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The implementation of the SDGs in universities: a systematic review

Lucía Alcántara-Rubio^a, Rocío Valderrama-Hernández^a, Carmen Solís-Espallargas^b and Jorge Ruiz-Morales^b

^aDepartment of Theory and History of Education and Social Pedagogy, Faculty of Educational Sciences, University of Seville, Seville, Spain; ^bDepartment of Didactics of Experimental and Social Sciences, Faculty of Educational Sciences, University of Seville, Seville, Spain

ABSTRACT

Currently, in the field of Sustainable Development (SD), one of the most significant debates is the necessary incorporation of the Sustainable Development Goals (SDGs) in education and, specifically, in higher education institutions (HEIs). In the process of truly integrating the SDGs in HEIs, it is necessary to know and identify what is already being done and evaluate the efficacy or deficiency with which universities are carrying out studies and actions to integrate the SDGs. This systematic review aims to respond to this claim by analysing the most recent scientific evidence published in the period of 2015–2020 regarding SDGs in the university context at the international level. The results of this study identify: (1) a general approach on the SDGs from a global dimension in the reviewed studies, with SDG 4 (Education) being the most frequently referenced SDG; (2) the university area from which SDGs are addressed is research, followed by education; (3) the most frequent action gathered in the reviewed studies is the integration of the SDGs in the curricular schedule, in the area of education and learning; (4) with respect to the geographic and university context in which the SDGs are developed, the review showed studies in four geographic areas (Asia and the Pacific, America, Africa and Europe), with most studies being published from European and Latin American universities.

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Sustainable development goals; SDG; 2030 Agenda; systematic review; university

1. Introduction

Currently, in the field of Sustainable Development (SD), one of the most significant debates is the necessary incorporation of the Sustainable Development Goals (SDGs) in education and, more specifically, in higher education institutions (HEIs) (Adams, Martin, and Boom 2018). Universities are called to play a fundamental role in the attainment of the SDGs, due to their relevant position and essential function, within society, in the generation and dissemination of knowledge (Ketlhoilwe, Silo, and Velepini 2020). The university activity constitutes and integrates, in one way or another, the global challenges that our societies are currently facing and which we must overcome soon; moreover, universities are in charge of training the future professionals, who are and will be the protagonists of the transition toward more sustainable and resilient paths (Dlouhá, Mulà, and Henderson 2019; Gusmão Caiado et al. 2018; Lazzarini

CONTACT Lucía Alcántara-Rubio ✉ alcantaraluciaus@gmail.com  Department of Theory and History of Education and Social Pedagogy, Faculty of Educational Sciences, University of Seville, C/Pirotecnia, s/n, 41013, Seville, Spain.

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and Pérez-Foguet 2018; Sánchez Carracedo et al. 2018). As was stated by Neubauer and Calame (2017), the SDGs must be used as a unique opportunity to strengthen and intensify the dynamics of sustainability in HEIs all over the world. Without the commitment and involvement of this strategic sector, perhaps none of the SDGs will be attained. In this regard, a new acronym is proposed: Education for Sustainable Development Goals (ESDG). This concept reflects the importance of making use of the educational and, specifically university functions to integrate the SDGs (SDSN, 2020).

Similarly, according to Ketlhoilwe, Silo, and Velempini (2020), measuring and evaluating the impact of the actions of HEIs would show the advances achieved in the attainment of the SDGs, which requires determining which types of actions and studies are being carried out. As was stated by Calles (2020), in the process of truly integrating the SDGs in HEIs, it is necessary to know and identify what is already being done. The evaluation of the state of implementation of the SDGs has become a priority and an essential task for the United Nations and its member states. The generation and use of quality data are fundamental for the evaluation, follow-up and attainment of the SDGs (Choi et al. 2016; Gusmão Caiado et al. 2018). Therefore, it is very important to assess the efficacy or deficiency with which universities are carrying out research and actions to integrate the SDGs.

In this sense, knowing what studies are being published regarding the implementation of the SDGs in universities can provide a view that allows making such evaluation. According to Amaral et al. (2020), there are few studies focused on analysing the empirical results that emerge from studies, with the most common studies being those focused on analysing the content of the websites of HEIs, whose information does not always reflect reality accurately (Soini et al. 2018).

After an initial mapping conducted for the realisation of the present review, it was observed that, in the field of research on the SDGs in universities, advances are being made in terms of the number of publications. There is a sharp increase of scientific publications related to sustainability, especially since the launch of the SDGs (Galdos-Frisancho, Ramirez, and Villalobos 2020; Murga-Menoyo 2018; Hernández-Castilla and Opazo 2020; Pérez Esparrels 2020); however, the search identified very few systematic reviews of the scientific literature in this area, among which we can highlight the following: García-González and Ramírez-Montoya (2019); Gusmão Caiado et al. (2018); Machado Vargas and Ríos Osorio (2016) and Rashid (2019). No other reviews were found to directly analyse which SDGs are being implemented and from which dimensions, areas and perspectives they are being carried out.

Among the few studies found in this topic, the study of Leal Filho et al. (2019) explored how universities are adopting the SDGs, although focusing on their integration in teaching, which is one of the four areas reviewed in the present work. Considering that teaching is a fundamental element for the attainment of the SDGs, it is necessary to evaluate what is being carried out in HEIs in the different areas of the university, that is, the other three axes: research, management and governance, and social leadership and university extension (Cavallo et al. 2020). To explore the impact of the SDGs on the performance of universities, we must take into account the different initiatives linked to teaching, research and the third mission, which comprises all those activities that are directly connected to industry, authorities, society and its environment.

In a different study, Franco et al. (2019), who conducted a qualitative investigation using several methodological techniques, shows that, currently, the regional differences are not receiving enough attention, and they suggest that the differences and similarities between regions must be thoroughly explored. Therefore, this study helps to complement and delve into more specific aspects about the state of the SDGs in universities by reviewing and analysing the scientific literature.

The aim of this article, which is framed within the research typology of systematic review of the literature, was to analyse the scientific evidence published (2015–2020) on the SDGs in

the university, focusing the interest on identifying and analysing specific aspects of how they are being implemented. To this end, the following specific objectives were set:

1. To know the SDGs addressed in the identified articles and count them.
2. To identify the perspective from which the SDGs are being approached.
3. To know from which dimension the SDGs are being approached and whether there is a preference for any of them.
4. To know from which area the SDGs are being addressed.
5. To identify the type of actions that are being carried out to address the SDGs in universities.
6. To know whether the propositions and/or actions of the analysed studies emerge from the institution or they are carried out by people or groups of people of the university community in a more particular manner.
7. To know whether the propositions and/or actions proposed in the analysed studies are limited to a declaration of intentions or if they are propositions that have been implemented.
8. To know the geographic location of the contexts where the analysed studies were conducted
9. To identify the university context in which the analysed articles were conducted.

Taking into account the limitations of this study, the analysis of the results provides an approximation of how the SDGs are being implemented in universities, which allows for a scenario from which better decisions can be made to accelerate and favour the attainment of the SDGs in a more effective manner in the university scope. Moreover, this analysis enables the identification of possible divides, deficiencies or difficulties in the implementation of the SDGs, which can encourage institutions and their members interested in committing to the SDGs, as well as motivate and promote the necessary actions and changes for their integration in the different areas of the university.

Lastly, this research is part of an R+D+I project, entitled 'Integration of the objectives for sustainable development in the training in sustainability of the Spanish university degrees' (EDINSOST2 - ODS).

2. Justification

From the 1970s, the debate on sustainability has progressively increased (Griebeler et al. 2022). This is demonstrated by the large number of summits, meetings, declarations, forums, reports, etc., which have been continuously held and published from the UN Conference on the Human Environment (Stockholm, 1972), then with the Brundtland Report (1987) and the Earth Summit on Environment and Development (Rio de Janeiro, 1992) until the present. This trajectory shows an increasing interest for redefining the commitments, strategies and actions carried out in line with sustainability, which brought with it, at the same time, certain tendencies and a change from Environmental Education to Education for Sustainable Development (ESD) (González Gaudiano, Meira-Cartea, and Martínez-Fernández 2015; González-Gaudiano 2005; Wu and Shen 2016).

Particularly, the inclusion of sustainable development in universities has gone through several stages (Soini et al. 2018). Although the claim for integrating sustainable development in the university scope is mentioned in some documents published in the 1970s, we could say that it was officially established as a solid concept from the 1980s, when the first phase started. This stage brought with it an initial recognition response toward this scope in the university

context, where the attention was mostly focused on engineering and physical sciences. From the 1990s, a new stage began, in which sustainable development entered the study plans and academic activities of universities in a broader manner (Lozano et al. 2015). From this point, manifestos of commitment and declarations related to sustainable development promoting the generation of changes in the university started to be presented: Declaration of Taillores (1990), Declaration of Halifax (1991), Rio Declaration on Environment and Development (1992), Declaration of Kyoto (International Association of Universities, 1993), Declaration of Swansea (1993), Copernicus - The University Charter for Sustainable Development (1994), and Declaration of Thessalonica (1997), among the most relevant.

From the decade of 2000, the third stage began, in which sustainable development is further integrated in the structures and missions of universities (Soini et al. 2018). In this decade, the following declarations stand out: Declaration of Lüneburg (2000); the official presentation of the Earth Charter (2000); The Johannesburg Plan of Implementation (2002), which highlighted the development of capacities in ESD and collaboration of the interested parties among HEIs as key approaches for sustainability (UE4SD, 2015); Declaration of Barcelona (2004); Declaration of Lübeck (2005); Declaration of Gratz (2005); UNECE strategy for ESD (2005), Declaration of Sapporo (2008); Declaration of Turin (2009); Universities for Sustainable Development Declaration (2010); Higher Education Declaration for Rio + 20 (2012); The People's Treaty on Sustainability for Higher Education (2012); Nagoya Declaration on Higher Education for Sustainable Development (2014); IAU Iquitos Statement on Higher Education for Sustainable Development (2014) and The Lima Ministerial Declaration on Education and Awareness-raising (2014); manifestos assuming the severity of the ecological crisis faced by the planet, where universities are committed to introducing sustainability criteria (Barrón, Navarrete, and Ferrer-Balas 2010). However, despite the significance of these declarations, their adoption does not ensure that the signing parties integrate Sustainable Development in their institutions (Lambrechts & Ceulemans, 2013). In fact, the scientific literature in this respect highlights that, although these declarations show interest for integrating sustainability in the university tasks, to date, sustainability 'has not managed to impregnate, beyond a superficial and limited manner, the culture of university communities' (González Gaudiano, Meira-Carrea, and Martínez-Fernández 2015, 80).

Lastly, a fourth stage is established, after the launch of the 2030 Agenda and the Sustainable Development Goals (SDGs), thus approaching the concept of the institutionalisation of the 2030 Agenda in HEIs.

Throughout these phases, to date, there is a long research background demonstrating the interest that the scientific community has shown around the revision and establishment of the conceptual and methodological bases of ESD in the university scope (Amaral et al., 2015; Caride and Meira 1998; Ferrer-Balas, Buckland, and De Mingo 2009; González-Gaudiano 2005; González-Gaudiano and De Alba-Ceballos 1994; Leal-Filho 2011; Lele 2017; Limón 2006; Lozano et al. 2015; Novo 2009; Tilbury 1995; Waas, Verbruggen, and Wright 2010; Wright 2002; 2006; Xiong et al., 2013) and the development of specific research lines, such as environmentalisation and/or curricular sustainability (Junyent and de Ciurana 2008; Watson et al. 2013; Wemmenhove and de Groot 2001), faculty training (Aznar et al. 2018; Calafell and Junyent 2017; Gough 2016; Solis-Espallargas and Valderrama-Hernández 2015), the establishment of key competences (García-Esteban and Murga-Menoyo 2015; Roorda 2019; Sánchez Carracedo et al. 2018; Sims and Falkenberg 2013; Vare et al. 2019; Wiek, Withycombe, and Redman 2011), and the implementation of sustainability approaches, methodologies and projects carried out in the university scope (Aramburuzabala, Cerrillo, and Tello 2015; Tamura and Uegaki 2012), as is reflected in the bibliometric analyses performed (Alcalá del Olmo-Fernández et al. 2021; Toscano, Fuentes, and Fajardo 2019) and the extensive literature in this respect. Likewise, it is of necessary reference to create networks in the different regions of the world, together with the commitment and work that has been developed since the 1990s with respect to the inclusion of sustainability in the university scope. It is fundamental to highlight the work conducted at the regional level

by the following organisations: COPERNICUS Alliance (Europe), Association for the Advancement of Sustainability in Higher Education (AASHE) (North America), Iberoamerican Network of Universities for Sustainability and the Environment (ARIUSA) (South America) and Promotion of Sustainability in Postgraduate Education and Research Network (ProSPER.Net) (Asia-Pacific). International organisations are also of necessary reference, among which the following stand out: the International Sustainable Campus Network (ISCN), Global University Network for Innovation (GUNI), Global Universities Partnership on Environment and Sustainability (GUPES), Global Higher Education for Sustainability Partnership (GHESP), the International Organisation of Universities for Sustainability and the Environment (OIUDSMA), and the International Association of Universities (IAU)¹.

However, despite all the efforts conducted to date, it is announced that this is the first time that the world leaders have promised common actions and efforts in an agenda such as the one established for the SDGs (Manolis and Manoli 2021), with most organisations and institutions of the world joining this initiative.

In September 2015, after a profound participatory process with high-level expert panels and numerous inquiries, the heads of State approved the declaration of the United Nations entitled 'Transforming our world: the 2030 Agenda for Sustainable Development', which presents the declaration of the 17 SDGs. In this great global challenge of implementing the 2030 Agenda, education has become a fundamental element for its realisation, to such an extent that it includes a SDG exclusively dedicated to education (SDG 4: Quality education), within which higher education has been officially identified as a target (4.3) (Mallow and Land 2020). Likewise, the contribution of education is essential for the attainment of sustainability, thus it is linked to the realisation of the other 16 SDGs (UNESCO 2017; Priyadarshini and Abhilash 2020). Thus, the presentation of this global commitment started to generate new scenarios in which HEIs adopted a strategic position for the development of and compliance with the 2030 Agenda and its corresponding 17 SDGs.

The 2030 Agenda for Sustainable Development proposes an important expansion with respect to the preceding eight Millennium Development Goals (MDGs), which were launched in 2001 and expired in 2015 (UN, 2015). While the MDGs were mainly focused on poverty and health, the 17 SDGs establish 169 objectives, and include new areas such as climate change, economic inequality, innovation, sustainable consumption, peace and justice (Leal Filho et al. 2019).

To this respect, Gómez-Gil (2018) pointed out that, if the SDGs are much more ambitious than the MDGs, a significant number of them are 'the repetition of old unkept promises that have been postponed for lustrums, coming back once and again' (111).

In this line, we found certain critiques gathered in the scientific literature about the SDGs which we should not ignore, such as the ones provided by Kopnina (2020), which are shared by many social and environmental movements. This author argues that many of the challenges described in the SDGs are solved through an 'inclusive' or 'sustainable' economic growth, which are terms they repeatedly use in their final report, assuming that the economic growth can be conveniently detached from the consumption of resources. Kopnina (2020) pointed out that this perspective of sustainable development through 'sustainable and inclusive' growth integrated in the proposition of the SDGs, far from challenging the status quo, tolerates continuous exploitation, as the inequalities and the pressure on the natural resources increase, thereby exacerbating the loss of biodiversity, climate change and the resulting social tensions. The reflections of Rodríguez-Sánchez and Sánchez-Barreto (2020) are in agreement with this proposition.

Other critiques highlighted in the scientific literature are the ones commented by Sanabria-Suárez et al. (2020), who stated that some of the weaknesses of the SDGs are, on the one hand, their non-binding legal character, in terms of their content with respect to the lack of knowledge they reflect on some of the severe causes of inequalities, and, on the other hand, the lack of implementation and evaluation tools, among others. Similarly, Gómez-Gil (2018) refers to the questioning of different scientific institutions and entities about the formulation adopted in the SDGs: 'it has been criticised that numerous objectives are pure rhetoric, and many of the 169

goals would be idealistic and visionary, along with very serious problems in the reliability of the approved indicators' (p.110). This author also highlighted the weak and imprecise vocabulary with which they were written, which hinders their attainment, as well as their ethnocentric approach, since the SDGs are projected 'under the leadership of the developed countries', as if it were a model to be followed by poorer countries. Lastly, other critiques emphasise the scarce indications that countries are receiving on how to advance in their implementation, with the appearance of great disparities and incongruences between countries (Gómez-Gil 2018).

Despite assuming these critiques, one of the great strengths of the SDGs is their universal and integrative character, which, based on a systemic and planetary approach, presents the focus of action from a simultaneous multi-level perspective, relating the local, regional, national and global contexts (Vilalta et al., 2018). Following Ketlhoilwe, Silo, and Velempini (2020), the SDGs represent a change that aims to guarantee that sustainable development becomes the predominating paradigm in the transformation of society.

Likewise, numerous evaluations, such as those of the International Monetary Fund (IMF) and the Sustainable Development Solutions Network (SDSN), confirm that the SDGs are feasible, since, although they are ambitious objectives, 'if they are pursued with persistence and creativity, they can unleash human innovation and accelerate progress beyond the imaginable' (Sachs et al., 2020:s/p). As is claimed by these authors, the problem does not lie in the ambition of the proposition, but in the need to take them seriously and organise ourselves to achieve them, and this is where education plays a predominant and fundamental role for their attainment, especially higher education.

We know that many institutions are already addressing the SDGs as a university strategic action (Neary and Osborne 2018; Purcell, Henriksen, and Spengler 2019; Zamora-Polo and Sánchez-Martín 2019 & Rebelatto et al. 2019).

However, five years after their launch, and according to a recent report, public awareness on the SDGs and the 2030 Agenda seems to be scarce, in spite of the numerous actions implemented (Manolis and Manoli 2021; UN. Secretary-General, 2019; Ruiz-Mallén and Heras 2020). Authors of reference in this scope point out that the implementation of the SDGs in universities is still in diapers (Leal Filho et al. 2019).

The role of universities regarding the implementation of the SDGs must be related not only to initiatives focused on integrating environmental aspects in the teaching and learning processes (which is the initial initiative of the integration of sustainability in education), but also to research, management and governance, and social leadership (Owens 2017), as they are, along with teaching and training, the four fundamental areas/functions of the university. The problem is that most of these functions are addressed separately, with no connection between the areas, and they should be approached inter-connectedly. This aspect is set as one of the barriers for the implementation of the SDGs from an integral and systemic approach in universities. Therefore, it is necessary to address and integrate sustainability in all the areas of HEIs, in order for them to be in line with the global agenda of the SDGs (Franco et al. 2019). Thus, our interest was to identify the areas from which the SDGs are being approached in universities, in order to determine certain tendencies and possible deficiencies, which is one of the objectives of the present review.

Results of recent studies reveal that the aspects of social sustainability in the attainment of the SDGs are not approached in such a proactive manner as the aspects of environmental sustainability (Manolis and Manoli 2021), thus showing that there is a tendency toward the implementation of the SDGs from one of their dimensions, i.e. the environmental dimension, omitting their unavoidable inter-relation with the two other dimensions: social and economic. This justifies another objective proposed in this review, which is to identify whether there is a certain inclination or tendency toward any of the dimensions from which the SDGs are approached.

In this line, another aspect that must be highlighted is the dependency of some goals on others. The SDGs must be addressed from inter-connection, not only between the dimensions

(social, economic and environmental), but between the goals themselves. Stafford-Smith et al. (2017) underlined the importance of the links and interdependencies among the SDGs for an effective application. This interdependency and inter-connection is implied in the logic of the SDGs. Egron-Polak (2016) stated that the SDGs are inter-connected and integral, arguing that we cannot achieve a goal without achieving the others. As was claimed by Nilsson, Griggs, and Visbeck (2016, s/p), if these overlapping is ignored 'and we simply start attempting to attain the goals one by one, we will be at risk of obtaining adverse results'. In this sense, it is necessary to approach the goals in relation to each other, and not separately or sequentially (SDSN Australia/Pacific 2017). This is where another objective of this review is framed, as we aimed to analyse whether the SDGs are being addressed connectedly and inter-relatedly or, on the other hand, they are being approached independently and disjointedly.

Lastly, although there is a large and increasing number of publications that approach the SDGs in HEIs, the most recent literature indicates that there is a gap in the integration of the SDGs through a creative, participatory, community, practical and attractive manner in HEIs (Manolis and Manoli 2021). We agree with Leal Filho et al. (2019) in the need to implement studies oriented to practice, based on participatory and collaborative approaches and methods that favour the development of innovative ideas aimed at acting, that is, studies that lead to changes and improvements regarding the SDGs.

This is why we aimed to identify two fundamental aspects: on the one hand, whether the analysed publications emerge from the institutional scope or whether they are initiatives that are born from the interest and motivation of the university community itself, and, on the other hand, whether they are declarative or implementation studies in which specific actions have been carried out.

Considering the above mentioned, the aim of the present systematic review of the literature was to analyse the studies found based on the research objectives proposed and to evaluate their respective contributions regarding the SDGs in the university scope.

3. Methodology

3.1. Study design

Scientific literature review is an information compilation strategy that emerged from the need to know, synthetically, the results of research in a specific topic (Olarte-Mejía and Ríos-Osorio 2015). Particularly, systematic reviews aim to gather the existing knowledge on a certain matter, providing a critical and reproducible summary of the results of the publications of a single topic.

It is worth highlighting that this type of reviews have significant differences with respect to other types of reviews, such as narrative reviews, since the latter are characterised by a high degree of subjectivity (Del Pino, Frías, and Palomino 2014), while systematic reviews stand out for their thorough character and for being explicit, transparent and rigorous, thus reducing the risk of bias (Linares-Espinós et al. 2018).

According to Sanz (2020), among their contributions, systematic reviews: (a) can relate a high number of different studies; (b) present a view of the aspects on which the primary research has placed greater emphasis; and (c) access rigorous evidence.

Considering the above mentioned, the aim of this systematic review was to analyse how the SDGs are being implemented in HEIs. To this end, we followed a methodology that is specific to systematic reviews (Del Pino, Frías, and Palomino 2014; Linares-Espinós et al. 2018) under the strategy of the PRISMA statement (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), which is a document that describes the guidelines and steps to be followed for the realisation of systematic reviews based on 27 items (Urrútia & Bonfill, 2010).

The search comprised the articles published between January 2015 and October 2020 in the Web of Science (WOS) and Scopus databases and in the Google Scholar search engine.

3.2. Problem formulation

The question formulated for the systematic review was generated following the PICO methodology as shown in Table 1.

Thus, the question that we aimed to respond with the present literature review is: *‘What does the scientific literature show regarding the implementation of the SDGs in HEIs during the first five years since their declaration?’*. The Table 2 presents the list of research questions with the specific objectives set.

3.3. Search strategies

To guarantee the sensitivity of the search process, we decided to use descriptors incorporated in a thesaurus. We searched in SKOS, the thesaurus of the UNESCO; however, it was not updated, and terms such as ‘objetivos de desarrollo sostenible’ (‘sustainable development goals’ in Spanish) did not produce any results. Thus, we reviewed the keywords used in recent articles about the study subject and extracted the terms that we then employed as descriptors; in this way, the comprehensiveness of the search was also ensured. The descriptors used in the search were: ‘sustainable development goals’, ‘SDG’ ‘2030 agenda’, ‘university’, ‘higher education’, ‘college’ and ‘faculty’, both in English and Spanish. Lastly, to guarantee the specificity of the search, we used the established terms truncated, to ensure the reach and their combination through Boolean operators.

The specific search routes are described in Table 3.

Table 1. Question formulated based on the PICO methodology. Source: Urrútia & Bonfill (2010).

P=Population	I=Intervention	C=Comparison intervention	O=Outcome
University scope / Higher Education Institutions (HEIs)	Implementation of the SDGs (how they are being approached) and compliance with the 2030 Agenda	Not applicable	Specific actions and their contribution

Table 2. List of research questions and objectives.

Research question	Research objectives
What does the scientific literature show regarding the implementation of the SDGs in Higher Education Institutions during the first five years since their declaration?	To analyse the scientific literature published in the last 5 years about how the SDGs are being implemented in universities
Research questions	Specific objectives
1. What SDGs are being addressed the most in universities? Which are being addressed the least?	To know the SDGs addressed in the identified articles and count them.
2. What perspective are the SDGs being addressed from?	To identify the perspective from which the SDGs are being approached
3. Which dimension are the SDGs being approached from? Is there a preference for any dimension?	To know from which dimension the SDGs are being approached and whether there is a preference for any of them
4. Which area are the SDGs being addressed from?	To know from which area the SDGs are being addressed
5. What type of actions are being carried out?	To identify the type of actions that are being carried out to address the SDGs in universities
6. Do studies emerge from an institutional scope or from the university community?	To know whether the propositions and/or actions of the analysed studies emerge from the institution or they are carried out by people or groups of people of the university community in a more particular manner
7. Are these studies declarative or based on action implementation?	To know whether the propositions and/or actions proposed in the analysed studies are limited to a declaration of intentions or if they are propositions that have been implemented.
8. What is the geographic distribution of the contexts in which the studies were carried out?	To know the geographical location of the contexts where the analysed studies were conducted
9. From what universities are the SDGs being carried out?	To identify the university context in which the analysed articles were conducted

Table 3. Specific search routes and descriptors. Source: developed by author.

Search routes and descriptors	N° of articles		
	WOS	SCOPUS	GOOGLE SCHOLAR
Route 1: TI=(universidad AND objetivo de desarrollo sostenible)	0	0	19
Route 2: TI=(Educación superior AND objetivo de desarrollo sostenible)	0	1	2
Route 3: TI=(facultad AND objetivo de desarrollo sostenible)	0	0	0
Route 4: TI=(Universit* and sustainable development goal)	15	20	0
Route 5: TI=(Higher education* AND sustainable development goal)	15	18	0
Route 6: TI=(college* AND sustainable development goal)	0	0	0
Route 7: TI=(faculty* AND sustainable development goal)	0	0	0
Route 8: TI=(sustainable development goal* AND (University* OR higher education OR college OR faculty))	10	19	4
Route 9: TI=(universit* AND "sustainable development goal*")	15	20	0
Route 10: TI=(Higher education* AND sustainable development goal*)	16	18	0
Route 11: TI=((Facult* OR universit* OR higher education) AND (sustainable development goal*)	15	28	0
Route 12: TI=(universit* AND "Agenda 2030")	1	3	0
Route 13: TI=(universit* AND "SDG")	1	1	10
Route 14: TI=(Higher education* AND SDG)	1	6	12
Route 15: TI=(universidad AND "ODS")	0	0	15
Route 16: TI=(Educación superior AND "ODS")	0	0	11

Table 4. Inclusion and exclusion criteria. Source: developed by author.

Inclusion criteria	Exclusion criteria
Articles published in the WOS, Scopus and Google Scholar databases	Articles published in other databases
Scientific articles	Book chapters, reviews, acts of congresses, etc.
Studies whose titles contain at least one of the combinations of the descriptors defined in this review	Studies whose titles do not contain the defined descriptors
Articles in English and Spanish	Articles in other languages
Articles published between January 2015 and October 2020	Studies published before or after the period set for the search
Open access articles or articles accessible through the permits of our institution	Articles with limited and/or paid access that were not accessible through our institution

3.4. Inclusion and exclusion criteria

This review included scientific articles published in the Web of Science (WOS) and Scopus databases and Google Scholar search engine, both in English and Spanish. The search was set for the period between January 2015 (when the 2030 Agenda and the SDGs were declared) and October 2020, and it was limited to papers whose titles included at least one of the combinations of the descriptors defined above. This decision was made to focus the search on those studies specifically related to the relationship between the SDGs and HEIs. Lastly, the review included open access articles and articles that could be accessed through our institution in the databases in which they were located.

Table 4 shows the inclusion and exclusion criteria.

3.5. Development of the analysis tool and selection of the analysis categories

To analyse the selected articles and respond to our research questions, all the articles were read in full text to select the necessary information. We designed a table of categories that allowed systematising all the gathered data and information. The selection of the categories was consolidated after a debate process among the researchers. To ensure their reliability, a pilot test was performed, in which all four researchers analysed the same article.

In Table 5 we present the system of categories used in relation to the research questions:

Table 5. Table of categories.

Research questions	Categories	Definition
1. What SDGs are being addressed the most in universities? Which are being addressed the least?	Number of SDGs addressed in the identified studies	The SDGs addressed in the identified studies are analysed and counted.
2. What perspective are the SDGs being addressed from?	Specific General Holistic	A specific perspective is considered when specific SDGs have been approached without establishing relationships between them. A general approach was considered then neither the SDGs nor the perspective from which they were addressed are specified. Lastly, the holistic perspective refers to a globalising proposition that contemplates the SDGs inter-relatedly and interdependently.
3. Which dimension are the SDGs being approached from? Is there a preference for any dimension?	Economic Social Environmental Connected Global General	Based on the proposition of Polloni and Catalán (2017), the 17 SDGs were grouped into the following dimensions: Economic (SDGs 8, 9, 10 and 12), Social (SDGs 1, 2, 3, 4, 5, 7 and 11) Environmental (6, 13, 14 and 15) and Connected (16 and 17). Thus, in order to facilitate the analysis and assess the current tendencies in the implementation of the different SDGs in the university, this grouping was used, to which the global dimension was added, which represents the option in which all the SDGs are addressed in a single study, or several SDGs that correspond to the different dimensions, in a holistic manner. The general dimension was also included for the cases in which all or several SDGs are addressed, although in a general manner, that is, without a holistic approach.
4. Which area are the SDGs being addressed from?	Research Education and learning Management and governance Social leadership	Based on SDSN Australia/Pacific (2017).
5. What type of actions are being carried out?	* At the end of this summary, a figure shows the relationship between the areas and their corresponding actions.	For the analysis of the actions, we designed a system of categories from the proposition of SDSN Australia/Pacific (2017), which allows grouping them in their corresponding areas.
6. Do studies emerge from an institutional scope or from the university community?	Institutional University community	The aim is to determine whether the propositions and/or actions presented in the analysed studies were generated by the institution itself or by people or groups of people who belong to the university community in a more particular manner, without an institutional predominance.
7. Are these studies declarative or based on action implementation?	Declarative Implemented	This category shows whether the propositions and/or actions presented in the analysed studies are limited to a declaration of intentions (i.e. with none of them being implemented) or, on the other hand, they have been implemented.
8. What is the geographic distribution of the contexts in which the studies are carried out?	Analysis of the geographic distribution	The aim is to know the geographic location of the authors of such studies, since the geographic context does not always coincide with the university context in which the SDGs are being developed
9. From what universities are the SDGs being carried out?	Identify the universities of origin of the studies	This category shows the university context in which the analysed studies were carried out

As indicated in the table above to answer question number 5, for the analysis of the actions, a category system was designed based on the SDSN Australia/Pacific (2017) proposal, which allows them to be grouped into their corresponding areas, as shown in Figure 1.

The process conducted to develop Figure 1 was inductive-deductive. On the one hand, prior to the analysis of the studies, the authors proposed a set of categories that grouped those actions whose presence was considered relevant to be analysed; on the other hand, the open category system was maintained, in order to allow incorporating those actions that appeared along the reading of the studies.



Figure 1. University areas and actions. Source: developed by author.

3.6. Methodological trajectory

The development of this review was divided into five phases: (1) design phase; (2) exploratory phase; (3) eligibility and evaluation phase; (4) analysis of the content of the selected articles; and (5) description of the results.

1. Design phase. Formulation of research questions that allow responding to the main study objective, search descriptors, and inclusion and exclusion criteria; selection of analysis categories and design of the table. After several versions, a final category system was obtained through an expert validation process.
2. Exploratory phase. Search and identification of articles by three independent reviewers in two databases (WOS, SCOPUS) and Google Scholar search engine through the combinations of the defined descriptors. After the review of abstracts, we discarded the articles that were repeated and those that did not meet the inclusion criteria.

3. Eligibility and evaluation phase. The texts were reviewed to guarantee that they met the inclusion criteria.
4. Analysis of the content of the selected articles.
5. Description of the results. The results are presented through a descriptive development, based on the proposed categories.

Figure 2 shows the flow chart with the details of the data extraction.

4. Analysis of the results

This section presents the analysis of the results, responding to each of the proposed research questions. The table of the articles analyzed is presented as additional information.

4.1. Which are the SDGs that are being tackled to a greater extent in universities?

The SDGs appear in a general manner in 39% of the reviewed articles. Only 8.6% of the studies approached all the SDGs in their analyses (A17,A18,A20,A21,A36,A40,A41,A46). Among the articles

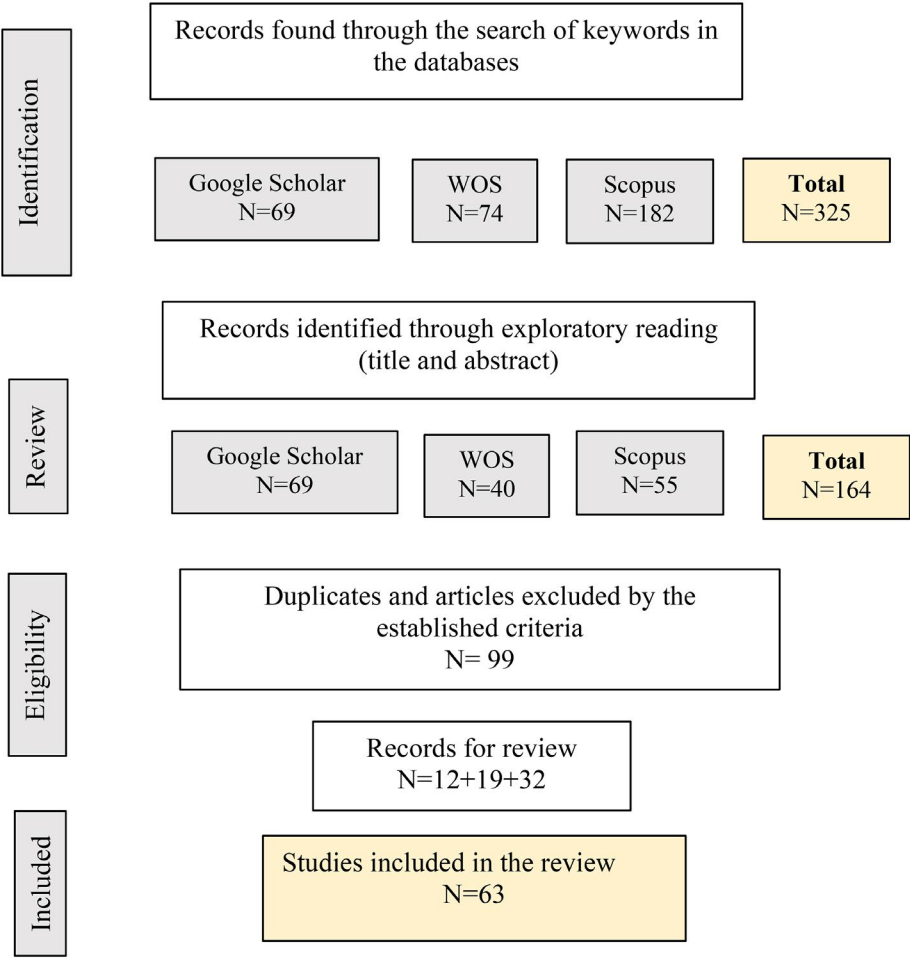


Figure 2. Flowchart. Source: developed by author.

focused on specific SDGs, SDG 4 (Quality Education) is the most referenced one (9.5%) (A11,A 16,A29,A31,A33,A38,A42,A47,A56), followed by SDG 13 (Climate Change) (4%)(A11,A19,A35,A38,A42). The SDGs that appear least frequently are SDG1 (Zero Poverty), SDG 10 (Reduced Inequalities), SDG 15 (Forests, Desertification and Biodiversity), and SDG 16 (Peace and Justice). SDG 9 (Building Resilient Infrastructure, Promoting Sustainable Industrialisation and Promoting Innovation) stands out as the only SDG that was not explicitly mentioned in any of the analysed articles. Therefore, research in this study topic tends to be focused on a general approach of the SDGs, without focusing on specific SDGs (Figure 3 shows the commented data).

4.2. Which perspective are the SDGs being approached from?

In 46% of the analysed articles, the SDGs were addressed in a general manner, thus they do not specify the SDGs that they tackled or the approach they used (A5-A7,A9,A10,A12,A 13,A17,A18,A20,A21,A23-A28,A30,A32,A34,A36A-A44). Another 31,7% of the articles present a holistic idea of the SDGs based on a total and global integration of each of the goals, which states that the SDGs can only be understood or addressed as a system, and never as a sum of objectives(A2-A4,A8,A15,A35,A46,A48-A53,A55,A57,A58,A60-A63). On the other hand, 22.2% of the studies were focused on a specific SDG, without specifying the work conducted with it, as part of a more globalising strategy (A1,A11,A14,A16,A19,A22,A29,A3 1,A33,A45,A47,A54,A56,A59). The data are in line with an incipient situation, since the identified actions are aimed at analysing the state of the study subject. It is worth highlighting that the year of approval of the SDGs was 2015 (Figure 4 presents the commented data).

4.3. Which dimension are the SDGs being tackled from? Is there a preference for any dimension?

The results reveal that the global dimension has greater presence with respect to the other dimensions (47.6%) (A1-A4, A8A, A15, A16, A20-A22, A35-A42-A50, A52, A54, A55, A57, A58, A59, A60-A63), which represents that the analysed studies address more than one SDG holistically, since there are variables of different scopes related to those of other scopes. However, the general dimension also obtained a high percentage (33%) (A5-A7, A9, A10, A12, A17, A18, A19, A23, A25-A29, A34, A36, A38-A41), which indicates that there is a superficial and very generic approach on the SDGs, without specifying which SDGs are being

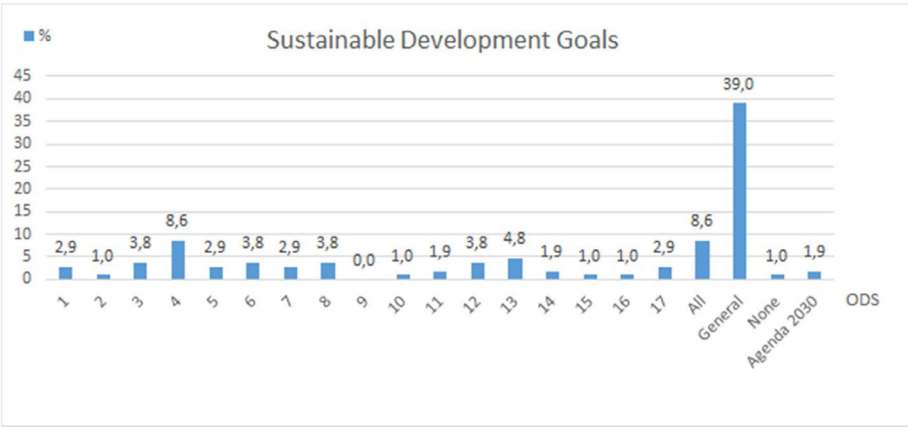


Figure 3. Sustainable Development Goals identified.

Perspective of SDGs approach

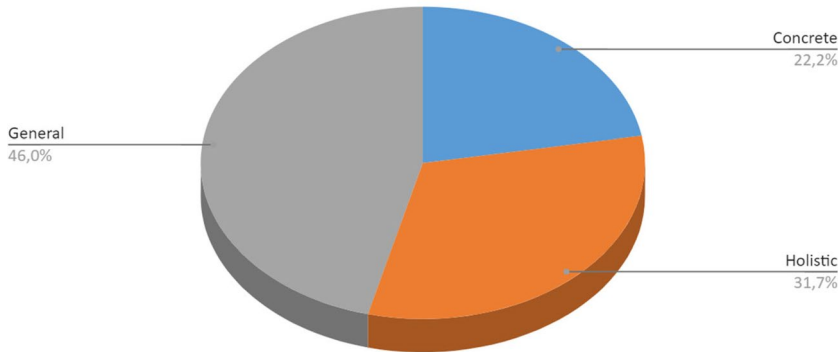


Figure 4. Perspectives from which the SDGs were approached.

addressed. Regarding the three main dimensions, the social dimension was the most frequently identified (7.9%) (A11, A31, A33, A53, A56), followed by the environmental dimension (4.8%) (A13, A32, A51) and the economic dimension (3.2%) (A14, A24) (Figure 5 represents the commented data).

4.4. Which area are the SDGs being addressed from?

This analysis allowed measuring the influence of each university areas on the tackling of the SDGs. The results provide information of interest to generate changes and favour the implementation of actions in those area that are being disregarded.

As is shown in the graph (Figure 6), the values are distributed. The main area identified was Research, with 36.5% of the analysed studies (A2,A3,A15,A18,A20,A21,A28,A33,A34, A42,A43,A46,A49-A54,A56,A58,A59,A61-A63), and education and learning with 31.7%(A1,A8,A9,A11,A12,A23,A27,A35-A38,A40,A41,A45,A47,A55,A57,A60), followed by Social Leadership (20.6%) (A5,A6,A1

From which dimension are the SDGs approached?

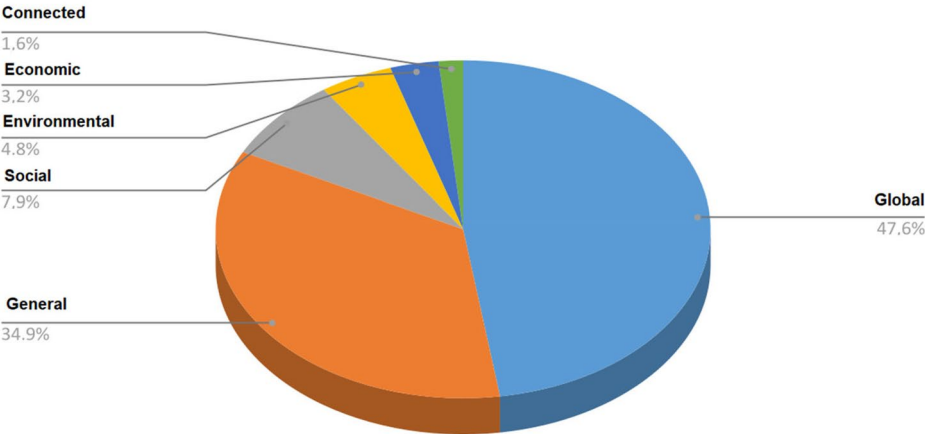


Figure 5. Dimensions from which the SDGs are approached.

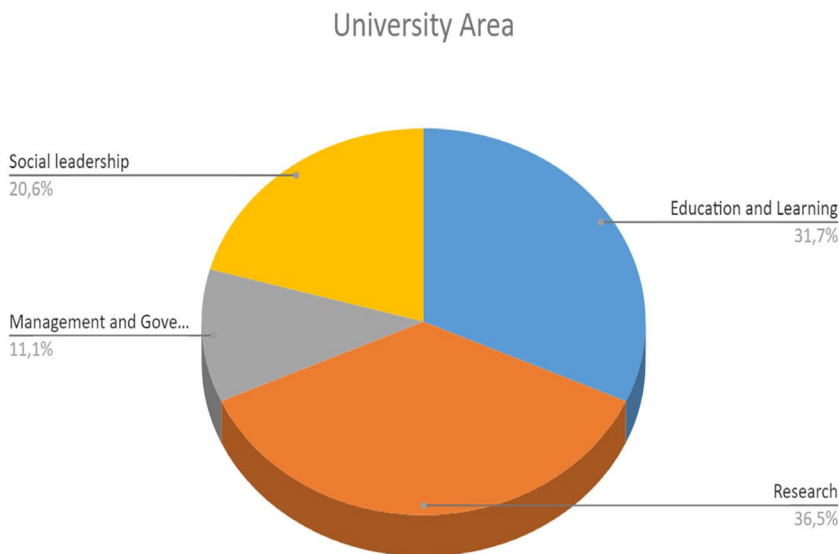


Figure 6. University areas.

0, A16, A17, A19, A22, A25, A26, A29–A31, A39, A48) and Management and Governance (11,1%) (A4, A7, A13, A14, A24, A32, A44) (Figure 6 illustrates the information analyzed).

4.5. What type of actions are being carried out?

Regarding the actions carried out by universities to implement and/or approach the SDGs, it was observed that, in the period of 2015–2020, the most popular action was the 'integration of the SDGs in the curriculum (EL2)', appearing in 10 articles (A8, A9, A23, A27, A35, A36, A38, A40, A45, A47). In this area (Education and Learning), another two actions were identified, with significantly lower results. These two actions were 'to mobilise and involve the university community for the design and implementation of solutions to attain the SDGs (EL4)', detected in 4 studies (A11, A12, A37, A57), and 'student training courses that approach the SDGs (EL3)', located in 3 articles (A41, A55, A60).

Another frequent action, found in 8 studies (A5, A16, A22, A26, A29, A31, A39, A48), was 'strengthening of the public commitment of the university and its involvement in approaching the SDGs (SL1)', in the area of Social Leadership, followed by 'to approach the state of the SDGs at the institutional level (R1)', which appears in 7 studies (A2, A3, A15, A21, A52, A58, A63), in the area of Research. This category groups those articles that were focused on determining the state of the SDGs from any of the involved levels, agents and documents (conceptions of the university community, analysis of institutional documents, revision of curricula, etc.). In the area of Research, we also found 6 articles (A20, A33, A50, A59, A61, A62) that presented 'case studies about the actions for the development of the SDGs (R2)', 4 studies (A18, A28, A34, A56) focused on 'to know impacts or changes through interventions/actions about the development of the SDGs (R4)' and 3 articles (A46, A51, A53) focused on 'to support and promote ways of innovating for the implementation of the SDGs and providing solutions (R3)'.

On the other hand, the least frequent actions among universities are 'to train students in the research of the SDGs (R7)' (A42), 'to foster and promote the SDGs as a research line within the university (R6)' (A54) (these two actions belong to the area of Research), 'teacher training courses that approach the SDGs (EL1)' (A1), which belongs to the area of Education and Learning, and 'to establish strategies, plans or indicators aligned with the SDGs (G2)' (A7),

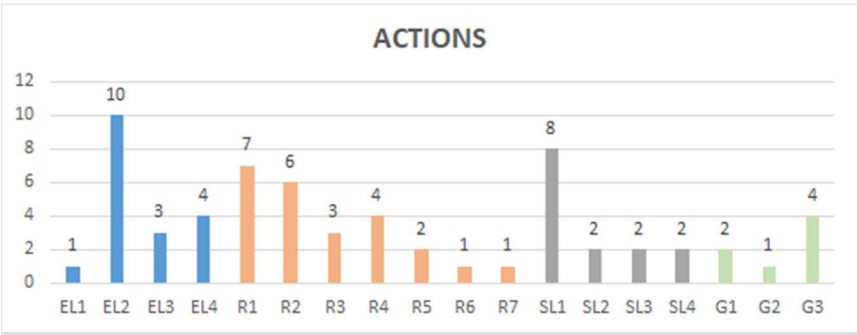


Figure 7. Actions carried out by universities.

which belongs to the area of Management and Governance. These actions are located in one study each.

Lastly, the following actions were identified in 2 articles each: ‘to support the entire spectrum of research approaches required to address the SDGs (R5)’ (A43, A49); ‘collaboration with external agents to address the SDGs (SL3)’ (A10, A25); ‘to play a leading role in the development and promotion of policies based on the SDGs (SL4)’ (A17, A30); ‘to initiate and facilitate participation in the intersectoral discussion and action regarding the implementation of the SDGs (SL2)’ (A6, A19); and ‘to include the SDGs in the accountability (G1)’ (A13, A14) (Figure 7 depicts the information analyzed).

4.6. In which geographic and university context are the SDGs approached?

By geographic location, the published studies that address the SDGs or the 2030 Agenda are globally distributed. Most studies were published by European universities (specifically in Spain and the United Kingdom), followed by Latin American universities and, with a considerably smaller number of studies, universities in other regions. That is, the present review showed articles in four geographic areas (Asia and the Pacific, America, Africa and Europe), which provides a view of the current situation of the regional debates and gaps regarding the effect of universities in terms of the SDGs and the Agenda 2030. (Figure 8 illustrates the commented data).

The authors of the analyzed articles are concentrated in European countries. Although the final result of the geographic analysis allows recognizing 38 nationalities, many of them only published one or two studies in the last 6 years. It is significant that these publications are designed by authors whose nationality does not coincide with the country or region where they were carried out, as is the case of the studies conducted in Angola and Manila, whose authors belong to universities of the United Kingdom.

Next, Figure 9 shows the number of publications according to the nationality or country of the authors.

4.7. Which universities are the SDGs being investigated from?

European and Latin American universities stand out, with a total of 55 articles from among the 63 that were published in important indexed journals in the period of 2015–2020. There is an upward tendency from the year 2019, since only 13 articles were published until that year, and the first analysis conducted in developing countries on the SDGs and the 2030 Agenda appeared in the year 2020. From 2015, when the SDGs were launched, the number of published articles increases significantly (see Annex I).

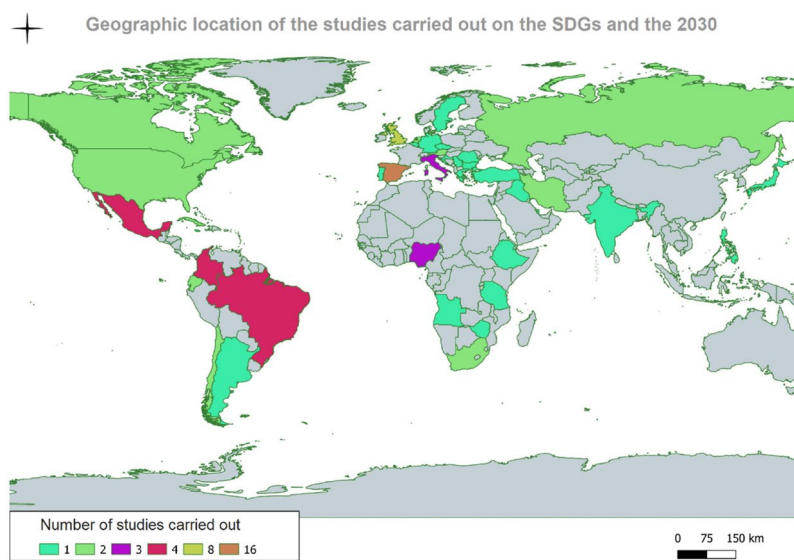


Figure 8. Geographic location of the studies conducted on the SDGs and the 2030 Agenda.

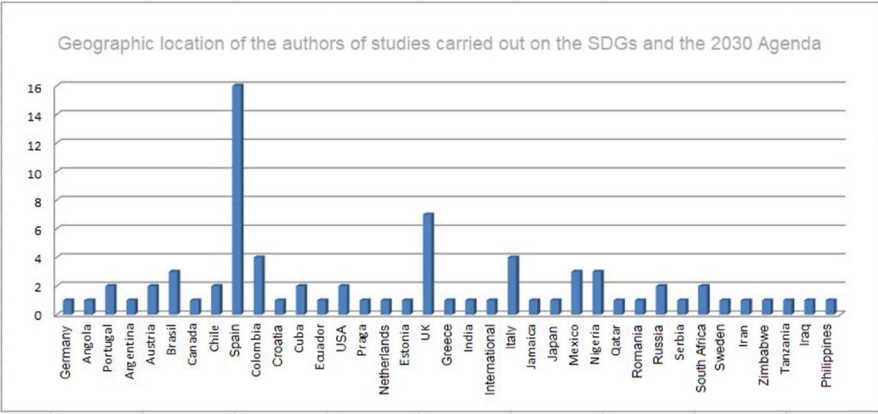


Figure 9. Geographic location of the authors of studies carried out on the SDGs and number of publications per region.

4.8. Do the studies in this topic emerge from an institutional scope or from the university community?

The perspective from which the articles emerge shows a balanced approach, although the members of the university community predominate over the institutional initiatives, 56.5% (A1, A3,A6,A8,A10,A18,A20-A23,A25,A27,A28,A31,A33-A42,A44,A51,A53-A59) vs 43.5% (A4,A5,A7,A9 ,A11-A17,A19,A24,A26,A30,A32,A43,A45-A50,A52,A60-A63). This is the result of research projects developed by research groups, faculty members, etc. However, it is interesting that institutions themselves are implementing the SDGs at such level (Figure 10 shows the commented data).

4.9. Are these studies declarative or are they focused on the implementation of actions?

As can be observed in Figure 11, around 67.7% of the analysed studies present a declarative research, whereas around 32.3% did implement their investigations. This category shows whether

Does the work emerge from an institutional environment or from the university community?

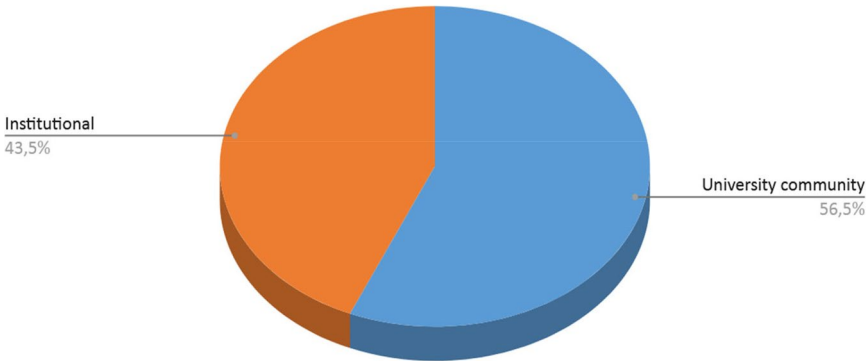


Figure 10. Scope from which studies emerge. Source: developed by author.

the propositions and/or actions proposed in the analysed studies are limited to a declaration of intentions (i.e. with none of them being conducted) or if they were implemented (Figure 11 shows the commented data).

Research on the SDGs must generate practical knowledge supported by evidence based not only on the analysis and understanding of the problem, but also on an application to propose strategies of transition and intervention toward the attainment of the 2030 Agenda. Precisely, declarative studies related to normative knowledge provide a view of the problem from several perspectives (e.g. temporal, political, economic, institutional, etc.), whereas the knowledge obtained from experience and implementation is applied accordingly, thus contributing to solving the problem or producing a view of the contexts (Figure 11 shows the commented data).

5. Discussion

The results obtained through this systematic review on the articles whose main topic is the SDGs in the university context are oriented toward the implementation of the SDGs in universities (SDSN, 2020; SDSN Australia/Pacific 2017).

Declarative or implemented research ?

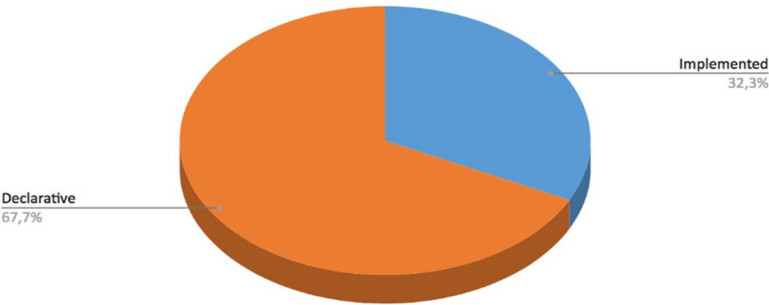


Figure 11. Proportion of declarative and implemented articles.

Firstly, the results show that a high percentage of the analysed studies address the SDGs from a general approach in the different university functions, which indicates that most of them specify neither the SDGs approached nor the perspective from which they have been tackled. This poses an obstacle and probably a research deficiency, to the extent that the general category represents that an abstract and wide approach has been proposed to define how the SDGs have been addressed. Thus, it is demonstrated that, in the analysed sample, there is a tendency to carry out studies that approach the implementation of the SDGs in universities from a poorly defined perspective, which hinders any process of follow-up and evaluation of the work conducted. This issue poses a challenge that has been repeatedly reported in the scientific literature (Findler et al. 2019), since the lack of results based on adequate indicators and instruments to monitor and analyse the actions performed by HEIs is highlighted as one of the greatest obstacles to acquire a clear view of the current situation of the integration of the SDGs in higher education all over the world (Lambrechts, Van den Haute, and Vanhoren 2009; Lozano et al. 2013; Omazic and Zunk 2021). To this respect, it is worth mentioning the work of ARIUSA, and the more recent work of the Observatory of Sustainability in Higher Education in Latin America and the Caribbean (OSES-ALC)², in the process of creating a system of sustainability indicators in HEIs in Latin America and the Caribbean that allows diagnosing and monitoring the commitment of universities to sustainability and the SDGs (Sáenz Zapata et al. 2017).

Regarding the studies that approach one or more SDGs in particular, SDG4 is identified as the goal that is most widely worked in a specific manner. This makes sense, since education, apart from being the centre of this SDG, is strongly related to all the other SDGs, thus it plays a dominant role in the support to the implementation of the Agenda in its entirety. At the same time, it is worth highlighting the particular efforts of the UNESCO toward the attainment of this SDG, which exerts a direct influence on the steps to follow from HEIs; an example of this are the numerous publications and reports presented, as well as the conformation of an international 2030 Directive Committee of SDGs-Education³. Surprisingly, SDG 9 does not present any influence, despite being related to the transformation of the infrastructures, to make them more resilient and inclusive and promote innovation, which is an essential aspect at the institutional level for the attainment of the SDGs. Although the infrastructure constitutes a central component of the SDGs and acts as a base for sustainable development, according to the report entitled 'Infrastructure as a base of sustainable development'⁴ (Thacker et al., 2018), 'the true influence of infrastructure has not been sufficiently explored in theory and has not been sufficiently exploited in the practice' (3).

These results can be found in particular studies such as the one conducted in the University of Évora (Portugal), whose results indicate that SDG 4 is the one with greatest presence in the course taught in the Faculty of Social Sciences and SDG 9 is only represented in 11.8% (Chaleta et al. 2021). This is in line with the study of Salvia et al. (2019), who aimed at identifying the main SDGs addressed by experts in different geographic regions, concluding that SDG 4 is one of the most widely researched SDGs in all regions, except in Oceania and Africa, whereas SDG 9 is the least researched goal.

This issue is another of the findings highlighted in the present study, since infrastructure is directly related to all the SDGs by playing a fundamental role in society, as it improves the sustainable management of resources, the access to basic services, education and employment opportunities, thereby significantly contributing to human development and the quality of life for the planet and people.

Therefore, as is pointed out by these authors, the network-connected infrastructure systems (governments, international organisations, companies, HEIs, research centres and civil society) constitute the core of modern society. Consequently, it is fundamental to understand the influence of infrastructure systems on the SDGs (Thacker et al., 2018) and to promote the possible and essential contributions of HEIs in this respect.

However, it is worth mentioning the efforts that are being made for this SDG, such as the work of the Nagaoka University of Technology (NUT), member institution of the initiative entitled United Nations Academic Impact (UNAI) in Japan and the SDG Centre for SDG 9. Among its main contributions, we highlight the implementation of an engineering study programme based on the SDGs, entitled 'Gigaku SDG Institute', based on interuniversity collaboration, as well as the establishment of the UNESCO Chairs of Engineering Studies for Sustainable Development, whose aim is to develop the capacity of the students to transform their knowledge and solve problems of the real world⁵.

Of the analysed studies, 33.8% addressed the SDGs from an integral perspective, as is gathered in the preamble of the 2030 Agenda, whereas 49.2% applied a generalist and disconnected perspective. These results are similar to those provided by the review of Findler et al. (2019) regarding university sustainability, which indicate that 21.28% of the analysed sample of studies are classified in the category of articles with a generalist approach.

These data indicate that there is a lack of studies that tackle sustainability from a holistic and systemic approach. This issue poses an obstacle in the approach of the SDGs that offers indications about where the initiatives, projects and studies must be oriented in the field of the SDGs and universities.

On the other hand, the economic and environmental perspectives have little presence. The latter has lost representation with respect to the results of the first World Survey on Higher Education and Research for Sustainable Development carried out by the International Association of universities (IAU), since, in the first edition, the environmental dimension was the most selected option (84%) (IUA, 2016). That is, one year after the adoption of the 2030 Agenda, there was a tendency toward relating sustainable development from an environmental perspective. However, in the second edition of the survey, presented in 2019, almost 53% of all the respondents considered sustainable development as a holist topic that comprises the three dimensions, which is not in line with the results of the present review, where it was observed to be the option with the lowest value. This reveals another of the deficiencies detected in the analysed literature, since the tackling of the SDGs from a connected approach showed the lowest presence in the results of this review, which demonstrates the importance of focusing the efforts on generating university initiatives that maintain a perspective of inter-relationship between the SDGs.

Regarding the analysis performed to respond to two of the main questions (*which area are the SDGs being addressed?* and *what type of actions are being conducted?*), the results show that HEIs are focusing their efforts on two of the main functions they carry out: *research* (39%), *education and learning* (31%). These results are similar to those reported in the recent study of Leal Filho et al. (2021), whose main objective was to document and show the tendencies in the scientific publication about topics related to sustainable development. Their results highlight that the most common aspects that are being addressed in HEIs are related to the area of education and research, with 40% of the analysed publications. Similar results were reported by the IAU (2020), which indicate the predominance of the area of education, with 84% at the global level and 87% in European universities. These results could be indicating that there is a tendency in the scientific literature toward addressing the SDGs from two of the main areas of university action: education and learning, and research.

In this regard, the results obtained in this review show the scarce attention that governance receives in scientific publications in terms of the attainment of the SDGs, with a percentage far below that of the rest of the areas, in addition to the declarative and theoretical character of most of the identified studies in this area. Of all the analysed studies, only 7 contemplate governance as a central axis; this is in line with the results of current reviews on the advances of higher education in the attainment of the SDGs, highlighting that the governance of HEIs is not fully committed to achieving the SDGs (Moon, Walmsley, and Apostolopoulos 2018). However, governance is a fundamental pillar of university function regarding the SDGs; it is

directly related to leadership and university extension, and it refers to the way in which universities are organised and structured from the perspective of their government and management, establishing in their design the channels to link and relate the institution and all its internal elements to agents and entities of the environment and territory (Pérez, Fernández, and Aguilar 2018). Among the studies identified in this area, we highlight A44 (Bosmenier, et al., 2020), which considers university governance as a central element to comply with their commitment and mission in relation to the 2030 Agenda and the SDGs. To this end, they propose five key ideas with the aim of contributing to strengthening the governance of Cuban HEIs: (1) university managerial external learning or benchmarking; (2) new conception or redesign of university management; (3) internal structuring and external collaboration; (4) operationalisation of university governance; and (5) coherent and effective integration with the SDGs.

Therefore, one of the aspects that derives from this analysis is the need to implement actions (and not only declarations) that help universities to promote the SDGs through management and governance. Such actions include: (a) incorporating the SDGs to the reports of the institutional structures of universities; (b) analysing how high-level information strategies, policies, plans and indicators of universities can improve their alignment with the SDGs and identifying which organisational units are most relevant to this end; (c) identifying and addressing any divide or gap in the response of universities toward the SDGs; (d) integrating common working methodologies, as well as shared and participatory strategic decisions made from spaces for dialogue and discussion among HEIs, companies, government and civil society; (e) maintaining awareness of the importance of the management of values as a central aspect for the regulation of the relationships between the university and its environment, sectors and agents (Pérez, Fernández, and Aguilar 2018). According to these authors, university governance must maintain a strong relationship with university social responsibility.

In this respect, A6 (Meseguer & Morales, 2019) presents a theoretical study that establishes a direct relationship between the encyclical *Laudatio sí* and the attainment of the SDGs, whose results indicate that the university social responsibility plays a leading role in the efforts to build a better world, as it 'materialises in specific dialogue actions between the university world and civil society' (145). An example of this would be the initiative developed by the University of Veracruz (A10 – Becerra et al., 2020), which presents an academic-civic experience through which a relationship has been established between the university and its environment, by gathering the opinions and needs of the local territory to organise actions for the attainment of the SDGs. Therefore, it is an initiative that integrates a common response to sustainable development from the three government levels: the private sector, civil society and HEIs.

Another example of particular action with respect to the contribution of social responsibility and governance in the attainment of the SDGs is presented in A56 (De la Rosa et al., 2019), which shows that the subject of Social Responsibility under the service-learning methodology (SL) favours encounters with NGOs and creates learning spaces that differ from the traditional learning spaces. The results indicate that students significantly increase the degree of social responsibility after undertaking this subject under the SL methodology, improving their involvement and contributing to the attainment of Goal 4.7. SL is presented as a successful methodology for the development of the SDGs, which is in line with the results of other studies in this regard (Cebrian et al., 2019; García Laso et al. 2019; Verdera 2015). Similarly, this study reveals the relationships that can be established in a single action between the university action areas, to such an extent that, through an academic action initially included in the teaching-learning area, social responsibility and governance have been improved with the promotion of dialogue and contact between the academic scope and civil society.

Although these responses require an institutional approach, it is also possible, at the personal level, and in collaboration with the university community, to start taking steps toward the generation of changes for the improvement of management and governance in the tackling of the SDGs. As an example, the International University of Andalusia performed an experience in

collaboration with the Eastern University of Santiago de Cuba, in which they developed a guide for the integration of the 2030 Agenda in university governance that could serve as a reference for the scientific and university community.

It is also important to highlight the contribution of A3 (Cebrián et al. 2019), which reviews the current university practices and initiatives worldwide aimed at complying with the 2030 Agenda, whose results show the connection and coordination among the different action areas as a central issue: governance, leadership, research and education. In this line, we can point out A61 (Paletta & Bonoli, 2019), which presents the case of the University of Bologna as an example of institutionalisation of the 2030 Agenda from a systemic design that integrates all the university action areas. This experience provides an innovative framework that could serve as an example for other university contexts.

Regarding the most frequently identified specific actions in the area of research, there is a predominance of articles aimed at determining the state of the SDGs in HEIs through the responses of the different sectors of the university community and the analysis of the institutional documents and study plans.

An example of this is found in A2 (Cavallo et al. 2020), which presents a research project primarily aimed at determining the impact of the perceptions and expectations of the academic community in the attainment of the SDGs. It is highlighted that the findings about the perceptions and expectations of the university community are management tools in the academic unit of reference, as they allow problematising the creation of models and the design of policies strategies for the attainment of the SDGs.

Another of the examples that respond to this category is A62 (Wagman et al., 2020), which is a descriptive study that analyses the presence of sustainability in the study plans of a Swedish university. The results showed that, from a concept of sustainable development, only a few courses and articles were explicitly related to this scope; however, these results increased when the perspective of the SDGs was applied, which shows the broad and integrating character of the 2030 Agenda. This suggests that the approach of the SDGs provides a larger scenario from which to contribute to sustainability. In this area, we also highlight A45 (Maruna, 2019), which is a study focused on qualitatively analysing the study plans of the biannual programme of Integrated City Planning in the Faculty of Architecture of the University of Belgrade. The results show key aspects to improve the planning of education at the MSc level in the Faculty of Architecture of the University of Belgrade, by including the framework of the SDGs.

This type of studies are relevant, since, on the one hand, they show the current state of the SDGs at the institutional level, providing a contextual view, and, on the other hand, they are necessary in a diagnostic phase; however, the analysis of documents and public information produced merely descriptive results that may distort a real image, as, in some, cases, there are significant differences between what is presented in official documents and the practical implementation in the development of the SDGs. Thus, the literature shows the need to generate evaluation tools that allow determining the current state of the SDGs in HEIs from a calculation of indicators that can produce contrastable data between official declarations and what is written in paper, and the results that are eventually obtained.

Moreover, the results of this study also reveal the lack of studies oriented to promoting the SDGs as a research line within the university, as well as studies aimed at supporting the entire spectrum of research approaches required to address the SDGs, including inter- and trans-disciplinary research. Once again, this issue shows a deficiency in the scientific literature, to such an extent that, in the field of the SDGs, inter-disciplinarity is presented as a fundamental element for their approach (Annan-Diab and Molinari 2017; Salvia et al. 2019)

With respect to the results of the activities in the area of education and learning, it was found that these are concentrated in three actions. Some studies are focused on the integration of the SDGs in the curricular programme, which were the most abundant. Other studies are aimed at mobilising and involve the university community to design and implement solutions

to attain the SDGs through formative activities. Lastly, there are studies focused on the implementation of training courses for students to address the SDGs.

In this area, A8 (Sánchez Carracedo et al. 2018) presents the EDINSOST project, whose aim is the inclusion of the SDGs in the curriculum of higher education, with a map that establishes the sustainability competences for the Degree of Computer Engineering. A9 (Zamora-Polo and Sánchez-Martín 2019), from a general review of the SDGs in the university, presents a specific proposition to introduce the SDGs in a subject of the Degree of Primary Education. A59 (Neuman, 2018) presents the course entitled 'CookUOS: cooking in the context of literacy in health and education for sustainable development' in the University of Osnabrueck, assuming that cooking and eating is a feasible method to transmit ESD combining the theory with an emotional activity that everyone knows (Neumann et al., 2016).

Lastly, A23 (Michalopoulou et al., 2019), in addition to discussing the ways in which a chemistry course could be reconstituted using a systemic thinking approach from the adoption of inter-disciplinary approaches to integrate the framework of the SDGs, it presents the case of the educational initiative of the University of Bristol (UB) 'Bristol Futures'. The latter is one of the strategic projects of the UB which, under a creative and integrated approach for curricular development, is aimed at providing all students with the skills required to be informed and committed citizens and scientists in a changing world⁶.

Although these results could be promising, the conclusions of other studies indicate that there is still much to do regarding the integration of Education for Sustainability in university education, since they do not have a transforming approach (Valderrama-Hernández et al. 2019).

In relation to the area of leadership, it is the third most frequently identified area, with four actions detected. The most abundant articles in this area are those dedicated to strengthening the public commitment of the university and its involvement in addressing the SDGs. With very low frequency, other studies are aimed at initiating and facilitating participation in discussion and the intersectoral action on the implementation of the SDGs, or focused on collaboration with external agents to approach the SDGs. Likewise, it is worth highlighting that, of all the articles identified in this area of action, only four of them have been implemented, with most of them being theoretical studies.

Among the studies identified in the area of Leadership, A16 (Owens 2017) proposed the evaluation of the introduction of the 2030 Agenda and the SDGs in higher education. The results indicate the following as essential factors to revitalise sustainable development in universities: (a) the necessary collaboration among governments, multilateral agencies and universities; (b) investing in knowledge and responsible research with public funds; and (c) creating new alliances and mechanisms of cooperation, such as regional associations of higher education. It is worth highlighting that most of the content of this article was developed as a preparation for the world education monitoring report of 2016.

A29 (Heleta & Bagus, 2021) is a theoretical study that addresses the help needed by low-income countries to strengthen their higher education systems and institutions. The results show that these countries must begin from the local needs, challenges and realities, 'take control of their own destiny' and stop consuming knowledge produced in other places that do not take into account the contextual realities.

A31 (Franco & Mc Cowan, 2020) is a case study with 23 interviews with different groups of the intercultural university. The findings indicate a high level of integration between teaching, research and community participation, with strong synergies between them. This study highlights the commitment of the faculty to community work, which is integrated in the learning processes as a fundamental part. However, the authors state that many universities remain closed to the participation of the community.

Lastly, the study of Becerra et al. (2020) emphasises the importance of generating synergies between the four main actors: government, the private sector, civil society and HEIs.

As a conclusion of these findings, we can say that there is a stress on the need for generating opportunities of collaboration between universities and the local community in order to respond

to the SDGs. It is stated that universities must attend and respond to aspects and issues of the territory with the participation of the social agents and the local civil society. The aim is to contribute to developing a university attention and commitment that are closer to the context which, at the same time, implements policies toward sustainability, given its responsibility with and toward society (SDSN Australia/Pacific 2017). On their part, in view of the predominance of theoretical and declarative studies in the area of leadership action, we point out the need to generate studies implemented on the terrain that allow obtaining results that are close to the realities of the context.

With regard to the scope from which the analysed studies were generated, there is a certain unbalance between the involvement of the university community (56.5%) and the initiatives developed at the institutional level (43.5%). These results could be comforting, as they represent the combination of community and institutional initiatives, overcoming the sectoral character of the tackling of the SDGs in HEIs. However, these results are not in line with those obtained in the World Survey (IAU, 2019), which shows that, in most cases, the initiatives are being generated at the institutional level from the highest government bodies (rectorate, management and government boards/commissions), pointing out that there has been a decrease in the motivation from the departments and, especially, from people at the individual level. According to this study, the tendency indicates that the contribution to the 2030 Agenda has assumed an institutional responsibility, which represents a response from top to bottom. Therefore, we believe that the actions and initiatives must be carried out from an intersectoral dynamisation that helps to build an ecological university community in each centre and at the city scale (Limón Domínguez and Ruiz-Morales 2013; Limón-Domínguez, Ruiz-Morales, and Torres Fernández 2019), combining the top-to-bottom approach (institutional) and the bottom-to-top approach (university community) (Lazzarini and Pérez-Foguet 2018). We thus agree with the proposition of Sachs (2012), who stated that the path to sustainable development must follow not an exclusive top-to-bottom approach but a powerful problem-solving network that involves universities, companies, NGOs, governments and, most importantly, young people.

With respect to the research questions about the geographic context of the publications and the university context on which the field work is conducted, the results of this review show that the two contexts coincide, except in very few cases, thus no significant differences were found, which indicates that there is a tendency toward analysing the geographic context in which the university of the authors is located. Lastly, it is worth highlighting that the publications are concentrated in Europe (Germany, Portugal, Spain, Prague, Croatia, Holland, Greece, Italy, Romania, Russia, Serbia and Sweden) and Latin America (Argentina, Brazil, Chile, Colombia, Cuba, Ecuador and Mexico), with Spain and the UK being the countries with the largest number of articles. These results make sense if we consider the efforts made from the Iberoamerican region, specifically from the Iberoamerican General Secretariat (SEGIB), in terms of sustainability and, more recently, in the attainment of the SDGs from the university scope. An example of this is the publication of the document entitled 'The role of the Iberoamerican university in the 2030 Agenda⁷ⁿ', which resulted from the 2018 Salamanca Seminar, which gathered a large group of faculty members and academic authorities to discuss the role of the university in the support to the dissemination and implementation of the 2030 Agenda for Sustainable Development. However, these results vary, to a certain extent, from those provided by another recent review (Omazic and Zunk 2021), whose results highlight that most of the analysed articles addressed the HEIs of North America (USA and Canada), South America (Brazil), Asia-Pacific (Australia and China), Europe (Germany, Spain, Portugal, Sweden and Belgium) and South Africa.

6. Conclusions

The methodology and approach proposed in this study constitute an important contribution to the evaluation and analysis of the advancement of the SDGs in HEIs, as it analyses the scientific

studies published since the launch of the 2030 Agenda up to the year 2020. It presents specific issues about the research tendencies, as well as the deficiencies and gaps found in this scope.

In this sense, this review is significantly useful, as it provides a general view of the situation of the articles focused on the SDGs in universities worldwide. It contributes to the current state of knowledge on the development of the SDGs in universities and offers some measures that these institutions can adopt to advance in their commitment to promoting actions oriented toward sustainability.

Similarly, the results presented in this work propose some strong ideas derived from the analysis of the scientific literature, among which it is worth highlighting the following: (1) there is a predominance for addressing the SDGs in a general manner, with SDG 4 and 9 being the ones with the greatest and least presence, respectively, (objectives 1 and 2); (2) there is a significant percentage of studies that approach the SDGs in a relational manner, although there is also a considerable number of articles whose focus is general and superficial. Of the three main dimensions, i.e. economic, environmental and social, the latter has greater value (objective 3); (3) the areas of research and education, in that order, are the ones that exert the greatest impact, according to the number of publications located in such categories (objective 4); (4) the most recurrent action gathered in the analysed studies is the integration of the SDGs in the curricular programme, which belongs to the area of education and learning (objective 5); (5) there is a balance in terms of the scope from which the actions linked to the tackling of the SDGs are carried out, which indicates that there is no institutional tendency that results in a top-to-bottom approach (objective 6); (6) there is a tendency toward declarative and theoretical research over practical and implemented research, especially in the university action areas of Governance and Leadership (objective 7); (7) regarding the geographic and university context in which the SDGs are developed, the review showed studies in four geographic areas (Asia and the Pacific, America, Africa and Europe), with most of them being published by European and Latin American universities, thereby reflecting the interest of these regions for the implementation of the SDGs in the university scope. Likewise, this study shows that there is a tendency to research on the geographical context of the university of the authors, which is convenient and coherent, since the transformation toward sustainable development of each institution is directly related to its context. It is important to know the specific reality in which the change actions are intended to be implemented; thus, it is recommended that the actions to be developed in a university context emerge from that context. As was stated by Sammalisto, Sundström, and Holm (2015), the environmental dimension must be integrated considering the specific reality of each centre (objectives 8 and 9). As significant gaps, there is a null presence of the SDG 9 in the analysed studies, which represents a deficiency for the implementation of the 2030 Agenda, to the extent that infrastructure, as an activity, is one of the sectors with the greatest energy consumption; moreover, it is contemplated as a fundamental axis for the attainment of the SDGs (Yepes 2019). Thus, it is necessary to potentiate university actions and studies that contribute to the implementation of this SDG.

Similarly, the results show that there are very few studies focused on the intersectoral discussion and action on the implementation of the SDGs in collaboration with external agents. This reflects an element that is directly linked to another of the results derived from the analysis relative to governance. Only 7 publications describe some actions of the university in this area, despite the fact that it is a fundamental pillar of the university function with regard to the SDGs. HEIs must incorporate in their response to the SDGs a more holistic perspective that connects the four main areas, not only because it is necessary for their adequate tackling, but because such interconnection provides great opportunities to create and establish convergences between these areas, which is essential for an authentic transformation of the university. Likewise, it is also necessary to develop a connected and inter-relational approach in the tackling of the SDGs. Lastly, it is worth pointing out the need for carrying out more practical studies, since there is a significant difference between theoretical and declarative publications and implementation

studies, which, in turn, requires the design and use of specific instruments that allow analysing and monitoring the actions that are being carried out from HEIs for the implementation of the SDGs. There is a need for studies with well-defined approaches whose results can be integrated in analysis and evaluation processes that provide a complete view of the state of the SDGs.

Thus, further research is needed in order to know what is being developed by universities, as powerful ecological university communities, as institutions and as spaces for the training of professionals who are agents of social transformation. We must ensure that the results and information derived from studies do not use the SDGs to simply convince the world that universities are contributing to Sustainable Development, since, as was stated by Lele (2017), sustainable development maintains interpretative limits, and it is fundamental to distinguish between trivial or little useful and useful conceptualisations of sustainability. We must avoid falling in a mere 'image clean-up' by including the SDGs in a superficial manner. The evaluations must be based not so much on the number of articles or simple declarations of intentions, but rather on a real impact on the improvement of people and the planet. Therefore, the present work proposes the following research questions: what contributions and changes are the SDGs producing in universities? What is scientific research providing with respect to the improvement of the socioenvironmental reality? Do we know which are the desired paths? How will these changes affect the future university and the creation of a sustainable citizenry? Is it possible to conceive a different development for humanity?

These research questions constitute a line of work that will allow analysing the institutional contributions and changes in the medium and long term until the year 2030, as well as the direction in which these changes are taking place. To this end, the scientific literature demands, on the one hand, an increase of systematic reviews that allow gathering and analysing the results published in this scope, as well as well-defined studies that provide measurable and contrastable results about the different SDGs, and, on the other hand, that the available information that emerges from the studies can be shared more extensively, in a way that people and university communities can benefit from them. For example, forums could be created for the exchange of experiences and information among people of different universities and for the dissemination of the best practices to solve localised environmental problems, as is proposed by the Environmental Association for Universities and Colleges (EAUC) (Storey, Killian, and O'Regan 2017). It is also necessary to generate more research through case studies, surveys with large and diverse samples, and cross-sectional qualitative interviews that comprise the different geographic regions, as well as to create and use new mechanisms of evaluation (Gusmão Caiado et al. 2018). With the aim of responding to such needs, we highlight the importance of sustainability centres as a useful and necessary niche within the university structures for their contribution to the sustainable transformation of universities (Soini et al. 2018).

Lastly, we must mention the limitations of this study. Firstly, the search routes were focused on the presence or absence of the keywords in the titles, which poses a series of biases with respect to the universe of the sample, since this excluded other studies that, for diverse reasons, did not include the selected keywords in their titles. Another limitation lies in the type of documents analysed; by focusing on scientific articles, we disregarded academic works, initiatives and reports that are focused on the implementation of the SDGs, either through certification initiatives, such as STARS in the USA and classifications like THE, or as part of the sustainability reports. Despite such limitations, we emphasise the reach that this type of research provides to the scientific field, as it allows systematising the scientific evidence regarding the SDGs in the university and offering a thorough analysis of the studies that are published in this scope.

Notes

1. The developed actions and projects can be consulted in the official websites of each of these networks.
2. It is an interinstitutional research, extension and continuous education programme about the commitment of HEIs of Latin America and the Caribbean to the environment and sustainability (U.D.C.A and RCFA, 2018).

3. <https://sdg4education2030.org/who-we-are>
4. It can be consulted in the following link https://content.unops.org/publications/Infrastructure_underpinning_sustainable_development_ES.pdf
5. <https://www.un.org/es/impacto-acad%C3%A9mico/centro-de-la-unai-para-el-ods-9-industria-innovaci%C3%B3n-e-infraestructura>
6. The study provides results of the "Bristol Futures" initiatives, since, at the publication date of the article, the study was still evaluating and analysing the impact.
7. The full text can be consulted in the following link: <https://www.segib.org/?document=el-papel-de-la-universidad-iberoamericana-en-la-agenda-2030>

Disclosure statement

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