'often', instead of immersion baths, and 52% save water in the shower by closing it while shampooing.

In 2019, environmental literacy for waste management was evaluated in the University of Madeira through a sample that included students (92), teachers (19) and staff (19) (Spínola, 2022a, 2022b). It showed a good level of knowledge, since more than 80% of answers were correct, and an even better performance for attitude as more than 90% 'agree' or 'totally agree' with an adequate waste management. For waste management best practices, the results weren't as good, but even so more than 60% showed a prevalence of 'often' or 'always' for those behaviours. More than 75% of the academic community assured that 'always' or 'often' sort wastes for recycling, 99% never toss wastes, 88% of smokers never toss cigarette butts, 39% 'never' or 'rarely' use paper towel to dry hands, 45% 'never' or 'rarely' drink bottled water and, among coffee machine users, 24% 'always' or 'often' uses reusable cups.

In 2014, the New Ecological Paradigm (NEP) Scale (Dunlap et al., 2000) was applied to a sample of 220 students at the University of Madeira and showed that the pro-environmental orientation is predominant (72.3%) (Spínola, 2022b). The results

from only three statements on the survey diverged from a pro-NEP attitude: The earth has plenty of natural resources if we just learn how to develop them (only 33.6% pro-NEP); Human ingenuity will ensure that we do not make the earth unlivable (only 37.3% pro-NEP); and We are approaching the limit of the number of people the Earth can support (only 48.2 pro-NEP).

Another survey applied in 2012 to a sample of 205 students from the University of Madeira (Spínola, 2012) showed that environment was the biggest concern for 18%, after the economy (40%) and poverty (31%). In purchase behaviours, 34% paid attention to the origin of the products, but for only 3% the environment was the most important criterion in their decision to buy a product (57% for price and 39% for quality). More than half students drove (car: 48%; and motorbike: 3.4%) to the university, the others going by bus (41%) or walk (7.6%), with female students (48%) showing a use of public transportation (bus) much higher than male students (28%). Saving water when brushing the teeth was highly frequent (76%) but less on the shower (49%). Switching off unnecessary lighting was a highly frequent behaviour (88%) but switching off the television directly on the button of the apparatus, instead of doing it through the remote control, in order to avoid standby energy consumption, had a much lower frequency (39%). Energy efficient bulbs were already adopted by more than half of the students (52%), at least in the room most used.

8 Discussion

The University of Madeira is a higher education institution statutorily committed to environmental sustainability, as can be seen in its mission and vision. However, to date, it still does not have an internal structure designed to control environmental and sustainability aspects. As such, its contribution to sustainability, with great relevance in research and campus operation but more limited in the curricular plans, emerges as a reflection of the topicality of the theme and in a bottom-up movement. Supporting this statement is the fact that the activity reports, year by year, increasingly mention environment and sustainability, but the activity plans don't. In other words, these activities are not planned institutionally, but they are later reported as happening, which can only arise from the will to act of the academic community itself. Thus, to reconcile the existing statutory and strategic framework with the willingness and availability of the academic community to act, there is a lack of an internal structure to guide, support and coordinate the sustainability effort. This role could be performed by a new structure, a Sustainability Office, or it could also become a new assignment of a pre-existing one, for example the Quality Control Office. Furthermore, only with the formal attribution of these responsibilities it will be possible to produce sustainability reports, particularly to systematically monitor the institution's performance. Also, and much more importantly, a cultural transformation towards sustainability demands an approach in which the needed practices are institutionalized in the daily functioning of the institution, and a Sustainability Office is a fundamental stone to achieve it.

Despite the lack of a Sustainability Office, important steps have been given at the University of Madeira, particularly for Campus Greening and Research on Sustainability. Along the past five years, benefiting from a few environmental education projects and the investment of the Students Union, a clear improvement on the environmental practices on Campus was achieved, especially on waste management. For energy and water management, despite the indicators that show a good performance, much more can be done, namely on the use of renewable energy, and reusing water. On research the University of Madeira has been showing a growing alignment with sustainability. As we have seen, half of the research units are working on sustainability themes, being Isoplexis- Centre of Sustainable Agriculture and Food Technology extraordinarily active in this purpose.

Regarding its training offer and the respective curricular plans, the University of Madeira, despite its efforts, has not been able to position itself in sustainability, particularly due to the lack of demand from students for the courses opened in this area. However, the alternative path, perhaps the most important, of integrating sustainability into all courses, has so far been timidly pursued. Therefore, while companies and the job market do not embrace sustainability and do not encourage the demand for specific training in this area, the University of Madeira should invest in greening its curricular plans.

On this path of the University of Madeira towards sustainability, the levels of environmental literacy that have been shown by the Academic Community are a good starting point. In fact, environmental knowledge and pro-environmental orientation attitude's just need very specific improvements, namely on the knowledge on how to sort specific waste materials and in a higher awareness on the consequences of human population growth. In need of a clear improvement are pro-environmental and sustainability behaviors, even more if we consider that self-report is often inflated by social desirability bias. However, to achieve that, the University of Madeira must pursue and insist in the transformation of the practices on Campus, which need to be better institutionalized and culturally integrated.

9 Conclusion

A cultural transformation towards environmental sustainability is under way at the University of Madeira. Statutes, campus management, research and academic community environmental literacy are aligned in the wright direction, and curricular plans just need to be adapted and reoriented. However, the institutionalization of this under way path is the weakest link of this effort. A sustainability office can be the solution to organize and guide the already great effort shown by the University of Madeira academic community. This office could also collect and systematize the information and communicate it back to stimulate a continuous improvement, making available sustainability reports. Above all, it could be a lighthouse for the transformation necessary to build an environmental educating community that could drive environmental culture and a sustainable community.

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Sustainability and Student Motivation: Does the Campus Matter?

Mariana Inácio Marques, Lurdes Neves, and Ana Maia

Abstract Sustainability is one of the major goals to a lot of countries. In fact, The United Nations 2030 Agenda for Sustainable Development defines some goals related to five P's: People, Partnerships, Prosperity, Peace and Planet. Is that sense, Higher Education Institutions are trying to make several changes to achieve these goals. The Sustainable Campus Net was created to promote sustainability issues in Portuguese universities and polytechnics and thus contribute to a more sustainable society. Through this Net, members share knowledge, initiatives and success stories and promote joint actions within the theme Sustainable Campus. Methodologically, authors applied a questionnaire to all the forty Higher Education Institutions that are member of the Sustainable Campus Net all over Portugal and Islands. Each institution was asked to apply the questionnaire to a class of each degree course they had. The aim of this chapter is to understand if the campus contributes to students' motivation to develop sustainable practices on their daily routines. Also important is to assess whether the fact that they study on a campus that belongs to this network motivates them to study.

Keywords Motivation · Sustainability

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1 Introduction

Sustainability themes are important nowadays. In fact, the United Nations stablish an Agenda with 17 SDG's (Sustainable Development Goals), and we can notice that this theme is under agenda. In 2016 sustainability became an important topic when the United Nations published the Agenda 2030 (Alm et al, 2022). However, it is important to know that higher education students do care about this topic, or not. In fact, according to some recent authors, to implement the Agenda 2030 we have an important aspect: the University Social Responsibility (Bokhari, 2017; Lo et al., 2017; Sánchez et al., 2013; Vasilescu et al., 2010).

Since 2018 a network about sustainability with Higher Education Institutions (HEI) was created. This network wants to involve members in the definition of some sustainable principles and practices, namely in the environmental, economic and social areas.

The aim of this chapter is to understand if the campus where students are, have some influence on their motivation to study and to improve their environmental behavior.

In fact, the study is based on the following premises:

- To what extent the HEI contributes to the motivation for sustainable practices.
- And because the student performs or strives for sustainable practices (that is, what is the individual motivation for this, given that the questionnaire intends to individualize the motivational factors for investment and is not assessing the commitment to the HEI, we consider that the items and dimensions of the MWMS reflect more clearly the type of individual motivation for sustainable practices in items such as: "Why do you strive or would you strive for activities related to sustainability?" in order to be able to identify the reasons (current and latent) to carry out this investment in carrying out sustainable practices.

Through knowledge of individual motivation factors, it will also be possible to assess the extent to which the HEI can contribute to the academic training of students in the development of individual motivational factors or dimensions.

In terms of methodology, authors used a questionnaire applied to higher education students, using The Multidimensional Work Motivation Scale.

Authors asked for the involvement of the forty Higher Education Institutions (HEI) in order to apply the questionnaires to their students. The questionnaire was open for two months and a reinforcement was needed.

The chapter have first some literature review on sustainability, about student motivation and present the Sustainability Campus Network. The authors also present the MWMD—Multidimensional Work Motivation Scale. Then, they show the methodology, results and the conclusion. At the end, some limitations and future lines of investigation are presented.

2 Theoretical Background

2.1 Sustainability

The United Nations 2030 Agenda for Sustainable Development has defined SDG's (Sustainable Development Goals), associated with the MDG's (Millennium Development Goals). These concepts have become extremely important to the study of sustainable development (Hall, 2019). In fact, in 2000, the Millennium Report was presented by United Nations. This document outlines a plan to minimize globalization effects for everyone. The values reflected in Millenium Report are freedom, equity and solidarity, tolerance, non-violence, respect for nature and shared responsibility. So, the Report refers to eight Millennium Development Goals (MDG's), which were oriented to the objectives, that we present now (Boluk et al., 2019):

MDG 1: End poverty and hunger;
MDG 2: Achieve universal primary education;
MDG 3: Promote gender equality and empower women;
MDG 4: Reduce child mortality;
MDG 5: Improve maternal health;
MDG 6: Combat HIV/AIDS, Malaria and other diseases;
MDG 7: Ensure environmental sustainability;
MDG 8: Develop a global partnership for development.

However, COVID-19 pandemic was a throwback on this because of the lake of support to work on the 17 Sustainable Development Goals (SDG). In fact, this pandemic had impact on 12 out of the 17 SDG. There has been an increase in economic inequalities and poverty. Although, because people got stuck at home, the carbon dioxide emissions decreased during pandemic. Now, we present how COVID-19 had impact in some SDG's (Barbier & Burgess, 2020):

(a) SDG 1—No poverty: if there are loss of income, we have more poverty;
(b) SDG 2—Zero Hunger: COVID-19 cause a disruption on food production and on distribution;
(c) SDG 3—Good Health and Well-Being: this pandemic had a huge impact on health and well-being;
(d) SDG 4—Quality Education: with the closure of schools and learning through a computer, inequalities have increased;
(e) SDG 5—Gender Equality: woman's economic gains at risk;
(f) SDG 6—Clean water and sanitation: pandemic cause supply disruptions and inadequate access to it;
(g) SDG 7—Affordable and Clean Energy: there were failures in the power supply;
(h) SDG 8—Decent Work and Economic Growth: pandemic causes unemployment and economic problems;
(i) SDG 11—Sustainable Cities and Communities: high population density exposure;
(j) SGD 13—Climate Action: less commitment to global action;

(k) SDG 16—Peace, Justice and Strong Institutions: there were some conflicts and civil unrest;
(l) SDG 17—Partnership: backlash against globalization, rising nationalism.

Because of all this context, we can say that COVID-19 pandemic causes throwbacks in several areas in terms of sustainability.

According to Avila et al. (2019), HEI's are too important in society transformation, namely in those sustainability questions. However, authors noted a certain resistance to change habits in a long-term.

2.2 Sustainability Practices in Higher Education

In 1990 is the year of the first official statement from universities to work on sustainable practices. Also in that year, the Association of University Leaders for a Sustainable Future was funded. The objective was to reinforce sustainability transformation in higher education (Figueiró & Raufflet, 2015).

According to Alm et al. (2022) study, students learn more about sustainability when they have work-integrated learning projects and participate in some real-life experiences. Also, these authors discover that, students improve their competences about sustainability when SGD's contents are introduced in university offers.

HEI can contribute to improve knowledge about sustainability because in the HEI context we have knowledge transfer, investigation and education. In fact, HEI's can be considered as key players in this theme. Since the 1990s, some declarations have been adopted to support a sustainable-oriented development in HEIs, signed by hundreds of universities around the world. In fact, some financed projects were created in the sustainability field. It is on that context that European Union creates the "Horizon 2020" research project (Kirst & Schroth, 2022).

2.3 The Sustainable Campus Network

At the end of 2018, more specifically on the 27th of November, the Sustainable Campus Network—Portugal (SCN—PT) was created in the city of Coimbra. The Sustainable Campus Network is a cooperation network between people from national higher education institutions (HEIs) for the implementation of the principles and practice of sustainable development in the environmental, social and economic aspects.

According to the Sustainable Campus Network website, their mission is "to promote and support academic and scientific cooperation and the coordination of actions for sustainable development".

The main objectives of this Network are the identification of areas of cooperation and promotion in favor of sustainable development, the organization of events that

allow the dissemination and sharing of knowledge and experiences on sustainability. In addition to the objectives identified above, the SCN aims to promote sustainability in HEIs through the integration of themes in the courses offered, the creation of advanced training courses, cooperation in research and the adoption of sustainability practices. Within the scope of society in general, cooperate in sustainable development initiatives.

The actions developed are guided by a holistic and integrated approach, designated by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as a "whole-School" approach. Sustainable 2030 of the United Nations, the areas of action are related to waste management, energy efficiency, mitigation/adaptation to climate change, consumption of paper, plastics and other waste, management of drinking water and water treatment waste, sustainable procurement, green spaces and biodiversity, among other activities in general that promote the circular economy.

In 2019, on October 31, the 1st Sustainable Campus Conference took place, where a document called the "Commitment of Higher Education Institutions to sustainable development" was signed, a document that constitutes the commitment of all HEIs that adhere to the SCN. In this sense, any HEI can be part of this SCN, to become a member it only needs to apply for membership and assume the Letter of Intent, that is, make a commitment to sustainable development. Currently, there are forty HEIs all over Portugal and islands.

2.4 Students Motivation

2.4.1 The Self-Determination Theory Applied to Higher Education Context

The SDT (Self-Determination Theory) that, in the present study applied to educational context, proposes a multidimensional view of motivation and distinguishes how different types of motivation can be promoted or discouraged, in this case, in the context of higher education. For the theory, 3 major categories of motivation are distinguished: amotivation, intrinsic motivation and extrinsic motivation.

In first place, the amotivation concept (Deci & Ryans, 2009) is defined as the absence of motivation for an activity. Second, intrinsic motivation is defined as the ability to do an activity for its own sake, that is, because it is interesting and enjoyable. Third, extrinsic motivation refers to commitment to activities for instrumental reasons, such as receiving rewards, approval, avoiding punishment and/or disapproval, increasing self-esteem, or reaching a personally valued goal.

Considering this diversity of instrumental reasons, the Self-Determination Theory also specifies different subtypes of extrinsic motivation, which vary in the way they are internalized.

According to the theory, the process of internalization refers to the value-oriented action of a particular objective or activity that was initially regulated by external factors such as rewards or punishments, so that it becomes internally regulated

(Deci & Rayans, 1985). A first form of extrinsic motivation, which is not completely externalized, is external regulation, which refers to the performance of an activity to obtain rewards or punishments administered by others.

Introjected regulation, on the other hand, refers to the regulation of behavior through the internal pressure of forces such as ego-involvement, shame and guilt. This form of internalization is experienced as internal control (Ryan & Connell, 1989).

Finally, the identified regulation that refers to the performance of an activity because it is identified with its value or meaning that is accepted as proper, in such a way that this form of internalization is volatile.

Identification differs from intrinsic motivation in activities in which it is not performed for internal satisfaction, but for the instrumental value it represents. However, depending on the research question, it is sometimes preferable to use the first order of factors—amotivation, external, introjected, identified and intrinsic motivation—since these motivational subtypes have different attitude outcomes in certain domains, such as motivation to preserve the environment (Pelletier, Tuson, Green-Demers, Noels & Beaton, 1995) and politics (Koestner et al., 1996).

Therefore, it is necessary to apply scale for each of the different forms of motivation as ***Multidimensional Work Motivation Scale***—**MWMS**.

There are also scales based on SDT in various domains of life such as academic, sport (e.g., Grolnick & Ryans, 1989; Guay et al., 2000; Pelletier et al., 1995; Ryan & Cornell, 1989; Ryan & Connell, 1989; Vallerand et al., 1992).

Regarding the domain of work, Blais et al. (1993) published the first motivation scale based on the TAD in French, despite having problems with internal validity and with the scale of extrinsic regulation (Cronbach's alphas obtained were only 0.50) which encouraged Tremblay et al. (2009) as well as Gagné et al. (2015) to develop the scale (in French and English).

These scales, however, had some problems, which led to the development and validation of the MWMS. It accesses work motivation in its domain of analysis (Vallerand, 1997), which differentiates it from other task-oriented instruments for measuring work motivation (e.g., Fernet et al., 2008). MWMS tries to develop the previous scales in 4 different ways, and, for this reason, it was the scale selected to develop its adaptation and validation to the educational context.

First, most motivational measures based on SDT follow the tradition of questioning the person through statements that reflect different types of behavioral regulations (Ryan & Connell, 1989) with questions such as "Why do you do this job?" (Blais et al., 1993) that works in the sports domain, but can be problematic in the work domain.

A second improvement of the MWMS compared to the previous scales refers to the inclusion of the scales "external regulation" and "introjected regulation" that were created to balance the reasons for approaching and avoiding work and to prevent confusion between the concepts of "external regulation" and "introjected regulation" (Assor et al., 2009). In previous scales, the external regulation items were more oriented towards the pursuit of rewards and rewards while the "introjected regulation" items were more oriented towards the avoidance of guilt and shame. Additionally,

the MWMS included items that focused on material rewards such as money as well as social restrictions considered important in the work context (Stajkovic & Luthans, 1997).

Thirdly, in MWMS, care is taken to ensure that the writing of items is distinguished from related concepts such as satisfying the needs for autonomy, competence, intrinsic and extrinsic values, and harmonious or obsessive passion for work (Grouzet et al., 2005; Vallerand et al., 1992; Van den Broeck et al., 2010; Vansteenkiste et al., 2007). For example, items referring to "amotivation" refer to low satisfaction of the need for competence (e.g., I ask myself the question, I am not able to perform the most important tasks of this job") (Tremblay et al., 2009), and items identifying the intrinsic value of affiliation "because, in my opinion, it is one of the best ways to meet people" (Pelletier et al., 1995).

Finally, to obtain cross-cultural equivalence, the items were written so that they could be interpreted in the same way in the different cultures in which they were validated.

3 Methodology

In terms of methodology, authors applied questionnaires to HEI students and obtained 126 valid responses and data was treated with a quantitative approach. We ask for the Sustainable Campus Network helping us with the direct contacts, but even though it was difficult to have responses.

Self-determination theory proposes a multidimensional conceptualization of motivation and distinguishes how different types of motivation can be promoted or discouraged. For its application to the educational context, the present study aimed at the application, adaptation and validation of the Multidimensional Scale of Motivation at Work to students in the context of higher education.

The Multidimensional Work Motivation Scale adapted to the educational context was constructed in its original version by Gagné et al. (2015) and aims to assess employees' perception of their level of motivation, considering five dimensions, specifically: (i) "amotivation"; (ii) "extrinsic regulation"; (iii) "identified regulation"; (iv) "introjected regulation" and (v) "intrinsic motivation". These dimensions assess the different levels of motivation to work from the absence of motivation (amotivation) to the optimal level of motivation (intrinsic motivation). It consists of a set of 19 items, evaluated on a seven-point Likert response scale (from 1—not at all to 7—completely).

MWMS tool

The MWMS is a tool consisting of 19 items with the objective of assessing work motivation. In adapting to the educational context, the word work is used, meaning employment situations in the context of Schools or School Groups, in which the employer is the State.

MWMS involves 5 dimensions:

1. Amotivation which consists ofdc the absence of motivation for an activity.
2. Extrinsic regulation refers to commitment to activities for instrumental reasons, such as receiving rewards, approval, avoiding punishment and/or disapproval, increasing self-esteem, or achieving a goal. It is external regulation and refers to the performance of an activity to obtain rewards or punishments administered by others. This dimension encompasses 2 types of regulation: extrinsic social and material regulation.
3. Identified regulation that refers to the performance of an activity because it is identified with its value or meaning, which is accepted as proper, in such a way that this form of internalization gives rise to a self-determined behavior.
4. Introjected regulation refers to the regulation of behavior through internal pressure from forces such as ego-involvement, shame and guilt. This form of internalization is experienced as internal control (Ryan & Connell, 1989).
5. Intrinsic Motivation, which consists of the ability to do an activity for itself, that is, because it is interesting and enjoyable.

Items in each dimension are rated on a 7-point Likert scale where 1 = not at all, 2 = very little, 3 = a little, 4 = moderately, 5 = strongly, 6 = very strongly, and 7 = completely.

As defined by Deci & Rayan, 2008) we can analyze 5 dimensions of motivation for sustainability practices in higher education.

1. Amotivation in students which consists of the absence of motivation for an activity.
2. Extrinsic regulation refers to commitment to activities for instrumental reasons, such as receiving rewards from IES as academic classifications, approval, avoiding punishment and/or disapproval, increasing self-esteem, or achieving a goal. It is external regulation and refers to the performance of an activity to obtain rewards or punishments administered by others. This dimension encompasses 2 types of regulation: extrinsic social and material regulation.
3. Identified regulation that refers to the performance of an activity because it is identified with its value or meaning, which is accepted as proper, in such a way that this form of internalization gives rise to a self-determined behavior.
4. Introjected regulation refers to the regulation of behavior through internal pressure to sustainability from forces such as ego-involvement, shame and guilt. This form of internalization is experienced as internal control (Ryan & Connell, 1989).
5. Intrinsic Motivation, which consists of the ability to do an activity for itself, that is, because it is interesting and enjoyable.

A first form of extrinsic motivation, which is not completely externalized, is external regulation, which refers to the performance of an activity to obtain rewards or punishments administered by others.

Introjected regulation, on the other hand, refers to the regulation of behavior through the internal pressure of forces such as ego-involvement, shame and guilt.

This form of internalization is experienced as internal control (Ryan & Connell, 1989).

Finally, the identified regulation that refers to the performance of an activity because it is identified with its value or meaning that is accepted as proper, in such a way that this form of internalization is volatile.

Identification differs from intrinsic motivation in activities in which it is not performed for internal satisfaction, but for the instrumental value it represents. However, depending on the research question, it is sometimes preferable to use the first order of factors—amotivation, external, introjected, identified and intrinsic motivation—since these motivational subtypes have different attitude outcomes in certain domains, such as motivation to preserve the environment (Pelletier, Tuson, Green-Demers, Noels & Beaton, 1995) and politics (Koestner et al, 1996).

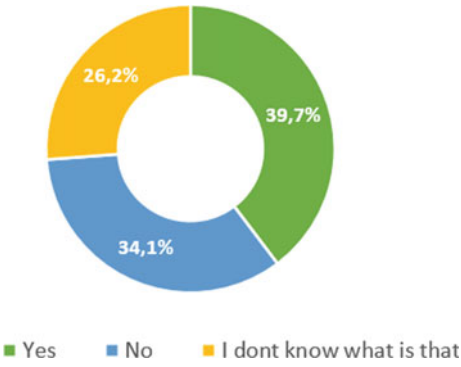
4 Results

In this study, authors have 126 valid questionnaires. The sample is mostly made up of students between 15 and 20 years old (58.7%) and with students between 21 and 25 years old (18.3%).

By gender, the study had 65.9% female and 34.1% male. Also, 77% has between 0 and 5 years of experience, with the completed high school (56.3%). In terms of the typology, 51.6% were from private and 48.4% were from public higher education institutions.

Regarding the fact that they are aware that they are studying in a Higher Education Institution that has adhered to the sustainable campus network, the results are quite divided, as we can see at Graph 1.

The following results is about statements where students must position themselves, using a scale from 1 (one) to 7 (seven), in which "1" means "not at all" and "7" represents "completely".



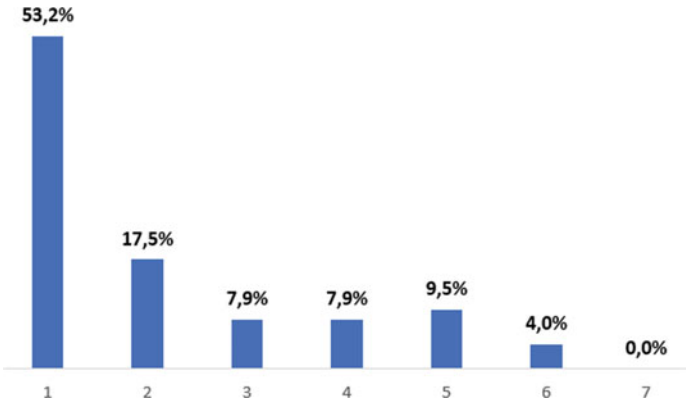
Graph 1 Knowledge about Higher Education Institution be part of Sustainable Campus Network

Font: Personal elaboration

About whether they feel that carrying out sustainable practices is a waste of time and, therefore, they do not try, the majority (53.2%) signs 1 on the scale, which correspond to "not at all", as we can see on Graph 2.

Regarding doing little in terms of sustainable practices because they think it is not worthy of efforts, the majority (54%) disagrees with the statement (see Graph 3).

About the fact that they do not know why they study at this Higher Education Institution that belongs to the sustainable campus network because the work they do is useless work, the majority (52.4%) do not agree at all (see Graph 4).



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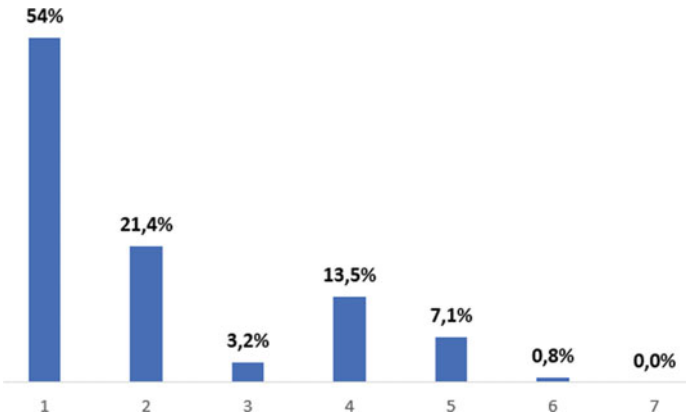
Graph 2 Sustainable practices is a waste of time



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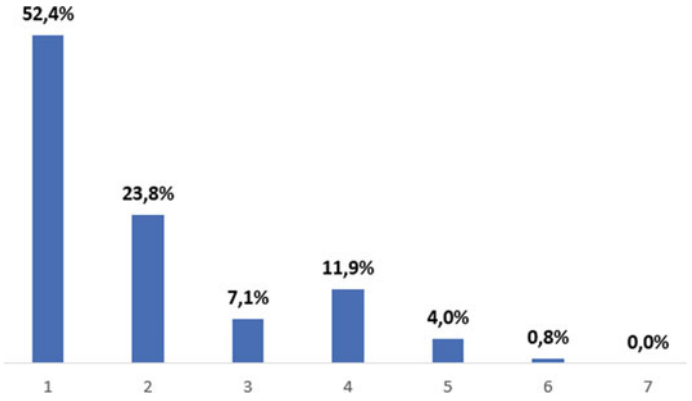
Graph 3 Effort for sustainable practices



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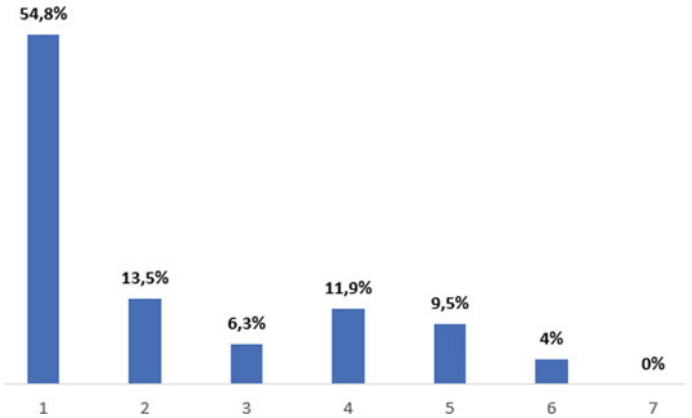
Graph 4 Relationship between belonging to the network and work developed

When questioned about if they study at a Sustainable Campus Network HEI, to get approval from other people, the majority (54.8%) do not agree at all (see Graph 5) and also to being more respected by other people (see Graph 6).

About the fact that they studied in a HEI that belongs to a Sustainable Campus Network to avoid being criticized from others, the results are very clear: they don't agree at all with these statements (61.9%). This result can be seen in Graph 7.

However, regarding the fact that they are studying in a Sustainable Campus Network HEI because if they make effort in their work, they will be rewarded by others, the results are not too clear. In fact, almost the majority does not agree with



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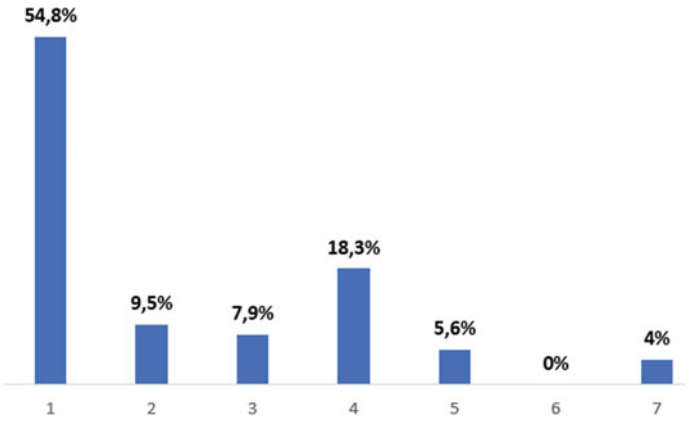
Graph 5 Study of a Sustainable Campus Network HEI to get approval from others



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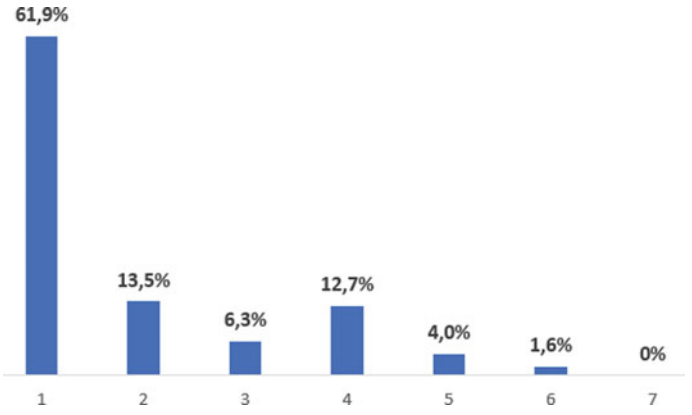
Graph 6 Study of a Sustainable Campus Network HEI to get respected from others



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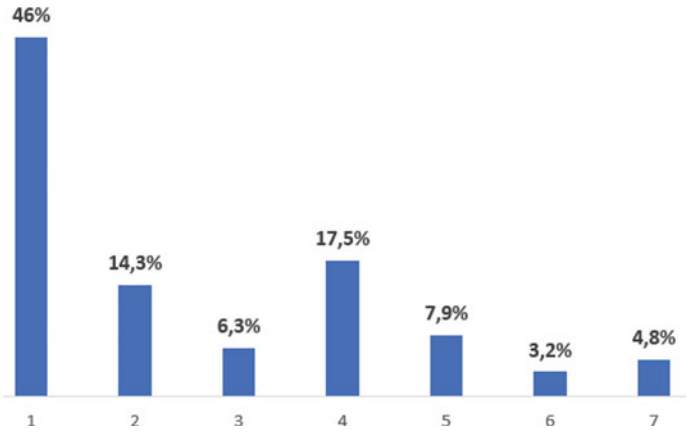
Graph 7 Study in a Sustainable Campus Network HEI to avoid criticism

the statement (46%), but we have 17.5% that choose number 4 on the scale (see Graph 8).

About studying at a HEI that belongs to the sustainable campus network because if they put in enough effort at work, they can be offered more condition, on Graph 9 we can see that 39.7% do not agree with that.

On Graph 10, we can see that students also don't agree (42.1%) with the statement about the fact that they study at an HEI that belongs to a sustainable campus network because they risk failing the year if they don't try hard enough.



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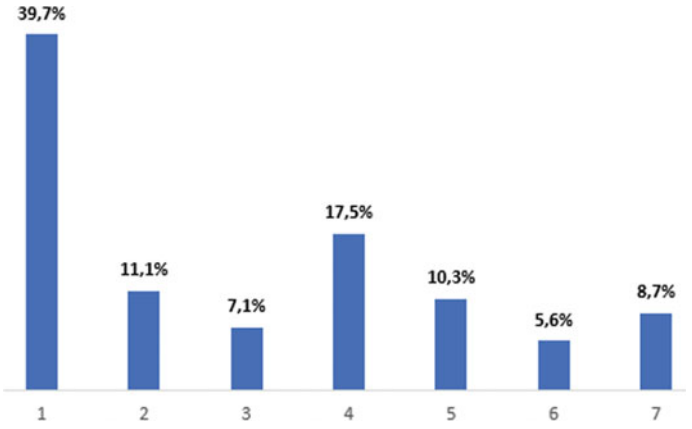
Graph 8 Study in a Sustainable Campus Network HEI to have rewards from others



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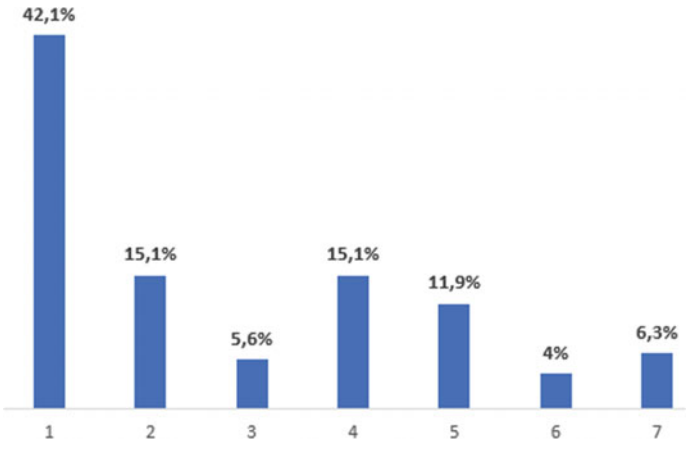
Graph 9 Effort to have more conditions

About the fact that the respondents work as students to prove themselves that they can, the results are very distributed on the scale, as we can see on Graph 11.

Regarding the fact that studying at an HEI that belongs to the sustainable campus network makes the student feel proud of himself, the results tend to be positive. In fact, 54.8% of students assign "5" or more on the scale as we can see at Graph 12.

On the contrary, on Graph 13, the respondents noted that they don't agree with the statement about going to classes at HEI because if they don't, they feel ashamed of themselves. In fact, 52.4% point out the "1" and "2" on the scale.



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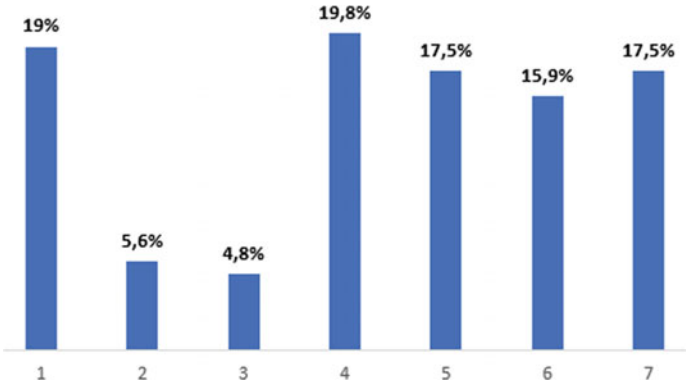
Graph 10 Risk failing the year if don't try hard enough



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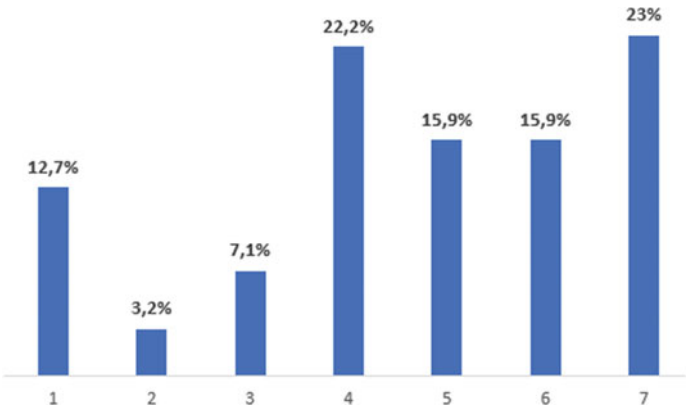
Graph 11 Work as student to prove they can

On Graph 14, we can see that the opinions are quite distributed between the scale, regarding that they go to classes on that HEI otherwise they feel bad about themselves.

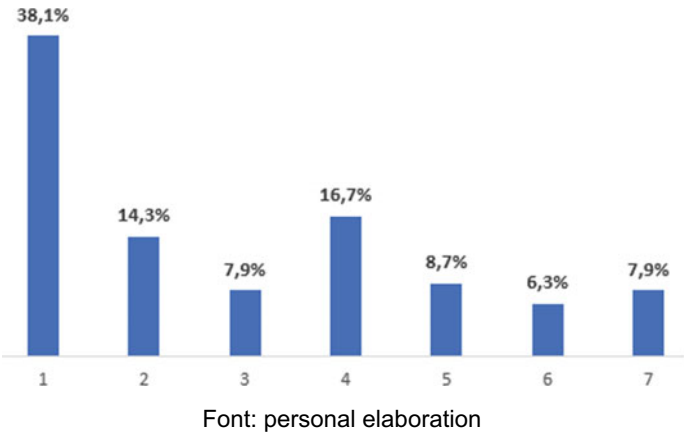
About the investment, authors gave some statements to the students in order to positioned themselves according to several statement.

Statements:

(a) "I invest on that HEI because, personally, I consider important to make efforts on this job": Graph 15 demonstrate that the majority (56%) completely agree with the statement;

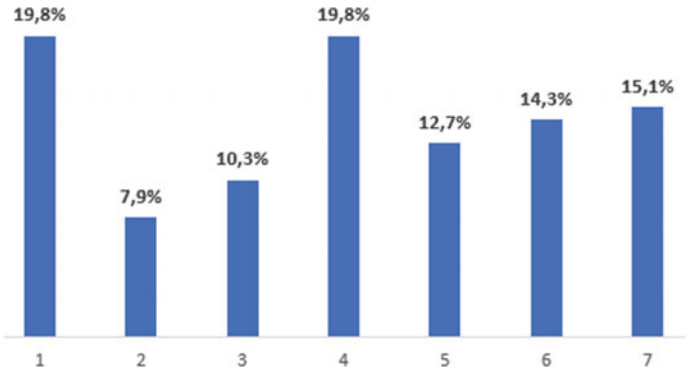


Graph 12 Pride of themselves



Graph 13 Shame of themselves if they don't go to HEI

(b) "Make an effort at my HEI (that belongs to Sustainable campus network) is aligned with my personal values": 59.6% points out "5" and more on the scale, which means that students completely agree with the fact that they are making efforts on this HEI (that belong to Sustainable Campus Network) is aligned with their personal values (Graph 16);
(c) "I invest on that HEI because make an effort at my HEI has a personal meaning to me": students agreed with the statement that they invest on this HEI because this fact has a personal meaning to them (57.4% point "5" or more on the scale, according to Graph 17);
(d) "I invest on that HEI because doing my job at my HEI (that belongs to Sustainable Campus network) amuses me: 44.1% assigned "5" and more at the scale,



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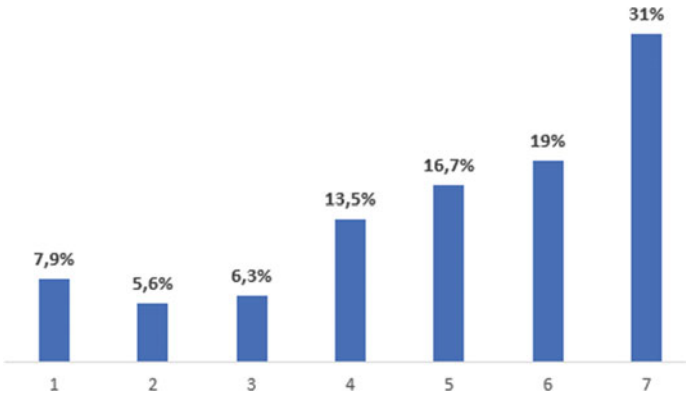
Graph 14 Go to classes at HEI to not feel bad to themselves



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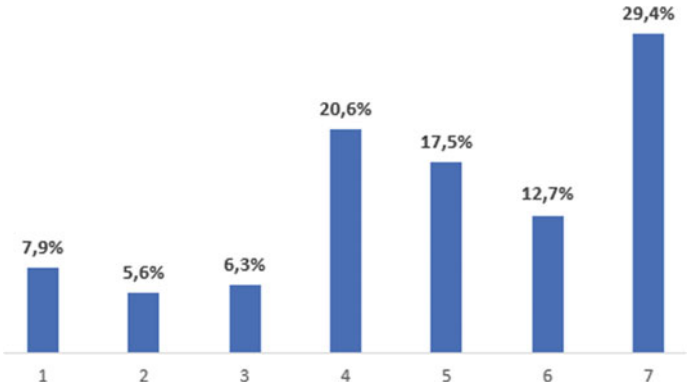
Graph 15 Investment and effort on work in this HEI

so we can conclude that almost majority agrees with the statement (see Graph 18);

(e) "I invest at that HEI (that belongs to Sustainable campus network) because the work I do at HEI is interesting": on Graph 19 we can have certain that 54.3% of students agrees with the statement, because they sign "5" or more on the scale;

(f) "I invest at that HEI (that belongs to Sustainable campus network) because the work I do at HEI is stimulating": 48.5% sign "5" or more on the scale, so almost the majority agrees with the statement (Graph 20).



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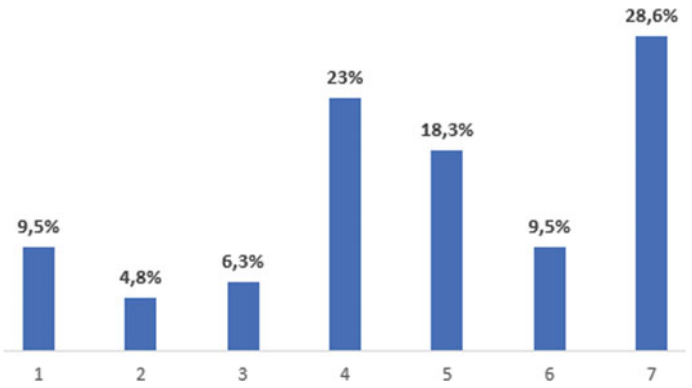
Graph 16 Effort aligned to personal values



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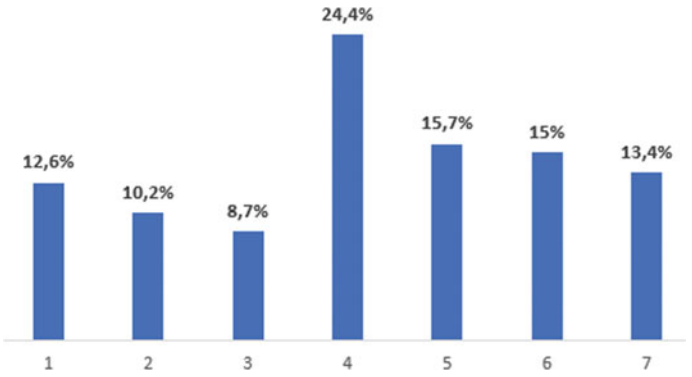
Graph 17 Investment because the effort has personal meaning

5 Conclusion

With this study, we can conclude that, probably, universities are note communicating well the fact that they belong to Sustainable Campus Network, because only 39.7% know that.

Also, students consider that carrying out sustainable practices is not a waste of time and that it is an attitude worthy of efforts.

They don't agree with the fact that, studying in a HEI that belongs to the Sustainable Campus Network is a useless work, is only to obtain other persons approval or get respected. Students also disagree to study at a HEI that belongs to sustainable campus network to avoid criticism or to have rewards from someone.



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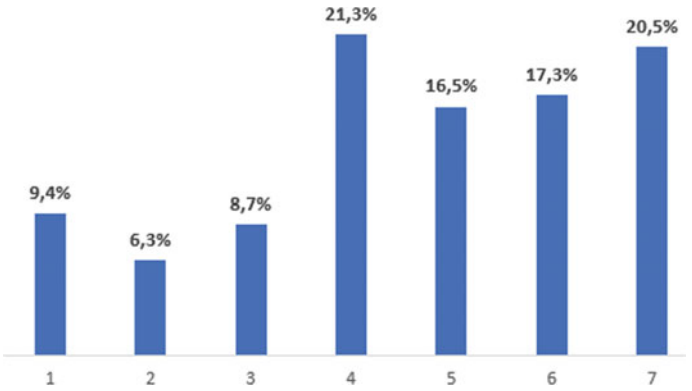
Graph 18 Fun at HEI



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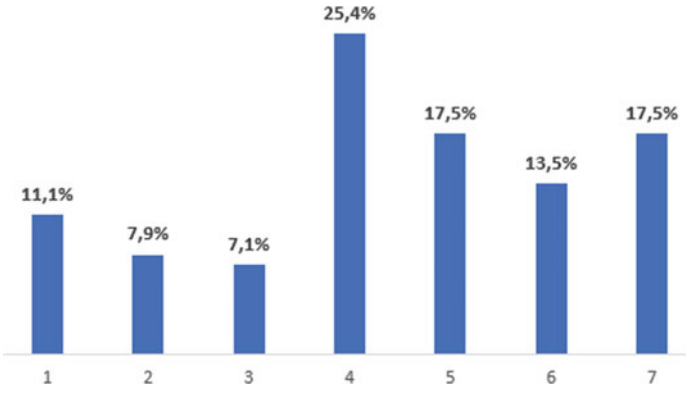
Graph 19 The work at HEI is interesting

However, the respondent students says that they work as a student to prove themselves they can (50.9% sign "5" or more on the scale).

Another important conclusion is that the majority (54.8%) consider that study at a HEI that belongs to Sustainable Campus Network makes them feel pride of.

Belonging to a HEI that belongs to Sustainable Campus Network is to align with the majority (59.6%) personal values.

In terms of investment in the HEI that belongs to Sustainable Campus Network, 66.7% invest in it, because they feel important to make effort, 57.4% consider that this has a personal meaning for them, 54.3% consider the work they do at HEI interesting and 48.5% stimulating.



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Graph 20 Work is stimulating at HEI

So, after collecting this data, authors can conclude that there is interest in the sustainability theme in higher education students. However, it seems like the communication of the Sustainability Campus Network is failing, because only a few students know this.

Sustainability is an important theme for young students, so they must be aware of what their contributions can be, and HEI must be a part of the solution.

With this study, we cannot establish a relationship between motivation to study at a HEI that belongs to the Sustainable Campus Network and the motivation to have sustainable practices on their daily routines, mostly because the majority does not know the HEI where they study belongs to a Sustainable Campus Network or even not know what that is.

6 Limitations

The author has difficulty in applying the questionnaire to HEI and needed to reinforce the request.

However, the author wants to thank all the attention from the Sustainable Campus Network to help with the direct contacts.

7 Future Lines of Investigation

It will be interesting to repeat this study, but more specifically about the sustainability practices on HEI students to understand if the public has conscience about the importance of it and what are their motivations to improve some practices on their daily routines.

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Sustaining the Well-Being of University Students: The Role of Expectations on the Usefulness of Education

Maria Eduarda Soares, Pilar Mosquera, Filipa Pires da Silva, and Maria João Santos

Abstract Due to the constraints of the COVID-19 pandemic, the relationship between remote learning and the well-being of students has been widely investigated. However, the process by which this relationship occurs remains under-researched. This study analyses the mediating role of expectations on the usefulness of education in the relationship between remote learning and well-being. Two pervasive issues of remote learning are considered: fear of academic impairment and social interactions. The data were collected in two moments of the 2020–2021 academic year: the end of semester 1, when classes were taught in a hybrid system (half of the students present and half online, with a weekly rotation), and the end of semester 2, when all classes were taught online. The results show that, between the two moments, there was an increase of fear of academic impairment and a decrease of well-being, of expectations on the usefulness of education, and of social interactions. To analyse the relationships among the variables under study, we tested a structural equations model with SmartPLS. In both semesters, the results show that fear of academic impairment and expectations on the usefulness of education are, respectively, negatively and positively associated with well-being. Social interactions are not directly associated with well-being, but indirectly through the mediation of expectations on the usefulness of education. Implications for sustaining the well-being of students are discussed.

Keywords Remote learning · Higher education · Well-being · Social interactions · Fear of academic impairment

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Management and Industrial Engineering, https://doi.org/10.1007/978-3-031-28793-0_6

1 Introduction

Previous research on Higher Education Institutions (HEIs) has widely reported the negative consequences of the pandemic context for the mental health of students, including issues of anxiety, depression, burnout, and even suicidal thoughts (Amendola et al., 2021; Cao et al., 2020; Fernández-Castillo, 2021; Huckins et al., 2020; Kaparounaki et al., 2020; Liyanage et al., 2021; Mheidly et al., 2020; Rudenstine et al., 2021; Savage et al., 2020; Wathelet et al., 2020; Zis et al., 2021; Zolotov et al., 2020). Remote learning is often put forward as a pivotal cause for these mental health issues, and is generally considered to have had a negative impact on the well-being of HEI students during the pandemic (Almhdawi et al., 2021; Horita et al., 2021; Juntunen et al., 2022; Lister et al., 2021; Petillion & McNeil, 2020). The outbreak of the COVID-19 pandemic forced HEI to abruptly switch from on-campus classes to remote learning (Bond et al., 2021; Mheidly et al., 2020), with the majority of learning activities transferred to internet platforms, using synchronous and asynchronous tools (Turnbull et al., 2021). Remote learning entailed several challenges, often leading students to fear that they would learn less or that their grades would be affected (Gil Villa et al., 2020; Zolotov et al., 2020), or even that they would fail the academic year or fail to complete their degree (Aucejo et al., 2020; Hossain et al., 2021; Lyons et al., 2020; Plakhotnik et al., 2021). On the other hand, remote learning also limited social interactions with peers and faculty, which may have impacted students' sense of social belonging and increased feelings of loneliness and isolation (Appleby et al., 2022; Juntunen et al., 2022; Mäkiniemi et al., 2021).

While the relationship between remote learning and the well-being of HEI students has been widely investigated, not much research has explored the process by which this occurs, that is, identifying variables that may mediate or moderate the relationship. This study attempts to explore this process by analysing the role of expectations on the usefulness of education as a mediator. These expectations are conceptualized as a belief that education will serve as a mean to develop or achieve resources (e.g. knowledge, skills, prestige, networking) that will be relevant for students' future professional lives.

Expectations on the usefulness of education have become a relevant variable for HEI students in the pandemic context. Recent studies have indicated that students are considerably worried with the impact of the pandemic on their employment prospects (Appleby et al., 2022; Aucejo et al., 2020; Gil Villa et al., 2020; Lister et al., 2021; Poma et al., 2021; Ulrich et al., 2021). The probability of obtaining a position in the labour market depends not only on context factors, but also on possessing resources valued by the labour market (Akkermans et al., 2019; Lyons et al., 2020; Silla et al., 2009; Vanhercke et al., 2014). Therefore, the expectation that the education they are receiving will equip them with resources valued by the labour market in the post-pandemic era is currently of the utmost importance for HEI students. Furthermore, previous research provides evidence that positive expectations contribute to higher levels of well-being for students (Armor & Taylor, 1998; Jackson & Wilton, 2017; Pancer et al., 2000; Taylor & Aspinwall, 1996).

Another under-researched topic in the literature concerns how the process linking remote learning and well-being evolves over time. It is quite possible that HEI students' reactions to remote learning have changed since March 2020. The initial shock and novelty effects are unlikely to still be present, and it is thus arguable that the consequences of these reactions on the well-being of students may also have evolved. This study analyses whether a growing experience with remote learning leads to lower negative effects of variables associated with remote learning and, consequently, to higher expectations on the usefulness of education and to higher well-being of HEI students. For this, we track two moments of the 2020–2021 academic year—the end of the first semester (December 2020) and the end of the second semester (May 2021).

In sum, this study aims to contribute to the state of the art on the antecedents of social sustainability in HEI by addressing two gaps in the literature: 1) The mediating role of expectations on the usefulness of education in the relationship between remote learning and the well-being of HEI students and 2) The effects of a growing experience with remote learning.

2 Literature Review

In the following sections, we present a literature review of the variables under study. We will start with two variables related to pervasive aspects of remote learning: fear of academic impairment and (lack of) social interactions. Subsequently, we will refer to the expectations on the usefulness of education, that is, expectations that Higher Education will be relevant for their future professional lives. Lastly, we will consider the well-being of HEI students.

The relationships among these variables will be analysed through the lens of Conservation of Resources (COR) Theory (Hobfoll, 1989). Previous research indicates that COR theory is relevant for understanding HEI students well-being in times of COVID-19 pandemic, when students need to adapt to remote learning and to reduce their social interactions (Plakhotnik et al., 2021).

While the major assumption of COR theory is that individuals strive to obtain and maintain the resources that they value or prize, the theory also postulates that actual or potential loss of resources leads to stress, thus lowering well-being (Hobfoll, 1989). We propose that expectations on the usefulness of education are a personal resource that HEI students strive to maintain or develop. Under the pandemic context, this resource may be threatened by variables related to remote learning, leading to decreased well-being. Thus, in this study, we attempt to test a model including the antecedents and the consequences of expectations on the usefulness of education.

2.1 Remote Learning and Fear of Academic Impairment

Before the pandemic, several studies had already reported that students' attitudes towards remote learning were influenced by different types of fears, including fear of the unknown technology (Cleveland-Conrad, 2002; Innes & Campbell, 2012; Muilenburg & Berge, 2005), as well as fear that the quality of education would decrease in the online environment (Kentor, 2015). These early studies occurred in a context where remote learning was an optional approach, occurring as a planned and supported activity. This was not at all the case of the remote learning activities that took place during the COVID-19 outbreak. These activities were a mandatory and survival mode of education, implemented in times of crisis without any previous planning (Bozkurt & Sharma, 2020; Ferri et al., 2020).

Understandably, this situation had considerable effects on HEI students. Evidence indicates that students not only feared that remote learning would decrease the quality of the education received (Gonzalez-Ramirez et al., 2021; Sehran, 2020), but also that it would negatively affect their learning experience, in a way that their grades would be affected (Gil Villa et al., 2020; Zolotov et al., 2020), or even that they would fail the academic year (Aucejo et al., 2020; Hossain et al., 2021). While some authors label these issues as fear of academic delay (e.g. Hossain et al., 2021), we consider that they are broader and will therefore refer to them as fears of academic impairment, encompassing not only the fear of delay, but also fear of lower grades and of lower quality of education.

2.2 Remote Learning and Social Interactions

Long before the sudden shift to remote learning due to the COVID-19 pandemic, both practitioners and researchers had already put forward some concerns regarding the social dimension of remote learning (Muirhead, 2000; Wegerif, 1998). Social interactions in online learning may help to build collaborative knowledge (Holland, 2019) and to create a sense of community where students develop social bonds (Kim et al., 2011). However, social interactions in online settings face additional challenges when compared to face-to-face settings. Learners who experience lack of social interactions often feel isolation, disconnectedness and loneliness, which may reduce their motivation to learn and may lead to dropout intentions (Boelens et al., 2017; Carr, 2000; Kim et al., 2011).

Studies undertaken after the outbreak of the pandemic continue to indicate that lack of social interactions reduces motivation to learn (Langegård et al., 2021), as well as students´ involvement in the learning process and students' learning satisfaction (Baber, 2021; Cicha et al., 2021; Zalazar-Jaime et al., 2021). However, while some studies found that remote learning reduced the possibility of social interactions (Langegård et al., 2021; Serhan, 2020; Shim & Lee, 2020), other studies found that, in times of lockdown, students saw their online learning activities as an opportunity

to socialize with peers and tutors without breaching the imposed social distancing (Baber, 2021; Cicha et al., 2021). In other words, in lockdown periods, it is not clear whether students associated remote learning with reduced or increased opportunities for social interactions.

2.3 Expectations on the Usefulness of Education

Broadly defined, academic expectations refer to "motivations and cognitions, such as students' perceptions, aspirations, and desires, related to their learning experiences and development" (Diniz et al., 2018, p. 689). A substantial body of research has documented that academic expectations influence the adaptation of students to University life, their engagement in their studies, their academic performance and their dropout intentions (Brattesani et al., 1984; Braxton et al., 1995; Casanova et al., 2019; Cole et al., 2009; Helland et al., 2002; Jackson et al., 2000; Kinnunen et al., 2018; Neuville et al., 2007; Páramo Fernández et al., 2017; Pike et al., 2014; Smith & Wertlieb, 2005; Solberg Nes et al., 2009).

There is a growing consensus that academic expectations is a multidimensional construct and several models to assess its different dimensions have been proposed (Baker et al., 1985; Borghi et al., 2016; Braxton et al., 1995; Casanova et al., 2019; Deaño et al., 2015; Diniz et al., 2018; Dziewanowska, 2017; Kinnunen et al., 2018; Páramo Fernández et al., 2017). Among these models, one recurring theme concerns the usefulness of education, that is, the expectation that education will serve as a mean to develop or achieve resources (e.g. knowledge, skills, prestige, networking) that will be relevant for students' future professional lives. For example, the model of Kinnunen et al. (2018) distinguishes between short-term expectations, concerning current academic issues (topics of study and learning activities), and long-term expectations, related to the future career (career goals and preparation for future career). The models of Deaño et al. (2015) and Diniz et al. (2018) include seven dimensions, of which three are closely related to the usefulness of education: The Training for Employment dimension includes expectations regarding the preparation for the transition into the labour market and the future career; The Personal and Social Development dimension refers to expectations related to the development of personal traits relevant for job performance; The Quality of Education dimension includes expectations regarding the scientific content of the studies. The value expectations model of Dziewanowska (2017) also includes seven dimensions, of which the two most important are in close connection with the usefulness of education. The functional dimension refers to the expectation that Higher Education studies will enhance their ability to effectively function in the labour market and to obtain a job that matches their prospects. The intrinsic dimension is related to the expectation that these studies will contribute to their personal growth and self-development.

Previous research indicates that, in remote learning, students' expectations of usefulness of education are positively associated with their perception of quality (Alsabawy et al., 2016) and their perspectives towards being able to learn in an

online environment (Panergayo & Aliazas, 2021). In the pandemic context, several studies report that students experience fears of academic impairment, including fear that the quality of education will decrease (Gonzalez-Ramirez et al., 2021; Sehran, 2020) and fear of learning less than in traditional settings (Gil Villa et al., 2020). Since there is evidence that quality of education and learning issues are associated with expectations of usefulness of education, it is, thus, arguable that students with higher fears of academic impairment (including lower quality of education and lower learning) will also have lower expectations on the usefulness of the education they are receiving. Therefore, we propose:

H1: Fear of academic impairment is negatively associated with expectations on the usefulness of education.

Previous research also indicates a possible relationship between social interactions and expectations on the usefulness of education. Kram and Isabella (1985) have long noticed the role of peer relationships to career development in early as well as later career stages. More recently, Peng (2019) refers the relevance of peer relationships at college to build a social capital that is positively related to students' employability. Social interactions are an opportunity to achieve social resources (develop social bonds and networking) which may increase students' perceptions of the usefulness of having a degree (Giannakos et al., 2017). In the pandemic context, it is arguable that students who expect to maintain their social interaction are also likely to have higher expectations on the usefulness of education. Thus, we propose:

H2: Social interactions are positively associated with expectations on the usefulness of education.

2.4 Well-Being of University Students

University students tend to report lower levels of well-being than the general population (Cooke et al., 2006) and are considered a high risk group for mental health issues (Can et al., 2021; Denovan & Macaskill, 2017; Van de Velde et al., 2021). During the COVID-19 pandemic, students faced additional challenges related to remote learning. Remote learning leads to fears of academic impairment (Gil Villa et al., 2020; Gonzalez-Ramirez et al., 2021; Sehran, 2020; Zolotov et al., 2020) and also to stress, anxiety and depression (AlAteeq et al., 2020; Elsalem et al., 2020; Fawaz & Samaha, 2021; Hung et al., 2021; Masha'al et al., 2020).

While the above-mentioned studies indicate that fear of academic impairment may be associated with lower levels of well-being, some studies have provided further evidence by correlating variables related to fear of academic impairment with measures of well-being. Results of these studies show that perceptions of remote learning crack-up and fear of loss of the academic year are positively associated with psychological distress (Hasan & Bao, 2020), and that lower perceptions on the quality of the education provided via remote learning negatively affect students' well-being (Maggio et al., 2021; Mheidly et al., 2020). Conversely, belief that distance learning is

as effective as in person learning is negatively associated with psychological distress (Marler et al., 2021). Based on this evidence, we propose:

H3: Fear of academic impairment is negatively associated with well-being.

Studies undertaken before the pandemic provide ample evidence that social connectivity and a sense of belonging protect students from negative feelings (Salles et al., 2019). During the pandemic, remote learning limited students' opportunities to build a sense of community and to develop social networks (Mäkiniemi et al., 2021; Tonon, 2021). Social distance from colleagues, lack of interaction with colleagues and isolation in social networks were associated with mental health issues such as depression, anxiety and stress (Elmer et al., 2020; Mäkiniemi et al., 2021; Villani et al., 2021). On the other hand, online learning activities were also an opportunity for social interactions with peers and tutors during lockdown (Baber, 2021; Cicha et al., 2021). There is evidence that social contact and connection with peers were positively associated with the well-being of students during the pandemic (Erden et al., 2022; Graupensperger et al., 2020). Thus, we propose:

H4: Social interactions are positively associated with well-being.

We were unable to find studies relating expectations on the usefulness of education to the well-being of HEI studies. However, considering that usefulness of education is as a pivotal resource for students' job and career prospects, COR theory (Hobfoll, 1989) presents some insights for this association. COR theory postulates that actual or potential loss of resources leads to stress, thus lowering well-being. During the pandemic, there is evidence that some students feared that the education they were receiving was not equipping them with the knowledge and skills necessary for their future careers (Kapila et al., 2020; Miani et al., 2021; Varvara et al., 2021). According to COR theory, students who consider that they are facing a potential loss of a resource deemed relevant for their future careers are more likely to experience mental health problems and, thus, lower well-being. Conversely, students who believe that they will be able to maintain or optimize the usefulness of the education they are receiving are less likely to experience stress or other mental health problems and may thus experience higher well-being. Therefore, we propose:

H5: Expectations on the usefulness of education are positively associated with well-being.

As mentioned in the introduction, one of the objectives of this study is to explore the process linking remote learning to the well-being of HEI students by analysing the role of expectations on the usefulness of education as a mediator. For this, we considered two pervasive issues of remote learning, i.e. fear of academic impairment and social interactions. Considering the previous hypotheses, positing that fear of academic impairment and social interactions have an impact on expectations on the usefulness of education, and that these expectations have an impact on well-being, we propose:

H6: Expectations on the usefulness of education mediate between fear of academic impairment and well-being.

H7: Expectations on the usefulness of education mediate between social interactions and well-being

Figure 1 depicts the research model under study.

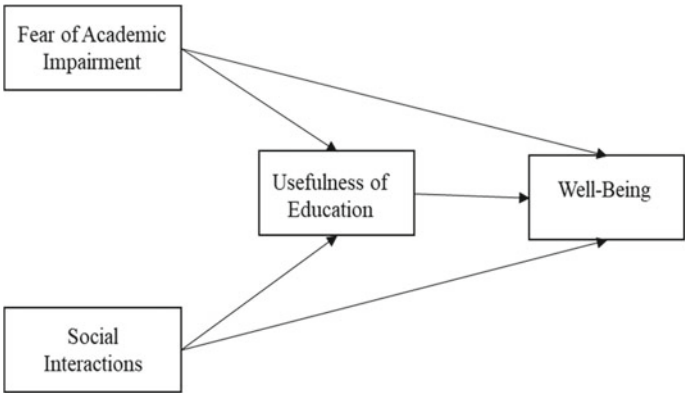

Fig. 1 Research model

3 Method

We collected data in a Business School in Lisbon, in two different moments of the 2020/2021 academic year: the end of the first semester (December 2020), where classes were taught in a hybrid system (half the students attending on-campus classes and half attending online classes via MS Teams, alternating in a weekly basis) and the end of the second semester (May 2021), where all classes were taught online via Teams.

In each of the data collection moments, we sent an e-mail to 508 students enrolled in three bachelor's degree programmes (Management, Economics, and Mathematics for Business and Economics). The e-mail requested the collaboration of the students, included information relevant for an informed consent and provided a link to a questionnaire in the *Qualtrics* platform. In the first semester, 160 students completed the questionnaires, for a response rate of 31.5%. In the second semester, 97 students answered the questionnaire, and the response rate was 19.1%.

3.1 Participants

In the first semester, among the total 160 participants, 109 (68.1%) are female, 82 (51.2%) come from areas of Portugal other than Lisbon, 144 (90%) are full-time students, and 112 (70%) live with their parents or other family members.

In the second semester, among the 97 participants, 66 (68%) are female, 43 (44.3%) come from other areas of Portugal, 89 (91.8%) are full-time students and 87 (89.7%) live with their parents or other family members.

3.2 Instrument

To analyse well-being we used the GP-CORE measure (Evans et al., 2005), with 17 items (e.g. "I have felt able to cope when things go wrong"). For each item, participants rate how often they have experienced the event described over the last week on a 5-point scale, ranging from 1 = Not at all to 5 = Most or all the time.

Fear of academic impairment was analysed with the measure developed by Martins Rosa (2020), with three items (e.g. "I am afraid that online classes will have a negative impact on my academic results"). Participants rate their agreement with each item using a 5-point scale, ranging from 1 = Completely disagree to 5 = Completely agree.

Social interactions were measured with the six items of the Social Interactions dimension of Almeida et al. (2017), for which a 7-point scale is used, where 1 = Extremely low and 7 = Extremely High (e.g. "Having a group of friends with whom I can relax after classes").

To measure expectations on the usefulness of education, we adapted six items from the Quality of Education and Training for Education dimensions of the instrument of Almeida et al. (2017) (e.g. "Acquire skills to achieve professional success in the future"). A 7-point scale is used, where 1 = Extremely low and 7 = Extremely High.

4 Results

We conducted a descriptive analysis of the data with SPSS (Statistical Package for the Social Sciences) software, version 27. Subsequently, to test the conceptual model, we used structural equations modelling (SEM) with partial least squares (PLS). PLS is a valuable tool for exploratory studies and it can be used with small samples (Henseler et al., 2014; Sarstedt et al., 2014). The software used was SmartPLS, version 3 (Ringle et al., 2015).

The following sections present the descriptive analysis of data and then the two steps of the structural equations model analysis (Hair et al., 2017). Firstly, we analyse the measurement models in terms of reliability and validity. Secondly, we analyse the structural model by testing whether the relationships between the variables are significant, as well as the explanatory power and the predictive relevance of the model.

4.1 Descriptive Analysis

Table 1 shows the means and standard deviations of the items used in each of the measures. For the well-being measure, in Semester 1 the means vary between 3.388 (WB6) and 3.688 (WB3). In Semester 2, the means vary between 2.866 (WB6) and

3.361 (WB3). The only item whose mean is below the theoretical mid-point of the scale (3) is item WB6 in Semester 2. For all items, the means are lower in Semester 2 when compared with semester 1. The analysis of variance (ANOVA) shows that the difference of means between the two semesters is significant ($p < 0.05$) for all items, except WB2 and WB4.

For the fears of remote learning measure, in Semester 1, the item means vary between 3.331 (FA3) and 3.825 (FA2). In Semester 2, the means vary between 3.742 (FA3) and 4.041 (FA2). In both semesters, the means of all items are above the theoretical mid-point of the scale (3). Also, for all items, the means are higher in Semester 2 when compared with Semester 1. However, ANOVA shows that the difference is only significant ($p < 0.05$) for item FA3.

As far as the social interactions measure is concerned, in Semester 1, the means vary between 4.700 (SI3) and 5.543 (SI1). In Semester 2, the means vary between 4.732 (SI3) and 5.433 (SI5). In both semesters, the means of all items are above the theoretical mid-point of the scale (4). The means are lower in Semester 2 when compared with Semester 1, except for item SI4. However, ANOVA shows that the differences from one semester to the other are not significant.

For the usefulness of education scale, the means in Semester 1 vary between 5.350 (UE1) and 6.019 (UE2 and EC4). In Semester 2, the means varied between 5.093 (UE1) and 5.742 (UE4). In all cases, the item means are above the theoretical mid-point of the scale (4) and the mean of the items in Semester 1 is higher than the mean in Semester 2. ANOVA shows that the mean difference in the two semesters is significant for all items ($p < 0.05$) except UE3 and UE4.

4.2 Measurement Models

The analysis of reliability was based on Cronbach's Alpha and composite reliability tests, for which the required threshold is 0.7 (Hair et al., 2011; Nunnally & Bernstein, 1994). Table 2 shows that, for all variables, the Cronbach's Alpha and the composite reliability are above 0.7, both in Semester 1 and in Semester 2.

The analysis of convergent validity also included two tests. Firstly, we assessed the average variance extracted (AVE), for which the required threshold is 0.5 (Hair et al., 2011; Henseler et al., 2009; Sarstedt et al., 2014). Table 2 shows that the AVE is above 0.5 for all variables. Secondly, we calculated bootstrap t-statistics of the item's standardized loadings (Table 1). All indicators had a significant loading ($t > 3.29$; $p < 0.001$) in the respective variable, which is also an indication of convergent validity (Anderson & Gerbing, 1988).

For discriminant validity, we followed Fornell and Larcker, (1981) criterion and, thus, compared the square root of average variances extracted (AVE) with the correlations for each pair of latent variables. Table 3 shows that, for all pairs, the square root of the AVE is higher than the correlation. This indicates that each variable shares more variance with its measurement than with other variables, which may be considered evidence of discriminant validity.

Table 1 Means. Standard deviations and standardized loadings of indicators

Variable	Item	Mean	Standard deviation	Loadings	Bootstrap t-test	p
End of Semester 1						
Well-being	WB1	3.481	1.015	0.805	22.260	0.000
	WB2	3.469	0.911	0.752	15.232	0.000
	WB3	3.688	0.946	0.840	25.192	0.000
	WB4	3.494	0.932	0.844	35.253	0.000
	WB5	3.393	0.984	0.845	31.331	0.000
	WB6	3.388	1.033	0.865	38.463	0.000
Fear of academic impairment	FA1	3.731	1.185	0.951	102.479	0.000
	FA2	3.825	1.158	0.949	80.883	0.000
	FA3	3.331	1.114	0.894	38.312	0.000
Social interactions	SI1	5,247	1.627	0.891	35.762	0.000
	SI2	5,165	1.539	0.888	39.125	0.000
	SI3	4.732	1.717	0.869	29.070	0.000
	SI4	5.433	1.529	0.886	25.586	0.000
	SI5	5.196	1.404	0.897	26.720	0.000
Usefulness of education	UE1	5.350	1.077	0.791	13.148	0.000
	UE2	6.019	1.113	0.851	19.687	0.000
	UE3	5.887	1.239	0.800	15.501	0.000
	UE4	6.019	1.124	0.895	29.416	0.000
	UE5	5.944	1.134	0.830	11.938	0.000
	UE6	5.894	1.062	0.795	10.189	0.000
	UE7	5.844	1.179	0.859	22.525	0.000
End of Semester 2						
Well-being	WB1	3.237	0.899	0.764	13.405	0.000
	WB2	3.320	0.884	0.787	13.699	0.000
	WB3	3.361	0.926	0.836	26.657	0.000
	WB4	3.351	0.979	0.660	6.903	0.000
	WB5	3.124	0.869	0.837	19.952	0.000
	WB6	2.866	1.007	0.806	18.454	0.000
Fear of academic impairment	FA1	3.979	1.258	0.959	61.056	0.000
	FA2	4.041	1.216	0.957	49.751	0.000
	FA3	3.742	1.244	0.915	37.917	0.000
Social interactions	SI1	5,247	1.627	0.891	35.762	0.000
	SI2	5,165	1.539	0.888	39.125	0.000
	SI3	4.732	1.717	0.869	29.070	0.000
	SI4	5.433	1.529	0.886	25.586	0.000

(continued)

Table 1 (continued)

Variable	Item	Mean	Standard deviation	Loadings	Bootstrap t-test	p
	SI5	5.196	1.404	0.897	26.720	0.000
Usefulness of education	UE1	5.093	1.155	0.827	13.948	0.000
	UE2	5.577	1.273	0.924	41.828	0.000
	UE3	5.588	1.337	0.858	16.501	0.000
	UE4	5.742	1.301	0.922	40.364	0.000
	UE5	5.577	1.314	0.948	61.933	0.000
	UE6	5.546	1.242	0.913	33.834	0.000
	UE7	5.361	1.401	0.807	13.710	0.000

Table 2 Reliability and validity measures

Variables	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
End of Semester 1			
Well-being	0.906	0.928	0.682
Fear of academic impairment	0.924	0.952	0.868
Social interactions	0.918	0.938	0.753
Usefulness of education	0.926	0.940	0.693
End of Semester 2			
Well-being	0.874	0.905	0.615
Fear of academic impairment	0.939	0.961	0.891
Social interactions	0.932	0.948	0.785
Usefulness of education	0.954	0.963	0.787

4.3 Structural Model

Considering that there was evidence of reliability and validity in the measurement models, we proceeded to the analysis of the structural model in each of the two semesters (Hair et al., 2017; Henseler et al., 2009).

The significance of the path coefficients was analysed with bootstrapping t-tests ($t > 3.29$; $p < 0.001$). Of the five direct relationships under study, two were not significant in any of the semesters, showing t-statistics below 1.645 ($p > 0.1$). The relationship between Fear of Academic Impairment and Usefulness of Education and the relationship between Social Interactions and Well-Being are non-significant. Therefore, hypotheses H2, H3 and H5 are validated but hypotheses H1 and H4 are not validated.

Table 3 Correlations between latent variables and square roots of the average variance extracted

	(1)	(2)	(3)	(4)
End of Semester 1				
1. Well-being	**0.826**			
2. Fear of academic impairment	−0.082	**0.932**		
3. Social interactions	0.274	0.344	**0.868**	
4. Usefulness of education	0.412	0.202	0.585	**0.832**
End of Semester 2				
1. Well-being	**0.784**			
2. Fear of academic impairment	−0.172	**0.944**		
3. Social interactions	0.329	0.207	**0.886**	
4. Usefulness of education	0.431	0.160	0.654	**0.887**

Note Numbers in bold denote the square root of the AVE

Table 4 presents the analysis of the path coefficients of the direct relationships after the deletion of the non-significant relationships. It is noteworthy that the significance level is above 95% ($p < 0.05$) for all path coefficients except for the relationship between Fear of Academic Impairment and Well-Being in Semester 1. However, since it fulfils the requirement of $t > 1.645$ ($p < 0.1$), we decided to maintain this relationship in the model of Semester 1.

We analysed the magnitude of effect sizes (f^2), considering the reference values of 0.02 for weak effects, 0.15 for medium effects and 0.35 for large effects (Cohen, 1988). In both semesters, the effect is large in the case of the relationship between Social Interactions and Usefulness of Education, medium in the case of the relationship between Usefulness of Education and Well-Being and weak for the relationship between Fear of Academic Impairment and Well-being.

We also used bootstrapping t-tests to analyse the significance of the indirect relationships (Table 5). Results show that the indirect relationship between Social Interactions and Well-being, through the mediation of Usefulness of Education, is significant

Table 4 Direct effects—significant relationships

		B	t test	p	f^2
End of Semester 1					
H2	Social interactions—usefulness of education	0.587	6.811	0.000	0.527
H3	Fear of academic impairment—well-being	−0.172	1.872	0.061	0.036
H5	Usefulness of education—well-being	0.446	3.568	0.000	0.238
End of Semester 2					
H2	Social interactions—usefulness of education	0.656	10.393	0.000	0.756
H3	Fear of academic impairment—well-being	−0.249	2.203	0.028	0.080
H5	Usefulness of education—well-being	0.471	4.347	0.000	0.287

Table 5 Indirect effects—significant relationships

		B	t test	p
End of Semester 1				
H7	Social interactions—usefulness of education—well-being	0.262	2.708	0.007
End of Semester 2				
H7	Social interactions—usefulness of education—well-being	0.309	3.506	0.000

at the $p < 0.05$ level in both semesters. However, the indirect relationship between Fear of Academic Impairment and Well-Being, through the mediation of Usefulness of Education, is not significant. Therefore, H7 is validated, but H6 is not validated.

Subsequently, we analysed the explanatory power of the model through the coefficient of determination (R^2) of the endogenous variables. In Semester 1, the model explains 19.8% of Well-being and 34.5% of Usefulness of Education. In Semester 2, the model explains 24.7% of Well-Being and 43.1% of Usefulness of Education. Finally, we assessed the predictive relevance of the model through Stone-Geisser's indicator (Q^2). For all endogenous variables, the values are above zero in both semesters, which is evidence of the predictive relevance of the model (Hair et al., 2017).

Through multi-group analysis, we found that there are no significant differences between the model of Semester 1 and the model of Semester 2. Figures 2 and 3 show, respectively, the final structural model at the end of Semester 1 and at the end of Semester 2.

4.4 Discussion

Results show that students' well-being was significantly lower in May 2021 (end of semester 2) when compared to December 2020 (end of semester 1). Besides, fears of academic impairment increased, while expectations of the usefulness of education decreased. In sum, contrary to our expectations, an increased experience with online learning did not lead to better results. One possible explanation is that, during the first confinement period due to COVID-19, students worked hard to prevent any academic impairment, achieving, overall, positive academic results (Gonzalez et al., 2020), but in May 2021, after overcoming a second confinement period where remote learning was the exclusive format of learning, students had their expectations of having a "normal" academic life frustrated.

Both predictors of the research model—social interactions and fear of academic impairment—affect students' well-being. However, it is noteworthy that fear of academic impairment has a direct effect on well-being, but the effect of social interactions is indirect, that is, mediated by expectations on the usefulness of education. A possible explanation is that students perceive that social interactions with their peers may increase their employability prospects by enriching their social capital (Peng,

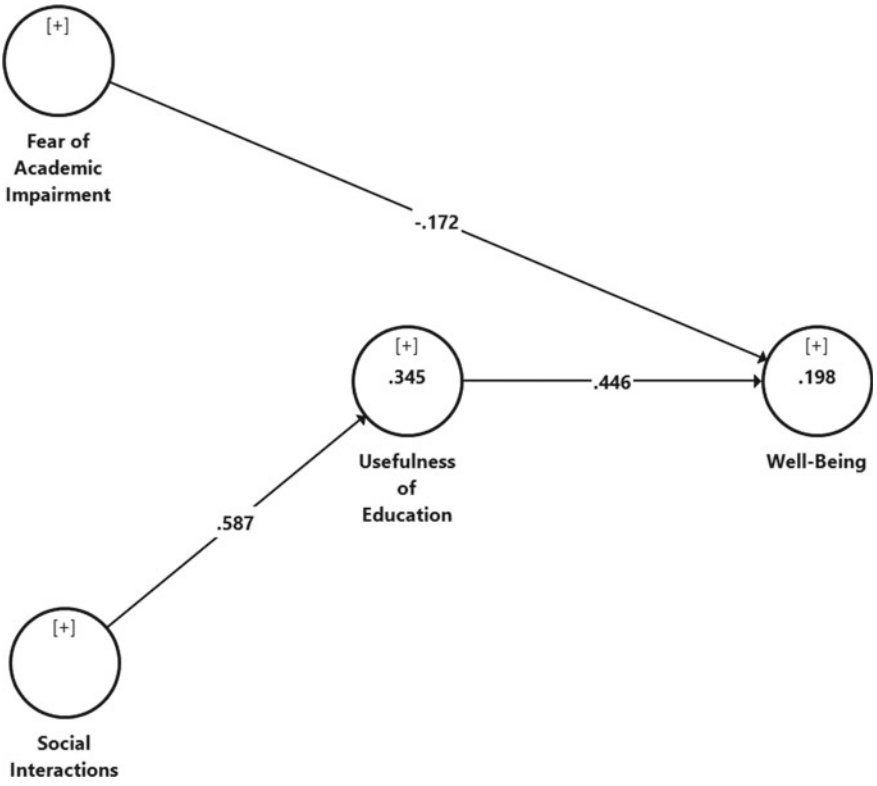

Fig. 2 Final structural model—end of semester 1

2019) and, thus, increasing the usefulness of education. The fact that the relationship between social interactions and well-being, though positive, is not significant reflects the mixed results of previous studies conducted during the pandemic. It seems that, for some students, the lack of in person social interactions had a negative impact on their well-being (Elmer et al., 2020; Mäkiniemi et al., 2021; Villani et al., 2021), while, for other students, social interactions with colleagues were not so relevant or they could find a way to substitute physical with online social interactions (Baber, 2021; Cicha et al., 2021).

As expected, fear of academic impairment has a direct negative effect on well-being, even though weak. Previous research (Gonzalez-Ramirez et al., 2021; Sehran, 2020) has already pointed out the pervasive effects that fear of a decrease on the quality of the emergency online education has on students well-being. Additionally, fear of academic impairment does not impact on students' perceptions on the usefulness of education. A possible explanation may be the fact that the students in this sample were studying economics and business, which were courses that can easily be taught online, since they do not require labs, gyms or other facilities only available

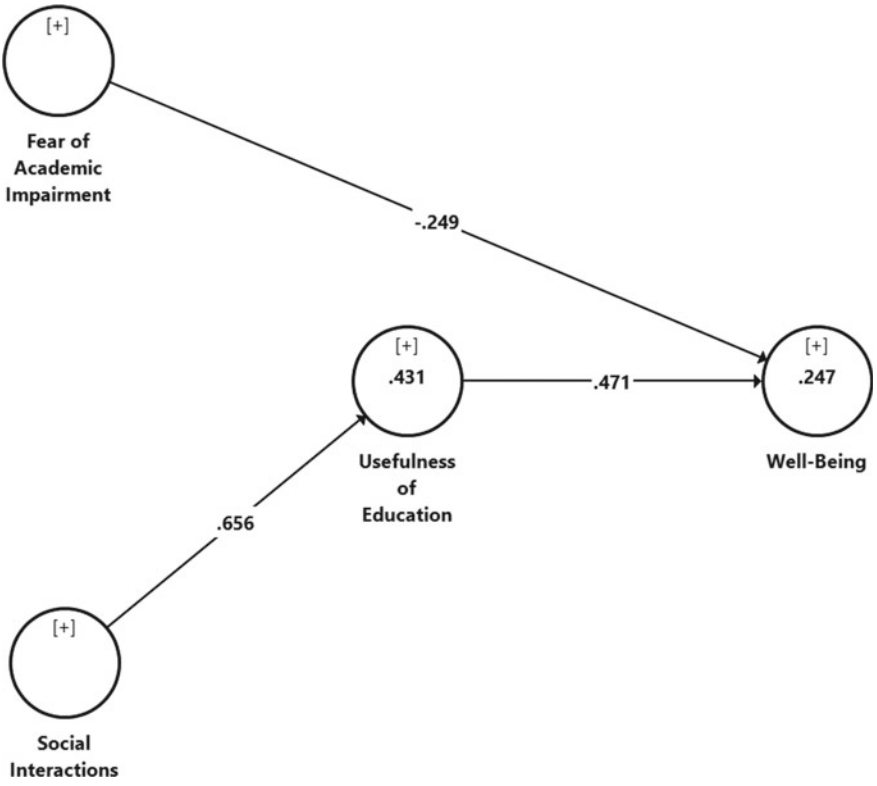

Fig. 3 Final structural model—end of semester 2

in campus, as it is, for instance, the case of undergraduate health sciences students (Abdull Mutalib et al., 2022).

5 Conclusions

The lack of social interactions and fear of academic impairment have long been considered as two pervasive factors of remote learning that negatively affect students' well-being. The present study clarifies the process that links remote learning features to students' well-being in the specific context of COVID-19 pandemic, by highlighting the mediating role of expectations on the usefulness of education. This is, to the best of our knowledge, the first research to present empirical evidence for this mediation.

This study also emphasizes the relevance of social interactions between college students to develop positive expectations on the usefulness of online education, which, in turn, positively affects students' well-being. In fact, social interactions

with classmates are not only important to provide social and emotional support but also to share ideas, ask questions, etc. (Bouhnik & Marcus, 2006).Therefore, HEI managers interested in providing online courses should consider promoting different opportunities for social networking, either to discuss class topics or to share personal interests, hobbies, etc. (Greenhow & Galvin, 2020). Instructors can also play an important role in compensating the lack of social interaction by adopting adequate pedagogical approaches and create learning activities that foster social interaction, teamwork and group discussions (Bond, 2021; Kim et al., 2020; Langegård et al., 2021; Vlachopoulos & Makri, 2019).

This study reveals that, contrary to expected, a growing experience with online learning didn't improve students' well-being, neither their perceptions on the usefulness of remote education. Therefore, future studies on this topic may clarify if these results are due to the specific context of the pandemic or whether we let split other relevant variables.

One limitation of this study relates to the fact that the sample in Semester 2 was not the same in Semester 1, which reduces the extent of results comparison. The results of the study are influenced by the specific context of COVID-19 pandemic, therefore cannot be extrapolated to a different context. Another limitation concerns the fact that data were collected from a single business school which limits the possibility of extrapolating the results from this study.

Students' well-being, both in remote and in person settings, is one of the main goals of any sustainable HEI (Wolff & Ehrström, 2020) and an essential ingredient to academic engagement and academic performance (Oriol-Granado et al., 2017). To promote students' well-being HEI should consider the relevance of students' expectations on the usefulness of education, that is, expectations that the education being given will lead to the desired learning outcomes—knowledge, skills and aptitudes—that match the labour market requirements and promote future employability.

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The Contribution of Social Sciences and Arts to the Sustainable Development Goals in Higher Education

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Abstract In this work, we analysed the mapping of the Sustainable Development Goals in the curricular units of the Social Sciences and Arts degree courses of the University of Évora. We took as reference the totality of the curricular units of Social Sciences (408) and Arts (261) degree courses existing in 2022. The data presented refer to the SDGs marked by teachers in the curricular units with the exception of SDG4 (Quality Education) previously marked by the university. The results showed that the most marked objectives in the area of social sciences were SDG5, SDG8. SDG10 and SDG16. In the Arts area, SDG3, SDG11. SDG12 and SDG13. We found statistically significant differences when comparing the Departments and also the scientific areas.

Keywords Sustainable development goals · Higher education · Social sciences · Arts

1 Introduction

The idea of sustainable development emerged in the 1980s aiming at changes in societies' behaviour towards a better balance between social, economic and environmental dimensions. The term "sustainable development" was formalised in 1987 in the Brundtland report "Our Common Future" by the World Commission on Environment and Development (Pisani, 2006; WCED, 1987). From this moment, the definition of sustainable development gains greater visibility since it highlights the development that seeks to meet the needs of the current generation without compromising the future of future generations. This allows people, now and in the future, to achieve a satisfactory level of social and economic development and human and

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cultural fulfilment based on a balanced use of natural resources and the preservation of species and natural habitats. Since then, a considerable amount of environmental legislation and a number of international agreements, in addition to the mapping of environmental change, have strongly driven global policy change in this context (Adams, 2006).

Although widely used in scientific literature, the term sustainable development reveals some diversity of concepts whose meaning varies according to the contexts and areas of application (Stepanyan et al., 2013; Yolles & Fink, 2014). Despite the lack of consensus on the concept, there is general acceptance that sustainable development is about achieving a balance between human needs and the environment and understanding the complex dynamics of interaction between the two (Barbosa et al., 2014). It also meets a consensus that it represents something positive that, in general, aims at human well-being in the long term by optimising the management of the environmental system (Seager, 2008).

Despite the diversity of approaches over the last four decades, climate change and its increasingly visible and catastrophic effects in many parts of the globe have put the issue in the spotlight. Thus, in 2015, the United Nations Summit on Sustainable Development was held in New York, which gave rise to the resolution "Transforming our world: Agenda 2030 for Sustainable Development" (Eurostat, 2017) that came into force on 1 January 2016 (UNRIC, 2016) constituting the new global sustainable development strategy. The SDGs replaced the Millennium Development Goals (MDGs), which were adopted in 2000 and were the guide for action for development until 2015 (Eurostat, 2017). The 2030 Agenda includes 17 Sustainable Development Goals (SDGs), 169 targets and 232 indicators that translate into an action plan focussed on people, the prosperity of peoples and the promotion of peace through the establishment of partnerships between developed and developing countries and different sectors that must be achieved by 2030 worldwide (European Commission, 2016). It thus aims for collaboration, mutual aid and shared responsibilities (European Commission, 2016) and, in this sense, it becomes a universal, broad and ambitious agenda (UNRIC, 2016).

The 17 Sustainable Development Goals (SDG) are presented below:

1. End poverty in all its forms everywhere.
2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture.
3. Ensure healthy lives and promote well-being for all at all ages.
4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
5. Achieve gender equality and empower all women and girls.
6. Ensure availability and sustainable management of water and sanitation for all.
7. Ensure access to affordable, reliable, sustainable and modern energy for all.
8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

10. Reduce inequality within and among countries.
11. Make cities and human settlements inclusive, safe, resilient and sustainable.
12. Ensure sustainable consumption and production patterns
13. Take urgent action to combat climate change and its impacts.
14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development
15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.
17. Strengthen the means of implementation and revitalise the global partnership for sustainable development.

Regarding its priorities, Portugal has identified six strategic SDG(s) for the country's development, specifically, Quality Education, Gender Equality, Industry, Innovation and Infrastructure, Reduction of Inequalities, Climate Action and Protection of Marine Life (MNE, 2017). Although the SDGs are non-binding, it is proposed that governments take responsibility for their implementation and monitoring (Eurostat, 2017) to respond to the problems facing the world have been identified as the most urgent aspect of coverage—from eradicating poverty and hunger to strategies that promote economic growth and address social needs, including education, health, social protection and employment opportunities, to climate change and environmental protection.

The concern with sustainable development on the part of Higher Education Institutions (HEIs) dates back to 1990, when the International Conference of Talloires, France, was held with the participation of 22 university representatives. This resulted in ten action measures for higher education institutions to contribute to a more sustainable future (Talloires Declaration, 1990). In the Declaration, we read: "Universities educate the majority of people who develop and manage the higher education institutions of society. For this reason, universities have profound responsibilities in raising awareness, knowledge, technologies and tools to create an environmentally sustainable future" (p. 1). This declaration was thus the first official document signed by universities, reflecting the commitment to teach and research within the framework of sustainable development (Figueiró & Raufflet, 2015).

Higher education is seen as an essential component specifically considering SDG4, given its role in policy and education at all levels through teaching and research. Universities should try to make the most of the many opportunities that SDG(s) offer, not only in the field of teaching and research, but also in their university extension activities (Leal Filho et al., 2017, 2019). According to Bautista-Cerro Ruiz and Díaz González (2017), this commitment in universities is advancing with the help of academics (teachers and managers) who, individually, include it in their disciplines and course design.

It is in this context that universities are challenged to include the 17 Sustainable Development Goals (SDGs) in the wide range of their training provision and higher education is expected to contribute with knowledge and innovation to meet social, economic and environmental challenges through the training of both academic staff and students. Goal 4 (Quality Education), in particular, recognises the importance of education for sustainable development and some goals explicitly call for action by Higher Education Institutions, given their direct relevance in teaching and learning activities, knowledge production and skills development to meet the challenges of today's and tomorrow's world (Leicht et al., 2018). In particular, it is intended to ensure that all students acquire the knowledge and skills necessary to promote sustainable development (UNESCO, 2017). Universities occupy a privileged place in society and assume an unquestionable role in the creation and dissemination of knowledge. Over time, they have proven to be powerful drivers of local, national and global innovation, economic development and human well-being (SDSN, 2017a). Thus, the contribution of universities can be very broad, as they cover several fields such as: (i) learning and teaching, where they can provide knowledge, skills and motivation needed to understand and address the SDGs and, in general, education for sustainable development; (ii) research, through scientific production, technological solutions and innovation resulting from new national and international interdisciplinary or transdisciplinary approaches; (iii) governance, through university management and extension policies and (iv) social leadership through strengthening the university's public commitment to the implementation of the SDGs (SDSN, 2017b).

The integration of the SDGs in university curricula is the great lever for their incorporation in future professionals, being necessary that this integration goes beyond the institutional dimension and advances to practical dimensions (Chaleta et al., 2021; Leal Filho et al., 2019). On the other hand, the perspective of application at a global level allows comparing indicators between the various institutions and knowing how the incorporation of the SDGs has evolved (Chowdhury & Koya, 2017; De La Poza et al., 2021; Freidenfelds et al., 2018; Perović & Kosor, 2020). De La Poza et al. (2021) proposed an assessment of the alignment of the SDGs based on the ranking developed by Times High Education (THE). Annan-Diab and Molinari (2017) consider that professionals from different fields should take every opportunity to implement the sustainable development dimension by considering social, environmental and economic aspects, as well as issues related to decent working conditions and climate change. In their case study on an MBA, they mention the importance of incorporating sustainable development across the curriculum from an integrated and interdisciplinary approach, recognising the added value of different sustainability perspectives. Interdisciplinarity is seen as key to understanding and acting on complex problems, and it is essential to align the expected outcomes of sustainable development education with the SDGs.

Despite progress, there is still a lack of integrative approaches to truly implement the Sustainable Development Goals in higher education. Sáez de Cámara et al. (2021) carry out a case study at the University of the Basque Country (UPV/EHU) proposing a holistic approach involving the whole institution. After defining the analysis path (mapping, integration, diagnosis and definition to estimate the situation taking into

account the SDGs), they concluded that it is crucial that the university defines indicators and values them in order to bring about a culture change in the organisation as a whole (which is traditionally difficult in universities). They conclude that if indicators are not endorsed and valued by the university, they may be seen as an additional administrative burden with the opposite effect. Thus, training university faculty for the development of sustainability through the SDGs is crucial for them to adapt their programmes and methodologies (Saitua-Iribar et al., 2020). It is desirable to achieve sustainable development and, to do so, it is necessary to cross organisational boundaries, align perspectives, ensure global coordination, etc. (Niedlich et al., 2020).

With this commitment, the University of Évora started in April 2020 the mapping of the SDGs in its education offer and was one of the Portuguese Higher Education Institutions to strengthen the alignment with the guidelines outlined in the 2030 Agenda for Sustainable Development. In this context, the University marked for all curricular units SDG4 and challenged teachers to identify other SDGs that could be developed from the curricular units for which they were responsible. This process consisted in marking the SDGs in the university platform (SIIUE-Integrated Information System of the University of Évora) where all the information about the courses is available.

We present, in this case, the data concerning the SDGs of the Social Sciences area and the Arts area considering only the curricular units of the undergraduate courses. We intend to identify differences between Departments of the same scientific area and to identify the main differences between the two scientific areas. In this context, the objectives of the study are: (i) to identify the SDGs marked in the curricular units of the Social Sciences courses; (ii) to identify the SDGs marked in the curricular units of the Arts degree courses and (iii) to identify possible differences in the mapping of SDGs at Departmental level in each area.

After this introduction, this chapter presents the following sections: Method, where the data collection and quantitative data analysis are presented; Results related to SDGs in curricular units by Department and analysis of differences between SDGs in Social Sciences and Arts and finally the Final Considerations are made.

2 Method

2.1 Data Collection

The study aims to map the SDGs marked on the University platform that contains information about all the curricular units. The analysis was carried out taking into account the curricular units of the degree courses indexed to each scientific area/department. The School of Social Sciences includes eight Departments

(Economics, Philosophy, Management, History, Linguistics and Literatures, Pedagogy and Education, Psychology and Sociology) and the School of Fine Arts includes three Departments (Architecture, Visual Arts and Design and Music).

2.2 Quantitative Data Analysis

For quantitative data analysis, descriptive analysis and analysis of variance (ANOVA), we used IBM SPSS Statistics 24.

To compare the SDGs marked in the curricular units we used simple descriptive statistics.

For the hypothesis test, we used analysis of variance (one-way ANOVA) because it allows us to compare the distribution of three or more groups in independent samples. We have proposed the following defined assumptions for the test:

(a) Differences between Departments.

- H0: There are no differences between the SDGs marked by teachers in each Department.
- H1: There is at least one Department where the marked SDGs are different.

(b) Differences between the area of Social Sciences and the area of Arts.

- H0: There are no differences between the SDGs marked by teachers in each area.
- H1: There are differences between the SDGs marked in the area of Social Sciences and the area of Arts.

3 Results

In the SDG mapping process at the University of Evora, SDG4 (Quality Education) is present in all curricular units (automatically marked by the institution). For this reason, results related to this SDG4 will not be presented. Regarding the marking of the other SDGs, it is the teachers responsible for the curricular unit who mark the SDGs.

It was found that although teachers were asked to mark their course units with the SDGs they considered relevant, about half of the course units have only indicated SDG 4, which was automatically assigned by the institution.

3.1 SDGs in the Social Sciences Curricular Units Per Department

The analysis of the data considering the curricular units of the Social Sciences and Arts degree courses by Department (Tables 1 and 2) shows us, as already mentioned, that SDG4 (ensure inclusive and equitable quality education and promote lifelong learning opportunities for all) was present in all curricular units.

In the Departments of the School of Social Sciences SDG4 corresponds to 39.5% of the objectives indicated and in the Departments of the School of Fine Arts to 68.9%.

Regarding the Departments of the School of Social Sciences (Table 1) we found more SDGs (excluding SDG4) in Linguistics and Literatures, History and Sociology. The most marked SDGs in the Departments were

- SDG5 (achieve gender equality and empower all women and girls) more referred by the Departments of Linguistics and Literatures, History and Psychology.
- SDG10 (reduce inequality within and among countries), more referred by the Departments of Linguistics and Literatures, History and Sociology.
- SDG8 (promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all) more referred by the Departments of Linguistics and Literatures, Sociology and Management.
- SDG16 (promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels) more referred by the Departments of Linguistics and Literatures, History and Sociology.

If we remove the values of SDG4 in relation to the total obtained by each Department, the data does not change in relation to the SDGs most marked in each Department.

We can observe in Table 2 that there are statistically significant differences between Departments in SDG1 (more referred by the Departments of Economics, Sociology and Psychology), in SDG2 (referred by the Departments of Economics and Linguistics and Literatures), in SDG3 (more referred by the Departments of Psychology, Pedagogy and Education and Sociology), in SDG5 (more present in Linguistics and Literatures and History), in SDG8 (more referred by the Departments of Linguistics and Literatures, Sociology and Management), in SDG10 (more in Linguistics and Literatures, Sociology and History), in SDG11 (more in History, Sociology and Linguistics and Literature) and in SDG16 (more in Linguistics and Literature and History).

Table 1 SDGs in the courses by Department of Social Sciences

Departments	SDG																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	T	%
Economics	5	3	1	46	2	0	1	11	5	6	3	5	1	0	1	5	2	97	9.4
Philosophy	0	0	1	32	2	0	0	0	0	1	1	0	0	0	0	3	0	40	3.9
Management	0	0	2	35	3	0	0	15	4	4	2	5	3	1	1	1	3	79	7.7
History	2	0	2	72	20	0	0	13	0	17	15	1	1	1	1	19	3	167	**16.3**
Linguistics and literatures	0	2	3	78	46	0	0	25	2	39	11	12	5	5	0	34	4	266	**25.9**
Pedagogy and education	3	0	12	43	10	0	0	8	3	13	8	0	1	0	0	6	3	110	**10.7**
Psychology	4	0	17	40	14	0	0	5	3	11	1	0	0	0	0	5	1	101	9.8
Sociology	5	0	9	60	12	0	0	17	6	17	15	3	1	0	0	10	12	167	**16.3**
Total	19	5	47	406	109	0	1	94	23	108	56	26	12	7	3	83	28	1027	100
%	1.9	0.5	4.6	**39.5**	**10.6**	0	0.1	**9.2**	2,2	**10.5**	5.5	2.5	1.2	0.7	0.3	**8.1**	2.7	100	

Table 2 Analysis of SDG differences in School of Social Sciences

SDG	M	SD	*F*	*p*
1. No poverty	1.03	0.182	4.278	**0.000**
2. Zero hunger	1.01	0.077	4.005	**0.000**
3. Good health and well-being	1.08	0.275	12.210	**0.000**
4. Quality education	2.00	0.000	–	–
5. Gender equality	1.16	0.367	28.022	**0.000**
6. Clean water and sanitation	1.00	0.039	0.195	0.992
7. Affordable and clean energy	1.01	0.109	1.070	0.382
8. Decent work and economic growth	1.14	0.343	12.649	**0.000**
9. Industry, innovation and infrastructure	1.06	0.237	2.106	0.033
10. Reducing inequality	1.18	0.382	13.805	**0.000**
11. Sustainable cities and communities	1.11	0.308	2.946	**0.003**
12. Responsible consumption and production	1.06	0.237	2.652	0.007
13. Climate action	1.04	0.207	1.373	0.205
14. Life below water	1.00	0.067	0.916	0.503
15. Life on land	1.01	0.077	0.924	0.496
16. Peace, justice and strong institutions	1.13	0.335	15.383	**0.000**
17. Partnerships for the goals	1.06	0.440	0.743	0.654

3.2 SDGs in the Art Curricular Units Per Department

In relation to Departments of the School of Fine Arts (Table 3), we verify that the Department that scored more SDGs is the Department of Visual Arts and Design (44.6%). However, it should be noted that if we remove SDG4, the Departments that scored more goals are the Department of Visual Arts and Design (n = 63; 53.4%) and the Department of Architecture (n = 49; 41.5%). In the Department of Music only 6 SDGs (5.1%) were marked in addition to SDG4.

The most marked SDGs in the Departments of the School of Fine Arts were

- SDG11 (make cities and human settlements inclusive, safe, resilient and sustainable) more referred by the Department of Architecture.
- SDG12 (ensure sustainable consumption and production patterns), more referred by the Department of Visual Arts and Design.
- SDG13 (take urgent action to combat climate change and its impacts) more referred by the Department of Architecture.
- SDG3 (ensure healthy lives and promote well-being for all at all ages) more referred by the Department of Visual Arts and Design.

In Table 4, we can observe that there are statistically significant differences between Departments in SDG3, SDG5 and SDG8 (more referred by the Departments of Architecture and Visual Arts and Design), in SDG10 (more present in

Table 3 SDGs in the courses by School of Fine Arts

Departments	SDG																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	T	%
Architecture	0	0	8	51	1	1	3	1	6	1	15	3	10	0	0	0	0	100	26.4
Visual arts and design	2	0	6	106	1	0	1	2	7	4	6	15	7	1	2	5	4	169	**44.6**
Music	0	0	0	104	0	0	0	0	0	6	0	0	0	0	0	0	0	110	29.0
Total	2	0	14	261	2	1	4	3	13	11	21	18	17	1	2	5	4	379	100
%	0.5	0	**3.7**	68.9	0.5	0.3	1.1	0.8	3.4	2.9	**5.5**	**4.7**	**4.5**	0.3	0.5	1.3	1.1	100	

Table 4 Analysis of SDG differences in Department of School of Arts

SDG	M	SD	*F*	*p*
1. No poverty	1.03	0.182	3.308	0.020
2. Zero hunger	1.01	0.077	0.853	0.465
3. Good health and well-being	1.08	0.275	6.364	0.000
4. Quality education	–	–	–	–
5. Gender equality	1.16	0.367	27.441	0.000
6. Clean water and sanitation	1.00	0.039	4.165	0.006
7. Affordable and clean energy	1.01	0.109	3.684	0.012
8. Decent work and economic growth	1.14	0.343	20.427	0.000
9. Industry, innovation and infrastructure	1.06	0.237	2.659	0.047
10. Reducing inequality	1.18	0.382	19.146	0.000
11. Sustainable cities and communities	1.11	0.308	9.980	0.000
12. Responsible consumption and production	1.06	0.237	4.104	0.007
13. Climate action	1.04	0.207	9.784	0.000
14. Life below water	1.00	0.067	0.435	0.728
15. Life on land	1.01	0.077	0.426	0.734
16. Peace, justice and strong institutions	1.13	0.335	15.735	0.000
17. Partnerships for the goals	1.06	0.440	1.969	0.117

Visual Arts and Design), in SDG11 and SDG13 (more referred by the Departments of Architecture) and in SDG16 (more in Visual Arts and Design).

3.3 Analysis of the Differences Between the SDGs in School of Social Sciences and School of Fine Arts

The analysis of Table 5 shows differences in most of the SDGs with the exception of SDGs 7, 10 13, 14 and 15.

These SDGs are more often mentioned by the School of Social Sciences, which is expected due to the higher number of Departments and curricular units. No results are presented for SDG4 since they are marked in all curricular units and for SDG6, which was not marked in any curricular unit.

Table 5 Analysis of SDG differences between School of Social Sciences and School of Fine Arts

SDG	Minimum	Maximum	M	SD	*F*	*p*
1. No poverty	1	2	1.09	0.280	3.73	0.002
2. Zero hunger	1	2	1.02	0.145	4.73	0.000
3. Good health and well-being	1	2	1.21	0.407	9.95	0.000
4. Quality education	1	2	2.00	0.000	–	–
5. Gender equality	1	2	1.60	0.490	12.0	0.000
6. Clean water and sanitation	1	2	1.00	0.000	–	–
7. Affordable and clean energy	1	2	1.01	0.073	1.97	0.072
8. Decent work and economic growth	1	2	1.48	0.501	3.52	0.003
9. Industry, innovation and infrastructure	1	2	1.12	0.323	3.12	0.006
10. Reducing inequality	1	2	1.57	0.496	2.67	0.016
11. Sustainable cities and communities	1	2	1.29	0.457	4.98	0.000
12. Responsible consumption and production	1	2	1.14	0.347	4.21	0.001
13. Climate action	1	2	1.07	0.255	1.12	0.350
14. Life below water	1	2	1.01	0.103	1,28	0.268
15. Life on land	1	2	1.02	0.126	1.28	0.268
16. Peace, justice and strong institutions	1	2	1.42	0.494	6.46	0.000
17. Partnerships for the goals	1	2	1.14	0.352	2.53	0.022

4 Final Considerations

The results showed that the most marked objectives in the curricular units of the Social Sciences area were, in order of magnitude, SDG5 (achieve gender equality and empower all women and girls), SDG10 (reduce inequality within and among countries), SDG8 (promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all) and SDG16 (promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels). In the area of Arts, the most signalled objectives were completely different, the most relevant being SDG11 (make cities and human settlements inclusive, safe, resilient and sustainable), SDG12 (ensure sustainable consumption and production patterns), SDG13 (take urgent action to combat climate change and its impacts) and SDG3 (ensure healthy lives and promote well-being for all at all ages). These results can be explained by the different nature of the courses and curricular units and the same can be applied regarding the differences between Departments where the respective scientific areas focus on different aspects of sustainable development.

In general, it is safe to guarantee that practically all the SDGs are present in the mapping under analysis in the curricular units of the first cycle courses in these two areas (Social Sciences and Arts) so it can be assumed that, at this early stage of university education, there is a concern to align education with sustainable development values. This shows that the University is trying to respond to the challenges of the 2030 Agenda although there is still a need for greater investment in this area, greater involvement of the various sectors of the institution based on greater coordination and interdisciplinarity. In this way, we can contribute to a university education that challenges its students to adopt more sustainable behaviours in the various domains. The work presented has limits because it only portrays the reality of one part of the institution (two of its five Schools) and because only the undergraduate courses were considered. We also intend to analyse the mapping of the remaining Schools (different scientific areas) and the existing relationship between sustainable development and the Master's and PhD courses in the various scientific areas given the relevance of scientific research and university extension in the framework of sustainable development. In future studies, it will be necessary to broaden the field of analysis to the national framework and whenever possible to the international context.

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Higher Education for Sustainability in Portugal: A Glimpse About What Has Been Studied and Published

Carolina Feliciana Machado and J. Paulo Davim

Abstract The problem of sustainability is a central issue nowadays. Engine of transmission of knowledge, experimentation, creativity and innovation, HEIs assume a primordial role in the promotion of a culture oriented toward sustainability. Effectively responsible for training future professionals, endowed with fundamental values and skills oriented toward the implementation of efficient and effective sustainability practices, HEIs assume a critical role in achieving the goals for sustainable development underlying the 2030 Agenda. Portuguese HEIs are not exception to this reality. In view of the importance that these assume in promoting and implementing sustainable procedures and behaviors, with this chapter, we intend to highlight the most important aspects of sustainability research in higher education in Portugal. More specifically, we intend, among others, to highlight the main themes within the issue of sustainability that have been investigated in Portugal, since when, by whom, and what are the main sources of dissemination of the work carried out. Using the Scopus database, and within the scope of higher education for sustainability in Portugal, 83 documents were identified, published in a period between 2011 and November 2022, for which the main authors and themes studied are highlighted.

Keywords Higher education · HEIs · Sustainability · Portugal · HE sustainability research

1 Introduction

Education for sustainability has proven to be a growing challenge for different countries. The changes that the world is progressively facing, and the urgent need to protect

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the world today, in a responsible way, to guarantee the future of those who will follow us, is one of the greatest challenges, but above all, an obligation that we all have to fulfill. Future generations have the right to enjoy a world with quality. According to Stefania Giannini, Director-General for Education at UNESCO (UNESCO, 2020) more and more we have to learn to live in community in a sustainable way. Whether as individuals, or in societies, the way we think and act has to undergo profound changes, and education assumes a fundamental role here by constituting a transmitting tool of knowing how to know, how to be, and how to do, capable of leading us to a peaceful and sustainable world that provides a dignified and prosperous future not only for current generations but, above all, for future generations.

Key stakeholders not only in the promotion and achievement of sustainable development goals, but also in the implementation of the 2030 Agenda, HEIs "play a pivotal role" (Aru et al., 2017). Due to their innovative capacity, resulting from continuous investments in innovation and development, as well as their responsibility in training competent and responsible professionals HEIs, in the role of educators and policymakers, live under continuous pressure, in a process of systematic transformations necessary for an effective response to the requirements underlying the promotion of sustainable development. Reinforcing the role that HEIs assume in the promotion and development of a more sustainable society Caeiro and Azeiteiro (2020) is of the opinion that HEIs "can implement sustainable development in different dimensions, according or not to a holistic approach, from education and curriculum, campus operation, organizational management, external community and research, to assessment and communication". Tejedor et al. (2022) in turn state that "Lifelong learning, and in particular university education, should assist in the acquisition of competencies for sustainability as tools for facing the complexity of today's world".

Recognizing the importance that HEIs assume, which, reinforced by Saudelli and Niemczyk (2022, 47), "can play a key role in contributing to a sustainable future for our planet and its inhabitants", there are many researches that are being carried out in this area in order to contribute to the study of higher education for sustainability (Machado & Davim, 2022). Portugal being no exception, it is important to understand what concerns have been observed in terms of the study of higher education for sustainability in this country. More specifically, this chapter intends to better understand what attention has been given to this problem in Portugal, namely, which Portuguese researchers have been researching more about higher education for sustainability, which areas of study are most been addressed, what are the main sources used to disseminate this research, in short, what dimension has research on higher education for sustainability in Portugal been assuming.

2 Higher Education for Sustainability

According to Le Grange (2017, referred by Preez et al., 2022), promoting education for sustainability does not imply, from the outset, a guarantee of sustainability, nor does it determine the trajectory of education to achieve sustainability. Quite the

contrary, and as mentioned by Preez et al. (2022, 121) "it opens up possibilities for critical discussions on/with sustainability and proposes learning processes that are always in-becoming". Effectively, not being synonymous with an immediate application of the principles leading to sustainability, higher education plays a key role in building and promoting a broad set of skills capable of leading us to the implementation of sustainable practices. According to Balcerak and Wozniak (2022), since the 1970s, many universities have been introducing courses that promote greater awareness of sustainability issues, and consequently knowledge, skills and attitudes related to sustainability. Leal et al. (2018) are of the opinion that HEIs constitute a fundamental engine in the development and expansion of knowledge and information, not only through their teaching and learning channels, but also through the involvement of the community, its various activities on campus and in research in a general way, promoting, in this way, a more effective education of the students for the problematic of the sustainable development. What becomes more relevant if we consider that the students, men/women and professionals of tomorrow are the future leaders and heirs of technological, economic and social development. In support of these opinions, Lim et al. (2022) recommend that HEI should professionally develop and continuously involve academics, as well as raise society's awareness of the need for experts in sustainability issues, in all fields of knowledge.

Expressions, such as "global learning for sustainable development" (Anderberg et al., 2009), "sustainable university" (Disterheft et al., 2015; Velazquez et al., 2006), "sustainable campus" (Evans et al., 2015; Sugiarto et al., 2022; Disterheft et al., 2012), among others, are beginning to be frequent. With regard to the sustainable campus, Disterheft et al. (2012) are of the opinion that this should combine the strand of teaching, research, and institutional management with education for sustainability so that both internal and external stakeholders recognize and practice lifestyles conducive to the well-being of present and future generations. Aware of the key role that universities assume in promoting sustainability, and in order to help their managers/responsible for accelerating progress toward achieving it, Velazquez et al. (2006, 810) developed a model "that offers a structured framework for visualizing and achieving a sustainable university system", thus helping universities to improve the effectiveness of their initiatives, potential or current, with a view to sustainability "through the identification of strategies and opportunities for sustainability within universities".

Highlighted the importance of higher education for sustainability, it is important to understand the relevance that this has been assuming in Portugal, particularly with regard to the focus that, in terms of research, has been manifested.

3 Methodology

Higher education for sustainability is an issue that has been increasingly present at the center of attention of many researchers, Portugal being no exception. In this context, and based on a bibliometric analysis, the aim of this chapter is to make a

global analysis of the research that has been developed in this area. More specifically, we intend, among others, to highlight the main themes within the issue of higher education for sustainability that have been researched in Portugal, since when, by whom, and what are the main sources of dissemination of the work carried out.

To this end, and based on a bibliometric analysis, a qualitative and exploratory study was carried out. Widely used to explore and analyze large volumes of scientific data (Donthu et al., 2021), bibliometric analysis allows identifying and analyzing the number of documents produced on the subject under analysis, when they were published, who were the authors, institutions and countries that published them, as well as, among others, the topics which, within the subject under analysis, have been studied.

In this analysis, and based on one of the most reputed databases in the field of scientific production, such as Scopus (from Elsevier), a documentary search (duly authorized) was carried out in November 2022. Specifically, based on the keywords "higher education", "sustainability" and "Portugal", or more specifically (TITLE-ABS-KEY {Higher education} AND sustainability AND Portugal). Covering the period from 2011 to November 2022 (also considering the forthcoming 2023 publications), and without any restrictions in what concerns to the types of documents, 83 documents were identified. These 83 documents became the target of our analysis, through which we look to answer the questions posed in this chapter.

4 Higher Education for Sustainability: About Research in Portugal

Aware of the role that HEIs assume, not only as promoters and transmitters of lessons conducive to sustainability/sustainable development, but also as assimilators and practitioners, themselves, of management policies and practices, conducive to higher levels of sustainability, are many, the Portuguese researchers who, over recent years, have been investigating the progress that has been observed in this matter, with particular emphasis on the Portuguese reality, as exemplified by Aleixo et al. (2018a, 2018b, 2020), Disterheft et al. (2016) and Farinha et al. (2018).

In this context, given the importance that higher education assumes in promoting and implementing sustainable procedures and behaviors, we intend, in this section, to highlight the most important research, in terms of sustainability in higher education, in Portugal.

More specifically, and as mentioned above, in this section, we intend to carry out a brief analysis that allows us to understand the evolution that research in this area has been assuming, who are the main researchers, what are the main topics studied, and what are the main sources of dissemination of these studies.

In this sense, developing a research guided by the keywords "higher education", "sustainability" and "Portugal", 83 documents were identified, which cover a time period from 2011 to November 2022 (date on which the present research was carried

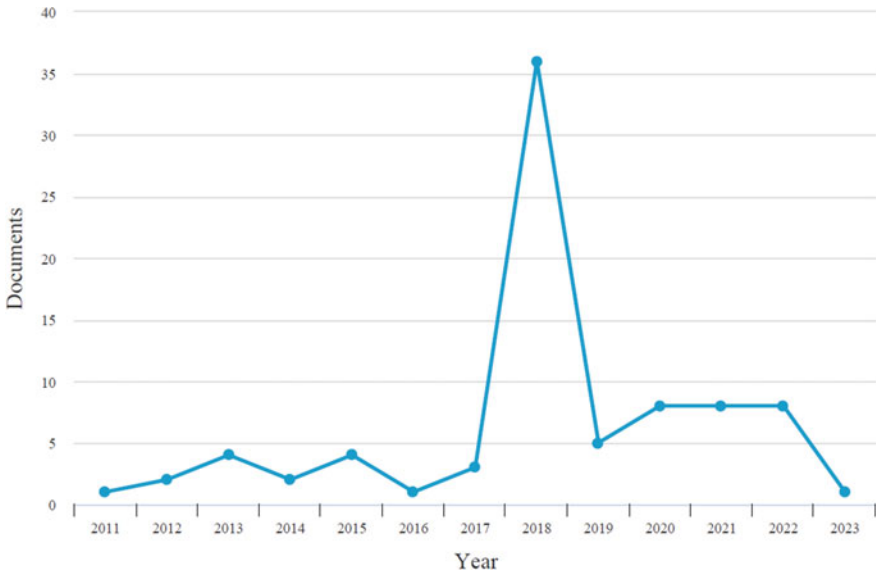

Fig. 1 Documents by year. *Source* Data obtained from SCOPUS (November 2022)

out). It should be noted that this number of publications already lists those that are forthcoming (with publication accepted for December 2022 and 2023).

Although publications with a particular focus on higher education for sustainability began to have greater emphasis worldwide from the end of the 1990s, largely as a result of the decisions taken at the Rio Conference, following the Agenda 21 discussion, with a focus on the role of education for sustainable development (ESD) (United Nations Conference on Environment and Development, 1992), studies, and, consequently, publications on higher education for sustainability focusing specifically on Portugal, only started to show evidence from 2011. With only one document published in 2011, and although evolving very slowly, it is in 2018 that publications on higher education for sustainability in Portugal reach their highest peak, with 36 documents published.

Decreasing considerably in 2019 (5 documents), the number of documents published, although lower, assumes, in the following years, higher values than those observed in the period preceding 2018 (8 documents published in each of the last 3 years) (Fig. 1).

Looking at the Top 5 authors who have been developing and publishing their work in this area, Azeiteiro, U. (with 11 published documents[1]), Caeiro, S. (9 documents[2]),

[1] Being Azeiteiro, U. and Azeiteiro, U.M. the same author, the documents published by each one were merged, resulting in the 11 documents attributed to Azeiteiro, U.

[2] Being Caeiro, S. and Caeiro, S.S. the same author, the documents published by each one were merged, resulting in the 9 documents attributed to Caeiro, S.

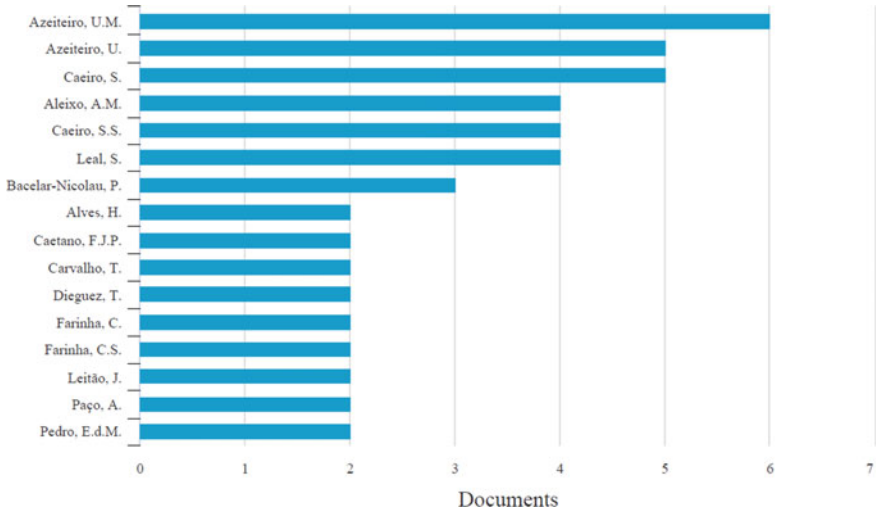

Fig. 2 Documents by author. *Source* Data obtained from SCOPUS (November 2022)

Aleixo, A., Leal, S. and Farinha, C.[3] (with 4 documents each), Bacelar-Nicolau, P. (3 documents) and Alves, H., Caetano, F., Carvalho, T., Dieguez, T., Leitão, J., Paço, A. and Pedro, E.d.M. (with 2 published documents each) stand out (Fig. 2).

With regard to Azeiteiro, U., Caeiro, S., Aleixo, A., Leal, S., and Farinha, C. along with Bacelar-Nicolau, P. (together and/or teaming up with other researchers), it can be observed that these authors assume particular prominence in the works that have been published regarding higher education for sustainability in Portugal. Just as an example, and with regard to this research problem, these authors have focused on a wide range of themes and approaches, as shown in Table 1.

Evidence of the importance that these works assume within the scope of the study of higher education for sustainability in Portugal is the number of citations that they have been receiving. As an example, and looking only at the most cited articles, we can highlight here the paper "*Conceptualization of sustainable higher education institutions, roles, barriers, and challenges for sustainability: An exploratory study in Portugal"* (Aleixo et al., 2018a) with 177 citations, as well as the paper "*Education for sustainable development through e-learning in higher education: experiences from Portugal"* (Azeiteiro et al., 2015) with 136 citations.

With regard to the remaining Top 5 authors, it is observed that topics such as the assessment of HEIs' efficiency (taking into account social, environmental and cultural factors), and quality of life, with a view to pro-sustainability efficiency, as well as the study of the quality of academic life as a mediator of satisfaction, loyalty and recommendation of HEIs students in Portugal, by Pedro et al. (2018, 2021, respectively); the perception of Portuguese and Brazilian university students regarding climate

[3] Being Farinha, C. and Farinha C.S. the same author, the documents published by each one were merged, resulting in the 4 documents attributed to Farinha, C.

Table 1 Higher education for sustainability in Portugal—some papers' example

Studied topics	Authors	*Cited by
Higher education students' perceptions of sustainable development in Portugal	Aleixo et al. (2021)	20
Towards effective e-learning on sustainability: a case study-course on participatory processes in environmental politics	Perbandt et al. (2021)	1
Universities speak up regarding the implementation of sustainable development challenges: The case of Portugal	Farinha et al. (2020)	6
Sustainability assessment and benchmarking in higher education institutions—a critical reflection	Caeiro et al. (2020)	46
Are distance higher education institutions sustainable enough?—A comparison between two distance learning universities	Casado-Aranda et al. (2020)	2
Sustainability strategies in Portuguese higher education institutions: Commitments and practices from internal insights	Farinha et al. (2019)	22
Conceptualization of sustainable higher education institutions, roles, barriers, and challenges for sustainability: An exploratory study in Portugal	Aleixo et al. (2018a)	177
The implementation of sustainability practices in Portuguese higher education institutions	Aleixo et al. (2018b)	58
Education for sustainable development in Portuguese universities: The key actors' opinions	Farinha et al. (2018)	24
Sustainable development policies as indicators and pre-conditions for sustainability efforts at universities: Fact or fiction?	Leal et al. (2018)	73
Rankings and sustainability in Portuguese higher education institutions: A descriptive analysis	Aleixo et al. (2017)	2
Education for sustainable development through policies and strategies in the public Portuguese higher education institutions	Farinha et al. (2017)	5
Strengths and weaknesses of an e-learning program in environmental sciences at Universidade Aberta, Portugal	Martinho et al. (2016)	3
Education for sustainable development through e-learning in higher education: experiences from Portugal	Azeiteiro et al. (2015)	136

* Data obtained from SCOPUS (November 2022). Own elaboration

change through distance learning (Caetano et al., 2018); the working conditions of researchers in Portugal, seen as invisible workers in HEIs, calling into question the sustainability of the system (Carvalho et al., 2022) and the study of the contributions from Portuguese-speaking countries to sustainability in higher education (Bizerril et al., 2018); and the development of leadership skills in the context of digital transformation toward sustainability (Dieguez et al., 2021), and innovation and sustainable development (Dieguez et al., 2020) are also studied with a view to highlighting the role of higher education for sustainability in Portugal.

Reflecting the concerns expressed by the authors who have been investigating the issue of higher education for sustainability in the Portuguese context, in its different dimensions, environmental, economic and social, it is observed that, when we analyze the documents published by subject area, it turns out that those that stand out the most are the area of Social Sciences (35 documents—25.5%); Physics and Astronomy (26 documents—19%); Environmental Science (19 documents—13.9%); Business, Management and Accounting, and Energy (each one with 15 documents—10.9%), closely followed by Engineering (with 8.8% of documents published—12) (Fig. 3).

Assuming publication in the form of articles particular emphasis (36 documents in Scopus, which corresponds to 43.4% of published documents), it is observed, however, that other types of publication also deserve our attention, such as the case of the Conference Review (26 documents in Scopus—31.3%), and at a lower level the Conference Papers (11 documents—13.3%) (Fig. 4).

Effectively, conferences on sustainability constitute a relevant mechanism for disseminating the work that has been developed in this area of research, not only for the discussion and sharing of ideas that is felt among all those who participate

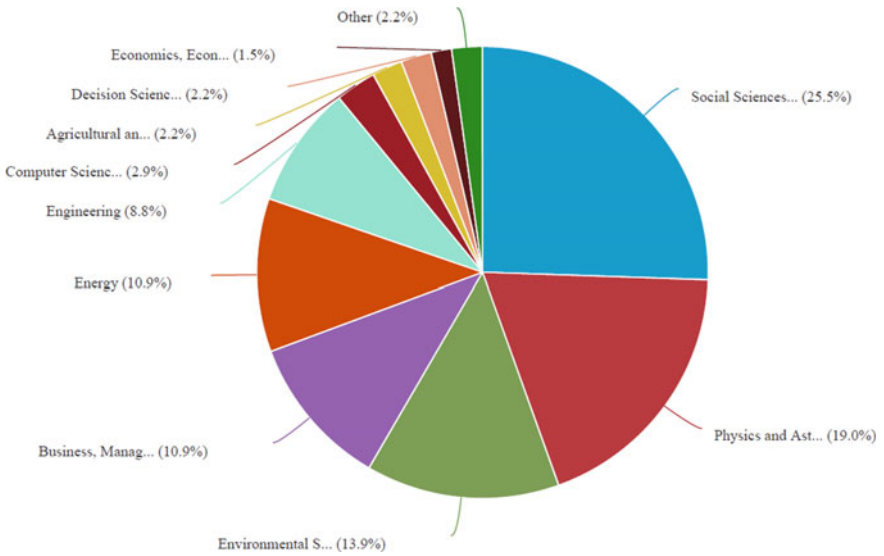

Fig. 3 Documents by subject area. *Source* Data obtained from SCOPUS (November 2022)

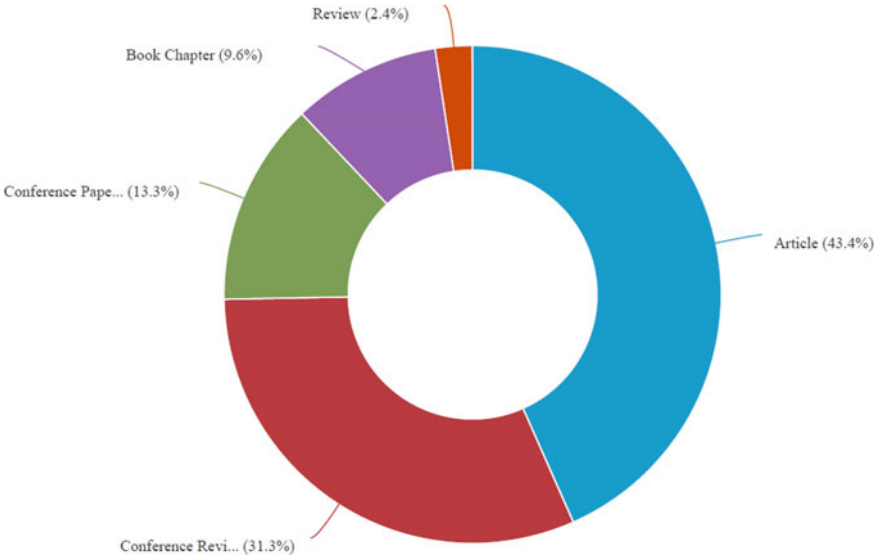

Fig. 4 Documents by type. *Source* Data obtained from SCOPUS (November 2022)

in them, but also for the dissemination, in the form of publication that may result from them. An example of this dissemination is the Journal of Physics: Conference Series, which, among the sources for the dissemination of the work carried out, assumes particular prominence in the documents published, per year by source (with 26 articles published) (Fig. 5).

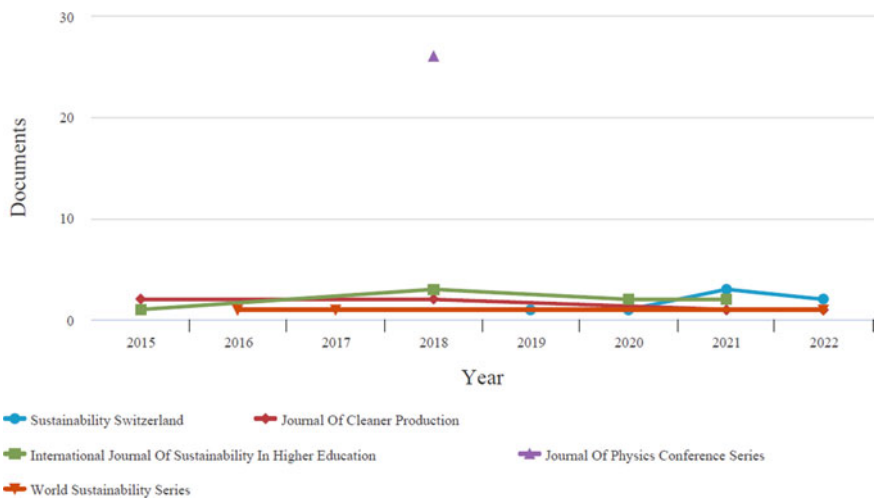

Fig. 5 Documents per year by source. *Source* Data obtained from SCOPUS (November 2022)

Within this Top 5 sources of dissemination of work developed on higher education for sustainability with a particular focus on Portugal, presented here, the International Journal of Sustainability in Higher Education (with 8 documents published), Sustainability Switzerland (7 documents), the Journal of Cleaner Production (6 documents), and the World Sustainability Series (with 3 published documents) correspond to the remaining sources that stand out the most.

It should be noted that, in addition to these, there are many sources of dissemination that over the years have been hosting and promoting the work carried out within the scope of higher education for sustainability in Portugal, which demonstrates a wide demand on the part of researchers in the dissemination of their works, as well as the great dispersion of existing dissemination sources.

Although, as expected, the vast majority of documents published in Scopus, focusing on the issue of higher education for sustainability in Portugal, originate, in geographical terms, in Portugal (56 documents in Scopus), it is interesting to highlight that the study of this matter has also been the subject of analysis by researchers from other countries (Fig. 6), who, not only in a team with Portuguese researchers, but also together with other foreign authors, among themselves, have focused on the study of this matter in joint analysis with the same reality in other countries. As an example of these documents published exclusively by sources other than Portugal, we can point to the work of Clark et al. (2020) from the United Kingdom.

With regard to the affiliation of the different authors of these documents, it should be noted that they are part of the different Portuguese higher education institutions (with particular emphasis on universities) (Fig. 7), which mirrors the dynamics that are felt in these teaching units in Portugal regarding a problem of which they are an integral part.

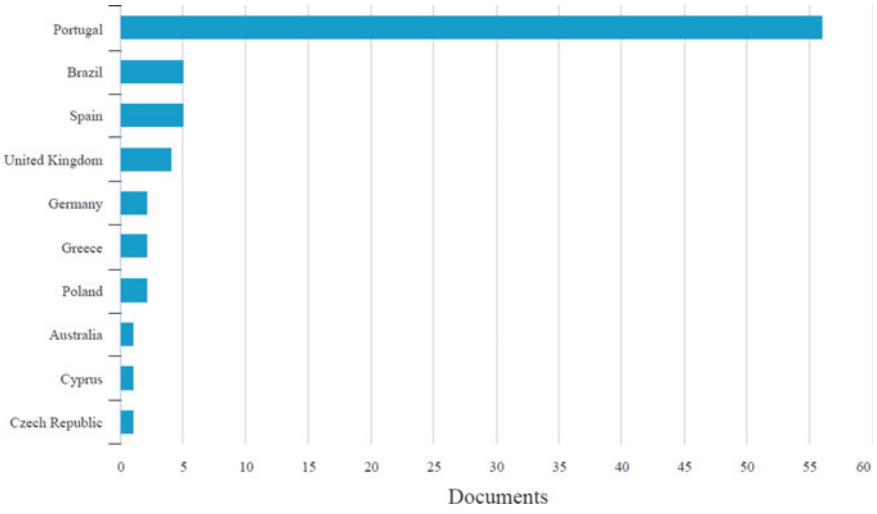

Fig. 6 Documents by country/territory. *Source* Data obtained from SCOPUS (November 2022)

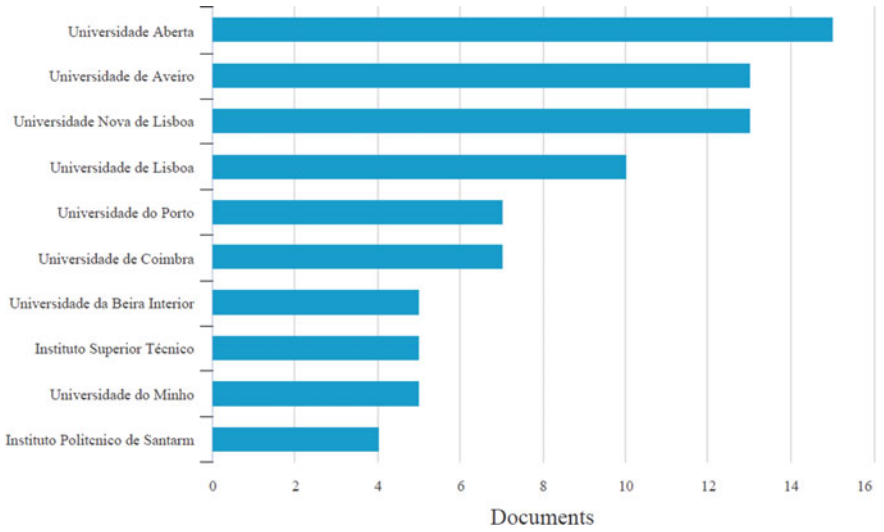

Fig. 7 Documents by affiliation. *Source* Data obtained from SCOPUS (November 2022)

Despite the great expression of Portuguese HEIs which, as mentioned earlier, clearly expresses the involvement and concerns that they have been manifesting in terms of higher education for sustainability, it is observed that the Open University (with 15 documents published in Scopus), the Universities of Aveiro and Nova de Lisboa (with 13 documents each), and the University of Lisbon (10 published documents) are the ones that stand out the most.

5 Final Remarks

From all of the above, it follows that the problem of higher education for sustainability has been receiving particular attention in Portugal. Privileged source of production and transmission of knowledge HEIs assume, par excellence, a double responsibility. On the one hand, as promoters, themselves, of sustainable practices, such as, for example, at the level of the sustainable campus and its teaching plans with the inclusion of curricular units oriented toward sustainability and sustainable development. On the other hand, also as a support and promotion of studies leading to the analysis of higher education for sustainability, by its researchers, resulting in important contributions in terms of defining and implementing sustainable strategies, policies, and practices, capable of contributing to training generations that are increasingly competent and oriented toward the efficient and effective use of economic, social and environmental resources.

Aware of the importance that this issue has assumed over recent times, and of the relevant role of HEIs in this matter, the attention that higher education for

sustainability has come to assume in Portugal is beginning to be significant. More specifically, and answering the questions that underpin the development of this brief research, it is observed that despite assuming prominence, in terms of publications, from 2011 onward (contrary to the global trend in which research at the level of higher education for sustainability began to assume greater evidence translated into published documents much earlier, namely, the end of the 90s), the documents published with a focus on this problem, in the specific case of Portugal, have been observing a positive evolution, showing a very expressive peak in 2018.

Dealing with quite diverse themes, ranging from the analysis of students' perception of sustainability and sustainable development in Portugal, the role of Portuguese universities in terms of implementing sustainability in its different dimensions (social, environmental and economic), education for sustainability, technological and digital transformations in the promotion of education conducive to sustainability, among others, the number of authors who have been dedicating their attention to the research they develop is increasingly significant. Among the increasingly wide range of Portuguese authors, it is worth highlighting the very particular contribution of some of these authors, such as Azeiteiro, U., Aleixo, A., Bacelar-Nicolau, P., Caeiro, S., Farinha, C., and Leal, S., clearly expressed in the number of documents produced and published by them (either among themselves or together with other authors).

With particular focus on the areas of Social Sciences, Physics and Astronomy, Environmental Science, Business, Management and Accounting, and Energy, it appears that publications in the form of articles (with 43.4% of published documents) are privileged by the different authors, with the Journal of Physics: Conference Series taking on a more prominent role (with its high point in 2018, as a result of the conferences that took place at this time and which shows the importance that this issue has begun to assume in Portugal), together with the International Journal of Sustainability in Higher Education, Sustainability Switzerland, the Journal of Cleaner Production and the World Sustainability Series.

Finally, it is important to mention that being mostly Portuguese authors, it is observed, even so, that either in a team with them, or in isolation, it is also evident the existence of authors of other nationalities involved in investigations (translated into published documents) in the higher education for sustainability in Portugal. With regard to Portuguese authors, these are affiliated to the different Portuguese HEIs, with particular emphasis on universities, which highlights the attention and growing concerns that the study of this issue has been assuming in the main sources of production, transmission, transfer, and dissemination of knowledge within the scope of sustainability and sustainable development, as is the case of higher education.

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