Journal of Cleaner Production 171 (2018) 600–612

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Review

Sustainability in higher education: A review of contributions from Portuguese Speaking Countries

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ARTICLE INFO

Article history:
Received 30 December 2016
Received in revised form
24 July 2017
Accepted 6 October 2017
Available online 6 October 2017

Keywords:
Higher education
Literature review
Portuguese Speaking Countries
Sustainability
Sustainable universities

ABSTRACT

The Portuguese-speaking countries (PSC) have a population of close to 250 million and occupy an area of about 10.7 million square kilometers across four continents. Most of these countries are rich in biodiversity and at the same time have a human development Index below the global average. This network of countries has a great potential to promote sustainability in higher education, due to cultural similarity and existing formal cooperation in other sectors. This is the first study to present a systematic review of the literature on this topic produced by PSC. Of the 50 publications selected for analysis in this paper, 36 were conducted by researchers in Brazil and 16 from Portugal, with only two partnerships occurring between authors of different PSC. The main contributions to the subject are in the areas of education, research, and assessment and reporting. Sustainability in operations and institutional frameworks were less represented in the analyzed sample, and therefore these are issues that need to be better exploited by PSC. Other contributions included strategies to reduce the gap between university and society and the political-emancipatory perspective as a pedagogical basis to support sustainability education in colleges and universities. Possibilities for future research on the topic of sustainability at universities are suggested considering the PSC context.

Contents

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https://doi.org/10.1016/j.jclepro.2017.10.048
0959-6526/

1. Introduction

Any global analysis of higher education should consider the diversity of cultures, organizational forms and the different goals and missions of higher education in about 17,000 universities around the world (Rauhvargers, 2011). Thus, knowing what is being done in specific contexts can be a useful source of information and influence the improvement of approaches adopted in other contexts.

Lozano et al. (2014) highlighted the collaboration between higher education institutions as one of the key elements in promoting sustainability in universities. Indeed, knowledge on sustainability in higher education should be exchanged among universities worldwide, but especially those located in regions with serious social and environmental challenges. Without such exchanges of information, universities will not be able to meet the expectations concerning their impact on this subject. Researchers urgently need to discuss how cooperation can foster knowledge sharing already accumulated in this area and how to add to the knowledge developed in other cultural contexts, thus transitioning to more sustainable societies. In this sense, networks are essential for the success of Sustainable Universities (SU) since cooperation may be more efficient between countries that are culturally similar and have already established formal cooperation in other sectors.

The Community of Portuguese Language Countries (CPLP is the official acronym) is an intergovernmental organization of nine countries that fosters cooperation in respect to a variety of cultural, political and socio-economic aspects. This organization can create interesting spaces for knowledge sharing in several emerging topics as is the case of Sustainable Universities. With a presence on four continents, the CPLP is also well positioned to disseminate Portuguese thoughts about sustainability in higher education through its relationship with other networks and cooperation efforts underway in Europe (COPERNICUS Alliance, 2015), in Latin America and the Caribbean (Sáenz, 2014) and Africa (Lotz-Sisitka et al., 2007).

Identifying the state of knowledge on the issue of sustainability in higher education in these countries is the first step to mobilize CPLP's potential for action in the construction of the SU. The present study seeks to answer the following questions: (1) What kind of knowledge has been produced by the Portuguese Speaking Countries (PSC) about sustainability in higher education? (2) What is the contribution of this knowledge to the global discussion on the subject? In addition, the paper discusses the extent of cooperation between PSC in the production of this knowledge.

This is the first study to present a systematic review of the literature on this topic produced by these countries. Issues raised from these questions suggest that future actions can enhance the effectiveness of sustainability in higher education in order to strengthen its overall impact.

2. Portuguese Speaking Countries

The PSC have a population close to 250 million and occupy an area of about 10.7 million square kilometers across four continents. Most of these countries are rich in biodiversity (Myers et al., 2000) and at the same time have a human development Index below the global average (Table 1).

The development level of higher education among the PSC varies greatly, ranging from situations where higher education has only recently been established and percentage of the population served is still minimal (as in case of São Tomé and Principe) to cases such as Portugal, whose first universities date back over 700 years. However, in an age marked by the necessity for inclusion in the knowledge society, a general tendency among PSC is significant growth of higher education, particularly in the beginning of this century (Table 1).

The CPLP was created in 1996 by a group of seven countries: Angola, Brazil, Cape Verde, Guinea-Bissau, Mozambique, Portugal

Table 1
Characterization of the PSC, including indicators of higher education, human development and environmental quality.

Country	Population (million) [a]	Area (km^2)[a]	Carbon emission in million tonnes (per capita in tonnes) [a]	Forest area (%)[a]	Number of threatened species [a]	HDI[b]	EPI [c]	Number of students in higher education [d]	
								1999	2011
Angola	20,8	1.246.700	27 (1)	46,8	123	0,533	145	7.845	142.798
Brazil	198,6	8.514.877	367 (2)	61,2	1008	0,754	46	2.456.961	6.929.624
Cape Verde	0,49	4.033	0,35 (1)	21	47	0,648	143	706	11.769
Guinea-Bissau	1,6	36.125	0,24 (0,2)	71,6	61	0,424	155	499	3.689
Mozambique	25,2	801.590	3 (0,1)	49,4	230	0,418	172	10.322	113.464
Portugal	10,6	92.212	56 (5)	37,8	249	0,843	7	356.790	383.627
S.Tomé and Principe	0,18	964	0,1 (1)	28,1	78	0,574	154	0	766
East Timor	1,1	14.919	0,18 (0,2)	49,2	21	0,605	138	6.349	18.553
Equatorial-Guinea	1,0	28.051	5 (7)	57,5	131	0,414	90	–	–

[a] UNData (https://data.un.org).
[b] Human Deelopment Index (http://hdr.undp.org).
[c] Positionin the EPI ranking - Environmental Performance Index[1] in 2016.
[d] Cerdeira (2014). We did not have access to data on higher education in Equatorial Guinea.

[1] The EPI is a ranking created by Yale University to measure the environmental performance of 180 countries from the following indicators: health impacts, air quality, water and sanitation, water resources, agriculture, forests, fisheries, biodiversity and habitat, climate and energy. Source: http://epi.yale.edu/epi/country-rankings.

and São Tomé and Principe. In 2002, after independence, East Timor became the eighth member of the community and, in 2014, Equatorial-Guinea became the ninth member. The CPLP also has observer countries which are Georgia, Turkey, Namibia, Senegal and Mauritius[2].

Over the years, the gradual strengthening of the CPLP has favored the emergence of many kinds of cooperation projects transcending governments' purview and supporting higher education institutions. Some prominent examples include: the creation of the Forum on the Governance of Higher Education in the Portuguese Language Countries and Regions (FORGES); the Association of Portuguese Speaking Universities (AULP) and various cooperative networks, such as the Network of Environmental Studies of Portuguese Language Countries (REALP) and the Lusophone Network for Environmental Education (Redeluso). Among the CPLP goals that can be related to sustainability in higher education, are:

Encourage bilateral and multilateral cooperation for the protection and preservation of the environment in the member countries with a view to promote sustainable development; Stimulate and improve the cooperation in the University sector, in training and in the various sectors of scientific and technological research to a growing appreciation of its human and natural resources, and promote and strengthen staff training policies (CPLP, 1996).

The cultural similarity and the aforementioned existing formal cooperation forums suggest that this network of countries has great potential to promote sustainability in higher education.

3. Sustainability and universities

Universities have been considering sustainability as an issue of their responsibility and a subject for management since the 1970s (Alshuwaikhat and Abubakar, 2008; González-Gaudiano et al., 2015). However, it wasn't until after the Talloires Declaration in 1990 that a large number of universities formalized their commitment to act in favor of sustainable development by signing many other treaties (Lozano et al., 2014). The leadership of European universities in the study of sustainability in higher education is well recognized (Karatzoglou, 2013; Lozano et al., 2014). Nevertheless, there are reports of experiences and contributions from many other parts of the world, such as Saudi Arabia (Alshuwaikhat and Abubakar, 2008), India (Jain et al., 2013), Mexico (Juaréz-Nájera et al., 2006), Canada (Beringer et al., 2008), the United States (Lópes, 2013), China (Lo, 2013), Russia (Verbitskaya et al., 2002). This is evidence of an emerging and diverse subject.

Despite the relative consensus that the sustainability model is based on a three-pillar approach (environmental, economic and social), sustainability is still a controversial concept as it may reflect different ways to address the relationship between humanity and the environment. Such is the case if we consider other important aspects related to the cultural and political dimensions of sustainability (Burford et al., 2013). Jimenéz (2009) considers two prevalent views on sustainability, each related to a different concept of development: a capitalist perspective of the laws of the market, which relates to the concept of sustainable development and; an alternative perspective based on the respect for ecological and cultural diversity, which emphasizes aspects of sustainable production and consumption - often referred in the literature as socio-environmental sustainability. González-Gaudiano and Silva-Rivera (2015) highlight this dichotomy in the educational context by arguing that environmental education is a political-pedagogical practice leaning towards the critical analysis of environmental issues in order to foster responsible human development. In contrast, some propositions of Education for Sustainable Development propagate values and principles of an economic system that has generated stark social inequality and a global ecological crisis. The authors place this dispute within the wider debate on neoliberal globalization.

A similar idea is observed in the three macro trends of environmental education suggested by Loureiro and Layrargues (2013), which are defined as conservationist, pragmatic and critical. Again, the concept of sustainability would be influenced by different ways of understanding the implications of economic and political models, as well as the effects of science and technology on the environment and society. While the conservationist perspective rests on the affective dimensions of the relation between human beings and nature – as separate from its social and political dynamics – the pragmatic perspective treats the environment as a source of natural resources. It also considers that the maintenance of future generations can be ensured by the rational control of the uses of such resources, incorporating strategies for the promotion of behavioral changes and the implementation of green technologies. Lastly, the critical perspective perceives environmental impacts as consequences of social imbalances, ethical misconduct and development and society models that generate consumerism and poverty. In the words of the authors, it is necessary “not just to fight for a new culture in the relationship between humans and nature; we must fight at the same time for a new society” (Loureiro and Layrargues, 2013, p. 67).

These multiple approaches to sustainability are reflected by universities when they discuss or teach about sustainability. For example, when analyzing the level of understanding about sustainability by engineering students in different parts of Europe, Ségalas et al. (2012) identified greater attention placed towards environmental, technological and economic aspects than towards the social, ethical and political-institutional ones. This suggests that sustainability courses in engineering schools should give greater emphasis to the complexity of this subject.

Despite these contradictions, and in the context of the adjustments that organizations have been led to implement towards meeting the sustainability, universities are considered to be different both from the corporate world and from other public institutions (Celeumans et al., 2015). This is due to the unique characteristics of universities in terms of the activities they perform and their importance in society. Such a role puts them in a leadership position in terms of sustainability performance, both through the education of their students and by raising public awareness about sustainability issues (Cortese, 2003).

In the last two decades there has been a growing consensus that universities are strategic agents in the promotion of sustainability. Several aspects support this proposition, including the need to reduce the environmental impact of their activities (Alshuwaikhat and Abubakar, 2008), the fact that they are institutions that promote innovation (Lozano, 2006a), their role on the education of leaders, teachers and distinct professionals who influence society (Cortese, 2003), and their impact on regional sustainable development (Karatzoglou, 2013). In the literature on sustainability in higher education, there tends to be an agreement with Cortese's proposition (2003) that defines the university as a four-dimensional system: *education*, *research*, *campus operations* and *outreach*. According to Lozano (2006b), the assessment and reporting procedures related to these four dimensions is considered a fifth dimension, which is strategic for the incorporation of sustainability into the university's management practices. Lozano et al. (2014) proposed two further aspects of institutional framework and on-campus experiences, totaling seven dimensions to be

[2] Distribution of member countries on the world map is available in the following link http://www.cplp.org/Files/Billeder/cplp/bandeiras/Mapa_CPLP.jpg.

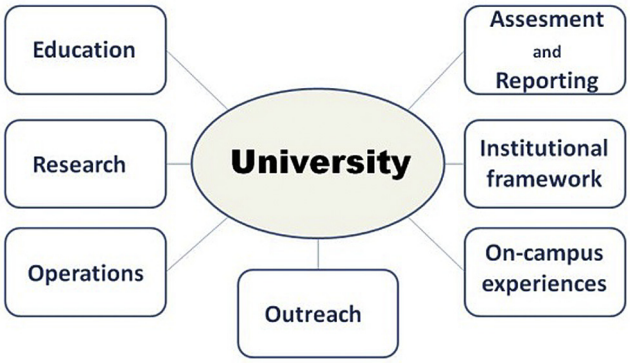

Fig. 1. University System used for the analysis of sustainability performance (adapted from Lozano et al., 2014).

considered when analyzing the sustainability performance of universities.

In Fig. 1 we present a synthesis of these dimensions. The following descriptions provide greater detail. The dimension of *education* includes propositions concerning the presence of topics in sustainability within the curriculum, development of skills and teacher training programs. This dimension relates not only to the theme of sustainable universities but to a much larger scope of knowledge that includes the central role that education plays in the science of sustainability (Barth and Michelsen, 2013) and for the promotion of sustainable development (Læssøe, 2010). This topic includes studies conducted in both formal and non-formal education settings, including key competencies for sustainable development as well as the process of competence acquisition (Barth et al., 2007). For this reason, education tends to be the dimension with the greatest production of knowledge available in the literature, but it must be carefully analyzed to avoid reductionism when included in higher education.

The dimension *research* relates to the existence of structures and financial support for the production of knowledge and technology on sustainability through processes of complex and transdisciplinary thinking. *Campus operations* deals with the presence of sustainability in the daily operation of the university, including resource use efficiency and the management of water, energy, waste and green-house gases, transport and accessibility, as well as the access to food of good quality. *Outreach* refers to actions related to the integration of the university with society, which includes other universities, governments, businesses, schools, civil society organizations and the local community. The *on-campus experiences* of sustainability, namely the existence of working groups and other sustainable practices among students, faculty and staff, are indicators of the everyday presence of sustainability concerns within the academic community. The dimension *institutional framework* is seen as an indicator of the institution's commitment to sustainability as it strengthens its presence in policies, missions and other official institutional documents. Finally, *Assessment and reporting* on university sustainability performance implies the deployment of some environmental management systems, among several that may be available, as well as the internal and external dissemination of the results of this monitoring. In recent years this topic has occupied a prominent place in research on sustainability in higher education. This includes discussions on the different types of environmental management systems initially adopted by universities, such as ISO 14001 and EMAS (European Union Eco-Management and Audit Scheme), to proposals developed specifically for the case of sustainability in universities, such as AISHE (Auditing Instrument for Sustainability in Higher Education), STARS (Sustainability Tracking, Assessment & Rating, System) and GASU (Graphical Assessment of Sustainability in universities), which incorporate the complexity of a university's dimensions and missions, especially with regards to education (Lozano, 2006b, 2011). These articles often corroborate the findings of the limited number of universities that carry out reports as well as their low quality (Celeumans et al., 2015).

Several studies have analyzed the transition processes of higher education institutions to Sustainable Universities. They even offer various aspects that favor and others that hinder this process that necessarily proposes profound changes in the way the university operates. Among the factors that tend to hamper the implementation and institutionalization of sustainability in universities, there is personal resistance to change and innovation (Lozano, 2006a), institutional and systemic barriers to change (i.e. disciplinary structures and economic forces, Clugston and Calder, 1999), limited perceptions of the concept of sustainability by managers (Wright and Horst, 2013), and the focus on behavioural modification neglecting the democratic and participatory empowerment (Læssøe, 2010). But, at the same time, there are also factors that potentially promote the implementation of sustainability in universities, such as: the formalization of an institution's commitment to sustainability (Lozano et al., 2014); the commitment of managers with the theme, credibility and personality of the "champions" of sustainability initiatives from the institution (Clugston and Calder, 1999); the establishment of a consistent way of assessing and reporting on sustainability institutional performance (Lozano, 2011; Celeumans et al., 2015); the involvement of teachers and especially staff (Brinkhurst et al., 2011); the establishment of an environmental sustainability culture on campus from the dissemination of knowledge about the processes and incentives for involvement (Levy and Marans, 2012); and the integration of sustainability into the curriculum from a critical and complex perspective (Segalàs et al., 2012).

4. Methods

In order to answer the questions presented in section 1, this study presents a systematic literature review on the topic of sustainability in higher education produced by PSC. Webster and Watson (2002) argue that literature reviews promote theoretical developments by pointing out directions for future research. The study also includes a summary of the main foci of the studies conducted by the PSC with respect to the different dimensions of sustainability in higher education. It is followed by a discussion on the points of convergence and the contributions of those countries to the international literature on the topic. The potential and needs for fostering further development of this area in the PSC are also discussed.

The selection of publications on the topic of sustainability in higher education in PSC was carried out through a search for the keywords "sustainability" and "higher education" or "university", or "sustainable university" and its Portuguese equivalents[3] in the publications' titles and abstracts. The search was done in the databases Scopus (www.scopus.com), Ebsco (www.ebscohost.com) and Scielo (www.scielo.org). The choice of these databases was due to their well-known impact both worldwide and within the context of the studied countries.

We considered papers in journals and conference proceedings that were produced in all years up until December 2015 in the Social Sciences and Humanities. These are the areas that include

[3] The exact Portuguese keywords used in the search were "sustentabilidade", "ensino superior", "universidade", "universidade sustentável".

Table 2
Selected articles from the search with the keywords "sustainability" and "higher education" or "university", or "sustainable universities" and their equivalents in Portuguese, in each database queried. The numbers in parentheses represent the number of articles written in Portuguese.

Database	Total number of articles	Number of articles authored by PSC	Number of articles selected for analysis
SCOPUS	1228 (10)	49 (10)	33 (3)
EBSCO	2172 (79)	86 (79)	19 (10)
SCIELO	23 (16)	16 (16)	9 (9)

works related to governance of higher education, while other subject areas such as Natural Sciences include other perspectives on sustainability not related to the purpose of this research. Even restricting the search to social sciences, the first search resulted in a very large number of articles. To narrow it further, the search results were limited to only authors from PSC. From the list of publications, we analyzed the abstracts and, if necessary, the complete texts, excluding the studies whose focus was not aligned with sustainability issues within higher education institutions (Table 2). For example, we did not include research on sustainability from a variety of contexts that do not refer to the role of the university in promoting it. After eliminating papers that appeared in more than one database, we reached a total of 50 items for this analysis.

For each study, we identified the methodology applied, the authors' countries of origin and the scope of the study in terms of the countries considered in the research. The articles were read and classified according to a concept-centric approach, as suggested by Webster and Watson (2002). The concepts used for the analysis on sustainability in high education were the seven dimensions proposed by Lozano et al. (2014): education, research, outreach, campus operations, assessment and reporting, on-campus experiences and institutional framework.

In some discourses on the sustainability in higher education, these several dimensions tend to be cited with varying degrees of intensity. However, in this classification, we picked the one dimension (in some cases more than one) that was the main focus of the paper. In cases where the paper broadly discusses sustainability in higher education without a clear focus on a specific dimension, we classified it in the “generalist papers” category.

The main findings and approaches presented in the articles from PSC were systematized and described in the results section for each of the dimensions cited above. In each category, an emphasis was given to major trends in the study sets. In the discussion section, the articles' topics were confronted by the way in which the issue has been addressed in recent literature. This highlights the strengths and the weaknesses of the studies in such countries.

5. Results

Data gathered from the Scopus database using the search terms described in the methods section produced a sample of 1228 papers, authored by researches from 90 different countries. Among them, the USA, UK, Australia, Canada and Germany revealed the highest number of publications. Brazil was in 13th place, the 23rd was Portugal, and Mozambique was the 84th. No publication from any other country from the CPLP was found in this search. Articles authored by the PSC available in the Scopus database are mainly written in English, while in Scielo and Ebsco the tendency was to find papers in Portuguese, except for a few in Spanish and in English.

Of the 50 publications selected for analysis in this article, 36 were written by Brazilians and 16 by Portuguese. Thirteen of them

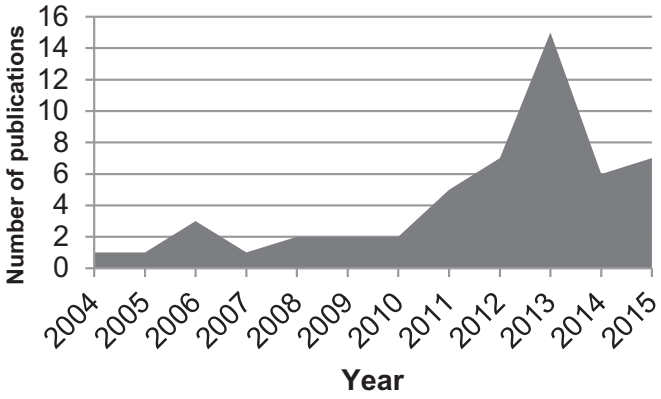

Fig. 2. Distribution of the 50 analyzed publications over the years.

(26%) were authored by researchers from more than one country, but only two were jointly produced by Brazilian and Portuguese authors. Co-authors were from Australia, Canada, Denmark, Germany, the United States, Spain, France and the United Kingdom. Publications on the selected topic started in 2004, with a significant increase in 2013 (Fig. 2).

Even with the possibility of carrying out studies with a more global approach, most articles were related to local contexts within PSC, with 27 studies focusing on the Brazilian case, seven on the Portuguese case, while only two included both Brazil and Portugal. In the set of researches not restricted to the PSC case, one study examined cases in Portugal and Australia, one in Spain, one in India, one in four countries (Portugal, Brazil, UK and Germany), one in the context of Europe, one in Latin America, while three adopted a more global approach involving several countries in different continents. In six cases of theoretical articles or framework proposals, specific geographic contexts were not identified.

The publications were obtained from 30 different journals, with the majority of studies appearing in the *Journal of Cleaner Production* (n = 9), followed by the *International Journal of Sustainability on Higher Education* (n = 6), the *Revista de Administração Mackenzie* (n = 4), and the *Revista Monografias Ambientais* (n = 3).

The methodological approach adopted in the papers include both theoretical articles (n = 9) and empirical research (n = 41), namely case studies, document analysis, surveys, framework proposals and action-research.

In terms of the distribution of publications among the different dimensions of sustainability in Higher Education Institutions (HEIs), there was a predominance of papers focused on education and assessment and reporting (Fig. 3). No publication was classified under the dimension of Institutional Framework. Twelve publications (24%) were classified under more than one dimension (Table 3).

5.1. What PSC say about sustainability in higher education: generalist papers

Eight articles were classified under this category. They are mostly theoretical essays defending the idea that the university should take up sustainability as a mission and analyze international situations (Conceição et al., 2006; Jabbour, 2010; Lara, 2012; Guerra and Figueiredo, 2014) and national examples (Silva and Marcomin, 2007; Soares et al., 2008).

Part of these texts have an exploratory approach or present non-systematic reviews, and were published in the early years of academic production on the topic, as we have previously noted in this review. It is worth mentioning that important themes emerged

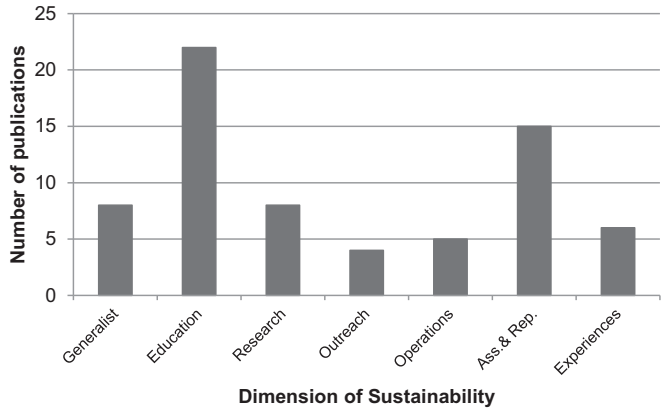

Fig. 3. Distribution of publications among the different dimensions of sustainability in HEIs.

from these texts that are rarely discussed in the literature on sustainability in higher education, such as university networks for sustainability, participation in higher education governance (Disterheft et al., 2015a) and the relationship between sustainability and violence (Zottis et al., 2008).

Guerra and Figueiredo (2014) emphasized that the movement for including environmental dimensions in higher education has existed in Latin America since 1950. They present the experiences and the history of networks in Brazil and in Latin America, such as REASul (South Brazil Network of Environmental Education) and ARIUSA (Alliance of Iberoamerican Network for Sustainability and Environment). The authors highlighted the role of environmental education in the emancipation of individuals and in social transformation as presented in the Treaty of Environmental Education for Sustainable Societies and Global Responsibility, produced under the Rio-92 Conference, as well as the concept of "sustainable educational spaces". The latter of which are spaces with the educational goal of promoting social and environmental sustainability. They also highlight editions of the Seminar of Sustainability in Universities, pointing out that books produced from these meetings[4] may represent the state of the art of the knowledge on this issue in the Ibero-Latin American context.

Disterheft et al. (2015a) listened to a group of experts from all over the world in their analysis of the critical aspects necessary for the inclusion of sustainability on university campuses - in terms of participatory approaches - thus recognizing that the culture of participation is conducive to the transition to sustainable universities. Zottis et al. (2008) argue that sustainable development cannot be discussed only in terms of the relationship that human beings maintain with natural resources, but mainly in terms of the relationship that humans have with their own species. From this perspective, sustainability should also be related to ethical principles, solidarity and respect for human rights, and would encompass the reduction of social inequalities, as well as of corruption and violence. These authors emphasized the need to factor in the current reality of violence, corruption, poverty and illiteracy when discussing sustainability in developing countries.

5.2. Education

Education was the category with greater number of studies, with 22 (49%) articles. The majority of them (n = 16) relate, with varying degrees, to the idea of greening higher education curriculum. The other studies addressed the perception of students from different majors about the aspects of sustainability, in addition to specific aspects of the pedagogical practice applied to the teaching of sustainability.

Conceição et al. (2006) and Guerra and Figueiredo (2014) discussed topics such as the values of justice, freedom and dignity that should be considered in green curricula and bring sustainability closer to the field of ethics and morality than to that of economic development. The authors recommended that such issues must be addressed through an interdisciplinary approach and through learning based on experience.

Correia et al. (2010) also advocated from the perspective of an education for sustainability which provides the balance between the ideas of sustainable economic growth and sustainable human development. They see scientific literacy as a chance for promoting this discussion in a broad way in higher education.

Most authors tended to analyze the greening of curricula from the point of view of specific courses, especially management and business (Jacobi et al., 2011; Palma et al., 2011, 2013; Jabbour et al., 2013; Gonçalves-Dias et al., 2013; Silva et al., 2013; Sinay et al., 2013) but also in other courses such as engineering (Almeida et al., 2013; Caetano et al., 2013), tourism (Neiman and Martins, 2009), energy and sustainability (Batterman et al., 2011), sustainability (Bursztyn and Drummond, 2014) and chemistry (Zuin and Pacca, 2013). Ramos et al. (2015) explored the occurrence of the Strategic Environmental Assessment theme (SEA) within multiple courses in Brazil and Portugal. They revealed the still limited presence of the subject, even though there are signs of growth in this field of study.

The understanding of sustainability by students was analyzed both in specific areas such as health (Backes et al., 2011), and in the context of a diverse set of courses (Lanero et al., 2013; Cunha et al., 2013). The findings indicate a limited understanding of students on the concept of sustainability and the important role the university plays in strengthening society so that it will effectively come to regard sustainability as a fundamental aspect of its proper functioning.

Among the educational experiences discussed, Isaias and Issa (2013) evaluated the use of learning management systems (LMS) and e-mail as a way to increase interest in sustainability. Correia et al. (2010) showed the use of collaborative concept maps to promote sustainability thinking in mixed groups of students from different courses, while De Goes et al. (2013) identified that teachers in green chemistry tend to approach the chemical content of their courses from a socio-scientific perspective while teachers from other areas of chemistry tend to adopt the traditional and contextual perspectives.

The articles analyzed in this category – especially those advocating for the greening of the curriculum – are in accordance with the defence that, in addition to deciding what should be taught, it is essential to discuss how it should be taught. A common feature of these articles is their advocacy for the replacement of traditional teaching practices, transitioning from a system centered on information transmission by the teacher to one whereby educational practices are more contextualized, incorporating problem-solving, participation, dialog, and which are more student-oriented. The authors suggested approaches that bring science closer to the socio-environmental context such as scientific literacy and the Science-Technology-Society-Environment (STSE) approach.

The application of such teaching practices is expected to lead to the development of essential skills for sustainable societies. Some examples of these skills include: critical thinking, complex perspectives, openness to interdisciplinary approaches, innovation,

[4] The books are: Visions and experiences of sustainability in Latin American Universities (Leme et al., 2012) and Greening in Brazilian institutions of higher education: paths, challenges and possibilities (Ruscheinsky et al., 2014).

Table 3
Characteristics of analyzed articles.

Year	Country of authorship	Partner countries	Geographical focus of the study	Authors	Journals	Methodological Approach	Dimension of sustainability at the university[a]						
							G	E	R	A&R	CO	O	OCE
2004	Portugal	–	Portugal	Gonçalves & Gomes	Conferência Nacional de Ambiente	case study				x			
2005	Brazil	France	Brazil	Zanoni et al.	Natures Sciences Societes	case study			x				
2006	Portugal	USA	None	Conceição et al.	International Journal of Technology, Policy and Management	conceptual/theoretical	x	x					
2006	Portugal	–	Portugal	Ferreira et al.	Journal of Cleaner Production	case study				x			x
2006	Brazil	–	Diverse	Tauchen & Brandli	Gestão & Produção	framework proposal				x			
2007	Brazil	–	Brazil	Silva & Marcomin	Congreso Internacional de Educación Ambiental dos Países Lusófonos e Galícia,	conceptual/theoretical	x						
2008	Brazil	–	Brazil	Soares et al.	Congreso Internacional de Educación Ambiental dos Países Lusófonos e Galícia	conceptual/theoretical	x						
2008	Brazil	–	None	Zottis et al.	Saúde e Sociedade	conceptual/theoretical	x					x	
2009	Brazil	–	Brazil	Neiman & Martins	Caderno Virtual de Turismo	documental analysis		x					
2010	Brazil	–	None	Jabbour	International Journal of Sustainability in Higher Education	framework proposal	x			x			
2010	Brazil	–	Brazil	Correia et al.	Journal of Cleaner Production	framework proposal		x					
2011	Brazil	Canada	Brazil	Jacobi et al.	RAM, Revista de Administração Mackenzie	conceptual/theoretical		x					
2011	Portugal	–	Portugal	Madeira et al.	High Education Policy	framework proposal				x			
2011	Portugal	USA	Portugal	Batterman et al.	Journal of Professional Issues in Engineering Education and Practice	framework proposal		x					
2011	Brazil	–	Brazil	Palma et al.	International Journal of Sustainability in Higher Education	documental analysis		x					
2011	Brazil	–	Brazil	Backes et al.	Revista Brasileira de Enfermagem	case study		x					
2012	Brazil	–	None	Lara	Revista Monografias Ambientais	conceptual/theoretical	x						
2012	Brazil	–	Brazil	Brandli et al.	Avaliação	case study				x			
2012	Brazil	–	Brazil	Freitas et al.	Espacios	case study					x	x	
2012	Brazil	–	Brazil	Löbler et al.	Journal of Technology Management and Innovation	case study					x		
2012	Portugal	–	Europe	Disterheft et al.	Journal of Cleaner Production	survey				x			
2012	Brazil	–	Brazil	Almeida Netto et al.	Revista Monografias Ambientais	action-research						x	
2012	Brazil	–	Brazil	Almeida Netto et al.	Revista Monografias Ambientais	action-research						x	
2013	Brazil	–	Brazil	Zuin & Pacca	Enseñanza de las Ciencias	case study		x					
2013	Brazil	–	India	De Castro & Jabbour	Journal of Cleaner Production	case study				x			
2013	Brazil	USA	Brazil	Almeida et al.	Journal of Cleaner Production	case study		x		x			
2013	Brazil	USA, Denmark	Brazil	Jabbour et al.	Journal of Cleaner Production	case study		x	x		x	x	
2013	Brazil	–	Brazil	Gonçalves-Dias et al.	RAM, Revista de Administração Mackenzie	case study		x					
2013	Brazil	–	Brazil	Palma et al.	RAM, Revista de Administração Mackenzie	case study		x					
2013	Brazil	–	Brazil	da Silva et al.	Revista de Ciências da Administração	case study		x					
2013	Brazil	–	Brazil	da Cunha et al.	Revista Eletrônica de Ciência Administrativa	case study		x				x	
2013	Portugal	–	Portugal	Caetano et al..	International Conference of the Portuguese Society for Engineering Education	framework proposal		x	x	x			
2013	Brazil	–	Brazil	Sinay et al.	RAM, Revista de Administração Mackenzie	documental analysis		x	x				
2013	Brazil	–	Brazil	Souza et al.	REAd. Revista Eletrônica de Administração	documental analysis			x				
2013	Brazil	–	Brazil	De Goes et al.	Educacíon Química	case study		x					
2013	Portugal	Australia	Portugal, Australia	Isaias & Issa	International Journal of Learning in Higher Education	case study		x					

Table 3 (*continued*)

Year	Country of authorship	Partner countries	Geographical focus of the study	Authors	Journals	Methodological Approach	Dimension of sustainability at the university[a]						
							G	E	R	A&R	CO	O	OCE
2013	Portugal	Spain	Spain,	Lanero et al.	International Journal of Sustainability Education	survey		x					
2014	Brazil	–	Latin America	Guerra & Figueiredo	Educar em Revista	conceptual/theoretical	x	x					
2014	Brazil	–	Brazil	Bursztyn & Drummond	Environmental Education Research	conceptual/theoretical		x	x				
2014	Brazil	–	Brazil	Pereira et al.	International Journal of Sustainability in Higher Education	case study				x			
2014	Brazil	–	Brazil	Marinho et al.	Journal of Cleaner Production	case study			x		x	x	x
2014	Brazil	–	Brazil	Machado Jr et al.	Gestão e Regionalidade	documental analysis			x				
2015a	Portugal	United Kingdom	Diverse	Disterheft et al.	Journal of Cleaner Production	empirical	x						x
2015	Portugal	–	None	Amaral et al.	International Journal of Sustainability in Higher Education	conceptual/theoretical				x			
2015	Portugal	Brazil	Brazil, Portugal	Ramos et al.	Journal of Cleaner Production	documental analysis		x					
2015	Portugal	–	Portugal	Soares et al.	International Journal of Sustainability in Higher Education	case study					x		
2015	Portugal	–	Portugal	Amador et al.	Assessment and Evaluation in Higher Education	framework proposal				x			
2015	Brazil	–	None	Palma & Pedrozo	Assessment and Evaluation in Higher Education	framework proposal				x			
2015b	Portugal	UK	Diverse	Disterheft et al.	International Journal of Sustainability in Higher Education	framework proposal				x			
2016	Portugal	Brazil, UK, Germany	Portugal, UK, Germany, Brazil	Shiel et al.	Evaluation and Program Planning	empirical						x	

[a] General (G), Education (E), Research (R), Assessment and Reporting (A&R), Campus Operations (CO), Community Outreach (O), On-campus Experiences (OCE).

cooperation and teamwork, the ability to adapt technologies and methodologies to different contexts, to make and implement decisions, as well as communicate and promote the interaction between institutions and people.

5.3. Research

Eight studies make up the research category, four of which specifically address research on sustainability, while the others discuss the topic of research from any of the other sustainability dimensions.

Machado-Junior et al. (2014) and Souza et al. (2013) developed bibliometric studies of business administration theses and dissertations in the field of sustainability from Brazil and identified an increase in scientific production in the area during recent years. However, it is concentrated in certain regions of the country and from a few institutions, so that regions with serious social and environmental problems have very limited production.

Sinay et al. (2013) analyzed the current situation of Business management courses in Brazil with regard to environmental management. The authors concluded that the national academic output on the theme of environmental management is still incipient, albeit growing. Of the total number of articles published from 2006 to 2012 in the six main national journals in the area of administration, the authors found that only 6.2% dealt with environmental management issues.

Three studies discussed the relationship between research and environmental management of HEIs. Marinho et al. (2014) and Caetano et al. (2013) analyzed cases where the implementation of sustainability practices in the institutions fostered scientific production in the area, while Jabbour et al. (2013) presented cases where the environmental management processes of institutions was initiated by research activities and teaching faculty.

Finally, two studies analyzed experiences of interdisciplinary' research programs on sustainability. Zanoni et al. (2005) presented the history and structure of a doctoral program in environment and development in a Brazilian university. Bursztyn and Drummond (2014) discussed the difficulties and possibilities for the development of interdisciplinary work in universities, based on the situation of sustainability science graduate programs in Brazil. These authors considered that environmental problems are complex and must be analyzed through an interdisciplinary approach, but concede that the structure and the history of universities generate strong resistance to this kind of work, both in research and teaching. They pointed out the “pathologies” that affect and hinder the establishment of interdisciplinary programs of teaching and research, and also discussed the effects of disciplinary fragmentation in causing segregation and complicating the relationship between university and society. As a contribution to the debate, an institutional model was presented to foster interdisciplinary knowledge and the universities are invited to learn with the interdisciplinary research experience of non-academic research institutions (NARIs).

5.4. Outreach

The outreach actions with local communities are exemplified in four articles. The first concerned the transdisciplinary care of victims of violence (Zottis et al., 2008). Partnership projects between universities and rural schools modeled on the basis of popular

education developed by Paulo Freire and social technology were the subject of two articles (Almeida Netto et al., 2012a, 2012b). Those articles argued that the teaching and learning process of popular education is an act of social transformation, where the community's knowledge is the raw material for teaching. Critical thinking and creativity were central in order to develop their autonomy. In the fourth paper, Shiel et al. (2016) studied universities in UK, Germany, Portugal and Brazil to analyze their externally-oriented activities aimed at building capacity within local communities to promote sustainable development. The authors considered that Portugal has lagged behind other EU countries in relation to sustainable development and that there is a lack of institutional approaches to sustainability in Brazilian universities (Shiel et al., 2016).

5.5. On-campus experiences

The on-campus sustainability experiences are considered in six articles. They are presented both in the form of specific initiatives (as in the case of promoting the replacement of disposable cups for mugs, Freitas et al., 2012), as well as through activities resulting from the integration of teaching and research (as in the case of the management schools studied by Jabbour et al., 2013).

A case of on-campus experiences that also had repercussions in society is a water resources management project on a college campus. The project promoted cost-cutting, student involvement and partnerships with other public institutions for water management over a period of nine years (Marinho et al., 2014).

In addition to the studies mentioned above, the arguments presented by Ferreira et al. (2006), Cunha et al. (2013) and Disterheft et al. (2015a) reinforce the potential of both outreach activities and the students' hands-on experience in teaching professionals committed to sustainability and educating citizens capable of participating and intervening in society.

5.6. Operations

Five articles addressed environmental management practices in on-campus operations. Of these, two criticized inefficient strategies for water management (Freitas et al., 2012) and electronic waste (Löbler et al., 2012). Two others presented the outcomes of research and teaching activities promoted by groups of teachers for the sustainable management of campuses as possible examples of bottom-up processes of environmental management in universities (Jabbour et al., 2013; Marinho et al., 2014). Lastly, Soares et al. (2015) proposed an energy efficiency plan for a higher education building in Portugal.

5.7. Assessment and reporting

Fifteen total articles dealt with the implementation of environmental management systems in higher education institutions. Among them, the articles that discussed the issue in a more comprehensive way were written by Portuguese researchers. Amaral et al. (2015) presented a review of the main procedures that have been used to implement, assess and report on sustainability in universities. Disterheft et al. (2012) analyzed European universities that have an environmental management system (EMS) and identified the types of systems adopted and the EMS implementation process and practices, taking into account different levels of participation. One idea put forth is that the participatory approach is more comprehensive than the top-down one because it not only aims to improve the environmental performance of the institution, but also to better incorporate sustainability at all university activity levels, particularly in the education of students so as to address the issue with the participation of society.

Two studies assessed the sustainability performance of certain universities according to pre-existing models and instruments such as the one proposed by Alshuwaikhat and Abubakar (2008), used by Castro and Jabbour (2013) to evaluate a university in India, and AISHE used by Brandli et al. (2012) to evaluate a Brazilian university.

Pereira et al. (2014) explored the concept of 'Environmental Organizational Culture' proposed by Harris and Crane (2002) to investigate the barriers that need to be overcome for a paradigm shift and the implementation of a culture of sustainability in one of the largest Brazilian public universities.

The other articles in this category proposed models for management or assessment (or both) of sustainability in HEIs through several approaches, such as: the Sustainability Action Plan (PASUS) (Caetano et al., 2013); the Sustainability in Higher Education Institutions (SusHEI) (Madeira et al., 2011); the application of the concept of Emergy Synthesis in the higher education context (Almeida et al., 2013); a model for analysis of environmental management in business schools (Jabbour, 2010); a model for environmental management in HEIs (Tauchen and Brandli, 2006); and the model of the Agrarian School of the Polytechnic Institute of Bragança (EcoESAB), a pioneering institution in Portugal (Gonçalves and Gomes, 2004).

Three recent studies dealt with the inclusion of educational aspects in the sustainability assessment criteria. Palma and Pedrozo (2015) proposed a complex matrix for the analysis of sustainable transformative learning (CMASTL), a model that integrates the management and teaching–learning processes to make the changes for sustainability in educational institutions. Amador et al. (2015) developed a set of assessment criteria for education for sustainable development in higher education curricula in line with Habermas' theory of knowledge-constitutive interests. Lastly, Disterheft et al. (2015b) developed assessment criteria for participatory processes in sustainable universities. These criteria are linked to learning theories, especially for transformative and social learning, and the authors considered that these aspects should be applied to all members of the academic community and the university itself as an institution in transformation.

6. Discussion

The criteria and keywords adopted for selecting the set of articles in this review may have occasionally excluded some publications. For example, the inclusion of 'curriculum greening' and 'environmental education' among the key search words probably would have expanded significantly the number of articles related to some dimensions of sustainability in the university system, namely education, outreach and on-campus experiences. The choice of databases may also have favored the access to the outputs of some particular countries, while reducing the chances of access to others. The selection also did not include articles from scholars who come from a PSC but work at a university in a non-PSC. Nevertheless, we consider that the selected texts are qualitatively representative of the production of PSC on the topic and serve as an illustration of the main contributions of this group of countries to the international debate.

It can be considered that the PSC, namely Portugal and Brazil, are well represented in the international debate on sustainability in universities, when considering the modes of publication and approaches that are consistent with the international literature. Part of the articles published in English has obtained significant number of citations. This is despite the fact that the contributions are rather modest in terms of the number of published articles and the authors represent a small proportion of the total number of existing

higher education institutions in these countries, especially in Brazil. The fact that only studies by Brazilian and Portuguese authors have been selected does not mean that the other countries of CPLP do not consider the importance of sustainability (see Varela, 2013; Novais and Sanchéz, 2013). Nevertheless, it indicates that their academic production on the subject should be increased and need to be more widely disseminated. In other reviews on the subject, such as Karatzoglou (2013), no publication from Africa was found in leading international journals.

With the exception of institutional framework, academic production is represented in all dimensions of performance of universities considered in other reviews (as Karatzoglou, 2013; Celeumans et al., 2015). And, the main contributions of the PSC on the subject are in the dimensions of education, research and assessment and reporting. The frequency observed for outreach and on-campus experience reports should be analyzed carefully because these subjects tend to be better represented in publications such as books, full papers at conferences and specific journals dedicated to this matter and not indexed in the databases consulted. Indeed, many Brazilian universities edit their own Extension Journals[5], which are not included in the international indexers. The weaknesses of the sample analyzed for PSC were operations and institutional framework, and therefore, those issues that need to be better exploited by the PSC. In fact, Brandli et al. (2015) considered that sustainability actions in Brazilian universities are mostly resulting from isolated projects, and low academic production on these two issues may explain the fact that the implementation of sustainability in the university routines of these countries does not seem to be sufficiently satisfactory or comparable with other European universities (Leal Filho, 2010).

In summary, the pattern found for PSC differs from that observed in the reviews presented by Lozano et al. (2014) and Wals (2014), except that education is the most discussed topic. In these reviews, most of the work concerned the education and operations, followed by assessment and reporting, outreach, institutional framework, and with research and on-campus experiences as the less treated themes.

In detail, the main contributions of the PSCs in education and research are: (a) a proposition of strategies to integrate sustainability into the curriculum and institutions; (b) a discussion about possible pathways for promoting interdisciplinary approaches in HE; (c) raising the importance of adopting a critical and complex worldview, and of promoting dialogue between science and traditional knowledge, especially addressing the pedagogical assumptions of critical environmental education. In the assessment and reporting, the focus is on the suggestions for processes, models and integration of sustainability tools in universities, including the analysis of barriers to intended changes and ways to overcoming them.

Although underrepresented in the sample of surveyed articles, there are two potential contributions of PSC in the context of Sustainable Universities. The first is the link between HEIs and society based on the tradition of extension as one of the HEIs missions, especially the Brazilian ones (Nogueira, 2013). Secondly, the literature from PSC can provide successful experiences of technology transfer between universities and the private sector, especially in the Portuguese case (Marques et al., 2010). Another contribution that finds support in the work of Portuguese-speaking authors is the defense of democratic management and participation in decision-making as processes that promote emancipation of community members (Freire, 1987), which also includes school (Lima, 2005; Trajber and Sato, 2010) and university governance (Santos and Almeida-Filho, 2008). Democracy is one of the main demands that Santos (2015) lists for universities in the 21st century. This demand also includes social responsibility and the production of transdisciplinary and contextual knowledge, from dialogue with other non-scientific knowledge.

As noted by Lozano (2011) in reference to various authors, developed countries tend to value the environmental aspects of sustainability more than the social ones, a fact that has been justified by a supposedly greater ease of measuring, evaluating and analyzing environmental variables. Ségalas et al. (2012) showed that despite the fact that "experts" (teachers and researchers on education for sustainable development) had considered the institutional and social aspects as being the most relevant for sustainability, a sample of 500 European engineering students gave more importance to the technological and environmental aspects, suggesting that the courses should give more emphasis to the complexity of sustainability and revise their teaching strategies. Nevertheless, it is common to find higher education references to traditionalism and the rigidity of HEIs in the literature, as well as a strong resistance to change (Lozano, 2006a; Ćulum, 2014). The predominance of Cartesian and Newtonian thought models relegate the teaching and learning processes to mechanical actions that do not promote the necessary skills for achieving sustainability (Lotz-Sisitka et al., 2007; Barth and Michelsen, 2013). That is why the foundations of Latin American environmental education (Lima, 2009; Sorrentino, 2014), mentioned by some of the articles analyzed, can contribute positively to pedagogical changes in universities. Such is the case, for example, with the popular education and the critical-liberating pedagogy of Paulo Freire (1987, 2004). This theoretical framework considers education as an inherently political action and holds a critical perspective with regard to development models (Loureiro and Layrargues, 2013; González-Gaudiano and Silva-Rivera, 2015). There is also a connection to Portuguese authors who proposed that participation must be employed as a method of promoting sustainability in universities (Disterheft et al., 2015a, 2015b) and democracy as a way of overcoming the individualistic and competitive culture that prevails in higher education (Lima, 2005, 2012). These issues are strongly related to sustainability in higher education and converge with reflections proposed by other authors (c.f. Barth et al., 2007; Læssøe, 2010; Barth and Michelsen, 2013), who discuss education for sustainability on similar principles, although from other theoretical frameworks.

Some analyzed articles highlighted other issues that are poorly treated in the literature on sustainability in higher education but which are not necessarily specific to developing countries, such as violence and interculturalism. The ideas defended by Zottis et al. (2008) agree with the perspective of the University of Costa Rica presented by Segreda (2002), which integrates peace as a substantial component of sustainability. This point of view also supports the discourse of UNESCO (1999) that argues the goal should not be solely that of sustainable development, but of a sustainable society. Such society is characterized by a culture of peace, and is based on values, attitudes, behaviors and experiences that reinforce non-violence and respect for freedom and the fundamental rights of individuals. Burford et al. (2013) stressed the importance of the cultural and political dimensions of sustainability, an approach that is strategic for PSC. This is because PSC experience cultural differences among themselves and internally within each country, despite the fact that they have the same official language. For example, Brazil has a large indigenous population that still faces significant barriers to access the universities (Brostolin and Cruz, 2010). At the same time, the PSC countries in Africa and East Timor deal with linguistic and cultural diversity (Godinho et al.,

[5] A specialized journal that publishes articles dealing with projects or outreach actions of Brazilian universities.

2013). Portuguese universities have experienced increased diversification of nationalities of students, most of whom come from the PSC (Cerdeira, 2014). This fact favors the practice of cross-cultural dialogue on campuses and brings up the challenge of discussing sustainability at both local and global levels. Recently, the University of International Integration of Afro-Brazilian Lusophony (www.unilab.edu.br) was created in Brazil. This university can play a strategic role in this debate. However, when the subject is sustainability in higher education, this PSC network is being underused. Apparently Brazil is interacting more with Latin America and Europe, Portugal is restricted to the European space, and there was no evidence of articulation between the other Portuguese-speaking countries in this topic.

7. Conclusions

The PSC have produced articles on sustainability in higher education since 2004. This shows a significant increase in recent years, and a production pattern similar to that presented in other reviews. An important difference found in relation to the overall pattern was the small number of articles focused on the operations dimension.

The PSC, and in particular Brazil and Portugal, have made significant contributions to the international debate on sustainability in higher education, especially in the dimensions of education, research and assessment and reporting. They also have remarkable experiences of rapprochement strategies between the university and society in the context of sustainability which, however, still needs further international dissemination. The experiences arising from the practice of democracy and the emancipatory perspective of critical environmental education can also contribute greatly to the pedagogical basis to support further education for sustainability and outreach actions in higher education.

However, it is surprising that there are very few partnerships among the authors from distinct PSC in the analyzed articles. This is despite the fact that the CPLP may be considered an important arena for cooperation and actions by some formal integration forums related to sustainability (REALP, Redeluso) and higher education (FORGES, AULP). Nevertheless, the subject deserves better attention and coordination if it is to grow properly and produce genuinely intercultural discussions.

This review indicates the possibility of future research on sustainability in universities from the reality of the PSC in at least two pathways: (1) to use this network of universities to conduct intercultural studies that produce new evidence and insights into the obstacles to the institutionalization of sustainability in HE and into ways of overcoming them; (2) to develop and study sustainability institutionalization processes in different socio-cultural contexts based on the research cooperation between these countries. A strategic action is to strengthen the discussion of the topic sustainability in higher education in existing forums mentioned above.

Acknowledgements

We thank the support of the University of Brasília, University of Aveiro and Center for Research in Higher Education Policies (CIPES) for the development of this postdoctoral research of the first author. We also thank the contributions of the anonymous reviewers for the final version of the article. Norio Takaki and Ryan Nehring revised the english version.

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