

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

# The International Journal of Management Education

journal homepage: [www.elsevier.com/locate/ijme](http://www.elsevier.com/locate/ijme)

## Integrating Sustainable Development Goals in educational institutions

María Ferrer-Estévez, Ricardo Chalmeta \*

Grupo de Investigación en Integración y Re-Ingeniería de Sistemas (IRIS), Departamento de Lenguajes y Sistemas Informáticos, Universitat Jaume I, 12006 Castellón, Spain

### ARTICLE INFO

#### Keywords:

Sustainability  
Sustainable development goals  
Education for sustainable development  
Stakeholders

### ABSTRACT

This research contributes to the achievement of the 17 Sustainable Development Goals (SDGs) through Education, a growing area of research, by means of a systematic review of the literature on Education and SDGs. A total of 160 articles published over the past 10 years were obtained and compared. This made it possible to identify the top contributing and most influential authors, countries, papers and research findings, together with the challenges facing current research.

Based on these results, this work provides a thorough insight into the field by (1) proposing six research categories and their future research directions, and (2) proposing a framework to guide academic institutions in the integration of SDGs in their activity. The framework makes it possible to incorporate the vision of the different stakeholders that constitute the learning community in order to generate a global strategy for continuous improvement, to implement it through action plans, and to measure and evaluate the results.

### 1. Introduction

Sustainability has undoubtedly been one of the key themes since the beginning of the Anthropocene (Crutzen, 2006). This historical period is characterized by the appearance of numerous advances that allow the quality of life to be improved, while society reflects on its actions and is self-critical (Beck, Giddens and Lash, 1997). The interconnections between humanity and the environment are beginning to become evident, and how the results of the actions carried out by humans may put their very survival in the future in doubt (Meadows et al., 1972). Humanity is beginning to become aware of the limits of the planet and the unsustainability of its development, which has led to the current worldwide state of emergency (Bybee, 1991).

Individual and collective decisions are closely related to the possibility of improving humanity's relationship with the planet. Therefore, a shift of consciousness in favour of values, attitudes and behaviours that enable the necessary conditions for change is an absolute must (Fien, 1995; Murga-Menoyo, 2015; Rieckmann, 2017). The United Nations Organization (UN) is aware of the importance of a collective awareness, and since the 1990s it has highlighted the significant role that education plays in the transition towards the new model of sustainable development. Education contributes to sustainability in two ways. On the one hand, fostering in people of all ages awareness, knowledge, attitudes, values, skills and actions to ensure environmental protection and conservation. On the other hand, encouraging economic sustainability and promoting social equity and inclusion through the development of productive skills to improve and maintain prosperity and competence, the development of civic skills to allow for meaningful participation in civil society

\* Corresponding author.

E-mail address: [rchalmet@uji.es](mailto:rchalmet@uji.es) (R. Chalmeta).

<https://doi.org/10.1016/j.ijme.2021.100494>

Received 29 October 2020; Received in revised form 6 February 2021; Accepted 8 March 2021

Available online 16 March 2021

1472-8117/© 2021 Elsevier Ltd. All rights reserved.

and political life, and the development of human talents and interests which allow the advance of the human knowledge (Bolstad, 2003; Nevin, 2008; UNESCO, 2014a). To this end, UN established Education for Sustainable Development (ESD) as the main engine driving change, and has carried out different institutional initiatives related with it since then, such as the United Nations Decade of Education for Sustainable Development (2005–2014), or the UN Global Action Programme on ESD (2014).

With the implementation of the 2030 Agenda and the 17 Sustainable Development Goals (SDGs) in 2015, the UN reiterates the importance of ESD by establishing the SDGs4 *Quality Education*, the seventh goal of which (4.7) mentions ESD: “By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture’s contribution to sustainable development”.

In turn, Education for Sustainable Development is a catalyst for achieving the SDGs. As Quian Tang, UNESCO Assistant Director-General for Education, states in the foreword of the publication “Education for the SDGs” when talking about the double meaning of SDG 4: on the one hand, education is a goal in itself and, on the other hand, it is an instrument of social transformation necessary for the achievement of the rest of the global objectives, through the acquisition of skills, attitudes and behaviours that guide towards a sustainable future. Therefore, it is necessary to propose a new educational model that, through ESD, integrates the SDGs in learning (Rieckmann, 2017).

This new educational model based on use education for the SDGs achievement generates a challenge in education management because it is necessary to reorient curriculum, programs, practices, and policies. This challenge affects the governance of education, educational institutions managers and educators, as well as the content and pedagogy of education.

The implementation of this new educational model in real cases of educational institutions is still limited, and hence practitioners (legislators, educational institutions managers, curriculum developers, educators or trainers from formal and informal education, etc.) have problems concerning how to use Education to promote the SDGs in educational institutions (Leal Filho et al., 2019). Main barriers to this include lack of awareness or knowledge about the principles of sustainable development, lack of senior management support, resistance to change, in some disciplines sustainability development is seen as irrelevant, perceived threats to academic integrity or freedom, lack of resources such as information, time or funding, and an overcrowded curriculum (Verhulst & Lambrechts, 2015). This could limit its dissemination, since existing literature in the field of ESD do not consider the Integration and impact of the ESD in educational institutions management. Therefore, further research on these issues is required.

In order to fill the research gap between the growing interest in use Education to promote the SDGs and how it can be integrated in educational institutions, this paper has a double objective: (1) to contextualize the state of the art by means of exploring the status of research in the domain of Education and SDGs, as well as of establishing research categories that bring together research conducted on the basis of relevant common points, and (2) to use the insights of this literature review to propose a framework to support educational institutions in integrating Education for the SDGs in these organizations. In particular, the following research questions (RQs) are posed:

- RQ1: Which are the top contributing authors, countries, and institutions in the field of Integration of the SDGs in Education?
- RQ2: Is it possible to define research categories on the basis of relevant common points?
- RQ3: What are the future research necessities in the field of Integration of the SDGs in Education?
- RQ4: Is it possible to develop a framework that allows Educational Institutions to integrate the SDGs in Education?

To answer the above research questions, and to address Education as a means to support the SDGs, this paper (1) carries out a systematic review of the literature on Education and SDGs published since 2015 (year of publication of the 2030 Agenda and the SDGs) until the end of 2020, since it is an efficient research method that allows a precise evaluation of the information published to date (Manterola et al., 2013); (2) provides a thorough insight into the field by using bibliometric analysis techniques to evaluate 160 articles published over the past 5 years, and to identify top contributing authors, countries and key research topics related to the field; (3) obtains and compares the most influential works based on citations; (4) identifies and proposes six established and emerging research categories that would encourage scholars to expand research on Integration of the SDGs in Education; (5) identifies the future research necessities in every research category; and (6) proposes a framework to support education Educational Institutions to integrate SDG in Education.

This paper is organized as follows: Section 2 presents a review of the literature related to Education for SDG. Section 3 describes the software tools and the research methodology used to perform the bibliographical analyses. Section 4 offers the findings of the bibliographical analyses. Section 5 shows the framework to support Educational Institutions to Integrate SGDs in Education. Finally, section 6 discusses the findings, and section 7 shows the conclusions, research limitations and future work.

**Table 1**  
Sustainable development goals.

Sustainable Development Goals	1. No poverty	2. Zero hunger	3. Good health and well-being	4. Quality Education	5. Gender Equality
6. Clean water and sanitation	7. Affordable and clean energy	8. Decent work and economic growth	9. Industry, innovation and infrastructure	10. Reduced inequalities	11. Sustainable cities and communities
12. Responsible consumption and production	13. Climate action	14. Life below water	15. Life on land	16. Peace, justice, and strong institutions	17. Partnership for the goals

## 2. Institutional Background

### 2.1. The 2030 agenda and the 17 Sustainable Development Goals

Almost 30 years after the report *Our Future in Common* (Brundtland et al., 1987), which analysed, criticized and reconsidered the policies of globalized economic development, and recognized that social advances were being carried out at a high environmental cost, humanity now has a global roadmap to achieve sustainable development: the Sustainable Development Goals (SDGs) (Table 1). The SDGs were defined by the UN at the United Nations Summit on Sustainable Development in September 2015, and are included in the document *Transforming our world: the 2030 Agenda for Sustainable Development* (UN, 2015), which contains 17 goals and 169 targets. The goals address global challenges crucial to the survival of humanity; set environmental limits and critical thresholds for the use of natural resources; and recognize that the eradication of poverty must go hand in hand with strategies that promote economic development (UNESCO, 2017). They are applied in the following areas: education, health, social protection and job opportunities, climate change and environmental protection. Their objectives are not independent, but are interrelated and represent the master plan to achieve a sustainable future for everyone.

The 2030 Agenda and its 17 SDGs pose a challenge for the global community, which must come together more than ever to act globally (Robertson, 2000). Although SDGs are not legally binding, governments are expected to adopt them as their own and establish frameworks, policies and measures at the national level for their implementation and analysis of the degree of achievement. But the involvement of governments is not only expected, but that of everyone: the private sector, civil society and every human being. However, five years after the launching of the 2030 Agenda, and despite the progress made in the first stage of its implementation, it is not progressing with the required speed. Hence, there is an urgent need for more ambitious collective attention and action, which will make it possible to accomplish the Goals in the 2020s and achieve sustainable and inclusive development (António Guterres, 2019).

### 2.2. Education for sustainable development

The need to achieve sustainable development and the fundamental role that education plays in accomplishing the SDGs have been highlighted, although as Verhulst and Lambrechts (2015) have proved, the emphasis on the links among ESD and the promotion of every SDG differ markedly. Links between education and economic growth and employment (SDG 8), gender (SDG 5), economic equality (SDG 10), health (SDG 3), peaceful societies (SDG 16), and means of implementation (SDG 17) are the most covered. By contrast, in addition to oceans, links between education and agriculture (SDG 2), cities (SDG 11), infrastructure (SDG 9), as well as water (SDG 6) and energy (SDG 7) are little reflected. Lastly, there is relatively weak coverage of linkages between education and SDGs 12 to 15, which address sustainable consumption and production, climate change, oceans and marine resources and terrestrial ecosystems.

The interest in use education as an engine driving change is reflected in the different international efforts to consolidate a type of education that allows people to have more sustainable lifestyles. Table 2 shows the different milestones that have taken place in the evolution of the concept of Education for Sustainable Development.

With the aim of promoting sustainable development, ESD advocates lifelong learning that not only focuses on content and learning outcomes but also on pedagogy and learning environments that enable social transformation. ESD promotes a holistic learning process that enables the necessary conditions for learners to be able to reflect, take responsibility and carry out actions. Furthermore, ESD

**Table 2**  
Education for sustainable development milestones.

Year	Milestone
1992	United Nations Conference on Sustainable Development (Rio Summit or Earth Summit). Education for Sustainable Development is introduced and chapter 36 of Agenda 21 reflects the vital role that education, training and awareness-raising play in achieving sustainable development.
2002	World Summit on Sustainable Development (Rio+10). The proposal for the United Nations Decade of Education for Sustainable Development begins.
2005–15	United Nations Decade of Education for Sustainable Development (2005–2014). It focused its efforts on four main areas: 1. Looking at education as a critical implementation tool for SD; 2. Reorienting education systems towards commitments of Millennium Development Goals (MDGs) and Education for All (EFA); 3. Networking and interaction among stakeholders in ESD; 4. Developing approaches for the assessment of progress in ESD (Glavič, 2020).
2012	United Nations Conference on Sustainable Development (Rio+20). With the publication of <i>The future we want</i> (United Nations, 2012) a proposal is put forward to promote education for sustainable development and to integrate sustainable development more actively in education beyond the United Nations Decade of Education for Sustainable Development.
2014	UNESCO World Conference on ESD. The Global Action Programme on ESD is launched, the goal of which is to generate and intensify initiatives in all areas of education and learning in order to accelerate progress towards achieving sustainable development.
2015	World Forum on Education. The Incheon Declaration is adopted with its horizon set at 2030. It also highlights the important role of education as the main driver of the development and achievement of the SDGs.
2017	Quality education is explicitly formulated as a stand-alone Sustainable Development Goal (SDG No 4), and Target 4.7 on education specifically addresses ESD and related approaches (UNESCO, 2017)
2018	UNESCO published a review on issues and trends in ESD (Leitch et al., 2018), aimed at providing policymakers, educators, and other stakeholders with state-of-the-art analyses of the topic.
2020	The 40th UNESCO World Conference on ESD, 2020. The framework for Education for Sustainable Development (ESD) after 2019, entitled "Education for Sustainable Development: towards the achievement of the SDGs (ESD by 2030)" is presented. It is established that the general objective of ESD for 2030 is to create a more just and sustainable world by achieving the 17 SDGs.

proposes an active role for young people, who should be the ones who participate and contribute to the process that guides societies towards a sustainable future (UNESCO, 2014b).

The relationship between SDGs and ESD is established in two ways. On the one hand, SDG 4 Quality Education identifies ESD as an educational goal (goal 4.7), since it establishes that *education must enable students to make informed decisions and adopt responsible measures in favour of the integrity of the environment and the viability of the economy* (UNESCO, 2014c). On the other hand, the SDGs must be included in education as an object of learning. ESD allows students to acquire key competencies to achieve the SDGs, such as synthetic thinking, anticipation, normative competence, strategic competence, collaborative competence, critical thinking, self-awareness and integrated problem-solving (de Haan, 2010; Rieckmann, 2012; Wiek et al., 2011).

Although it is not the objective of this paper to analyse the SDGs, it is important to remark that there is not a common agreement about the benefits of UNESCO SDGs. Although some authors use sustainability and sustainable development as similar and interchangeable terms (Weybrecht, 2017), others consider them almost an oxymoronic (Kopinina, 2017, 2020; Adelman, 2018; Bonnett, 2007; Kahn, 2008). For example, Haydn Washington (2015) states that *sustainability* refers not just to natural resources but the lives and flourishing of all beings on a finite planet, while *development* typically refers to industry and economy. Other example argued by these body of criticism is that when the first two aims of the SDGs, eliminating poverty and hunger, are addressed, inclusive and sustainable economic growth is highlighted as a solution for sustainability challenges. However, continuous (and sustained in a sense of continuing to perpetuity) economic growth is likely to result in increased consumption of natural resources, thus exacerbating environmental crises. Another example state by these authors is that growth fuelled by demand for resources exacerbates environmental crises through overproduction, overconsumption, and overpopulation. The environmental crisis, in turn, is likely to affect the long-term social and economic development. The same criticism happened with Education for sustainability and Education for Sustainable Development Goals. These authors argue that UNESCO's Teaching and Learning for a Sustainable Future program essentially could stress social and economic priorities with the exclusion of eco-philosophical and strong sustainability principles.

### 3. Research methodology

To answer RQ1, RQ2, and RQ3, scientific literature is systematically reviewed. A literature review methodology provides a systematic and reproducible design for collecting and evaluating the extant body of scholarly works on the topic studied. The results are presented in Section 4. Considering RQ4, a framework for to support educational institutions in integrating Education for the SDGs in these organizations is conceptualized from the findings of the review and presented in Section 5.

The research methodology is broken down into four phases (Fig. 1): (1) definition of the research, (2) data collection, (3) analysis of results, and (4) conceptualization. Phase 1 has made it possible to explore the current links between Education and SDGs and its implementation in educational institutions in the literature in order to define the research questions and to detect possible gaps. In phase 2, a systematic review of the literature, as proposed by Rowley and Slack (2004) and Mishra et al. (2016), has been carried out together with an identification of research categories, following the comparative method proposed by Collier (1998). Analysis of the findings (phase 3) has made it possible to identify the most relevant authors, countries and institutions in the field of Education and SDGs (RQ1), to identify research categories (RQ2) and to detect future research needs (RQ3). Finally, in phase 4, a Framework is proposed for the integration of SDGs in educational institutions.

#### 3.1. Definition of the research

In the definition of the research phase, we conducted a literature review to search for ideas and gaps in the Education and SDGs and its implementation in educational institutions. In particular, we were looking for frameworks, methodologies, and case studies to support managers and educators, within the ESD literature. Then, we identified a plausible gap in the research and derived the research questions to expand the understanding of the ESD implementation field.

#### 3.2. Data collection

The bibliography search was conducted using Scopus and Web of Science. These two databases are the main sources of bibliographic citations used for bibliometric analyses. This is mainly because they are the only ones that combine both a rigorous selection process and wide interdisciplinary coverage, which make them significantly stronger than the other databases (Martínez-López et al., 2018). There are other popular interdisciplinary databases such as Google Scholar, but the low quality data found in Google Scholar raises questions about its suitability for research evaluation [52]. Within these databases, the search has focused exclusively on articles

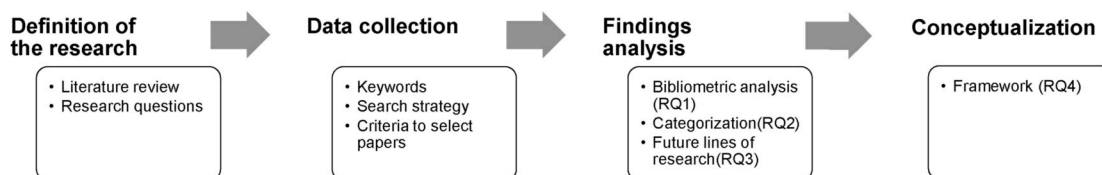


Fig. 1. Research methodology steps.

**Table 3**  
Search strategy.

Source	Keywords	Content	Period	Document	Category
Scopus	("Sustainable development goals" OR "SDG*") AND (educat* OR instruct* OR teach*, AND pedagog* OR didact* OR "Educational activity" OR coeducat* OR "Continuing education" OR course* OR "Course of study" OR "Course of instruction" OR class* OR "Elementary education" OR "Extracurricular activity" OR "Higher education"	TITLE ABS	2015–20	Articles Reviews	All (There is no Education Category)
Web of Science	OR "Secondary education" OR "Team teaching" OR "Work-study program" OR "Classroom project" OR classwork* OR homework* OR lesson* OR "Point system" OR "Academic program" OR "Department of Education" OR "Education Department")	KEY			Education Educational Research

and reviews since they are considered certified knowledge (Ramos-Rodríguez & Ruíz-Navarro, 2004). The search period was set to the period between 2015, since that is when the 2030 Agenda was established, until December 31, 2020.

The selection of articles and reviews was carried out by identifying those that had certain keywords in the title, in the keywords section or in the abstract (Table 2). The keywords used to search the databases were defined using the Wordnet database, which was developed by the Cognitive Science Laboratory at Princeton University. It is a lexical database, a reference for the English language, whose design is inspired by current psycholinguistic theories of human lexical memory (Miller et al., 1990). The keyword "Education" was entered in this database and the different synsets (sets of cognitive synonyms) were obtained, which allowed the search keywords to be defined.

The search strategy Table 3 resulted in 508 documents in Scopus and 293 documents in Web of Science. These results were compared and duplicate documents were eliminated, thus giving a final result of 656 documents. After carrying out a content analysis of the title and abstract, the documents that did not cover the ESD were eliminated, reducing the sample to 325 documents. The documents that do not deal with the integration of at least one of the SDGs in education were then eliminated (for example papers that propose innovative courses or that integrate competencies that are related with ESD, such as the student at the centre of learning or critical thinking, but do not directly address at least one SDG), leaving a total of 160 papers. These 160 papers were the sample on which this research was based (Fig. 2).

### 3.3. Findings analysis

Once the list of papers had been defined, the analysis tools available at Web of Science and Scopus were used. The following tasks were performed with these tools:

- Determination of the number of papers published by year.
- Analysis of the number of articles published by author.
- Analysis of the number of articles published by country.

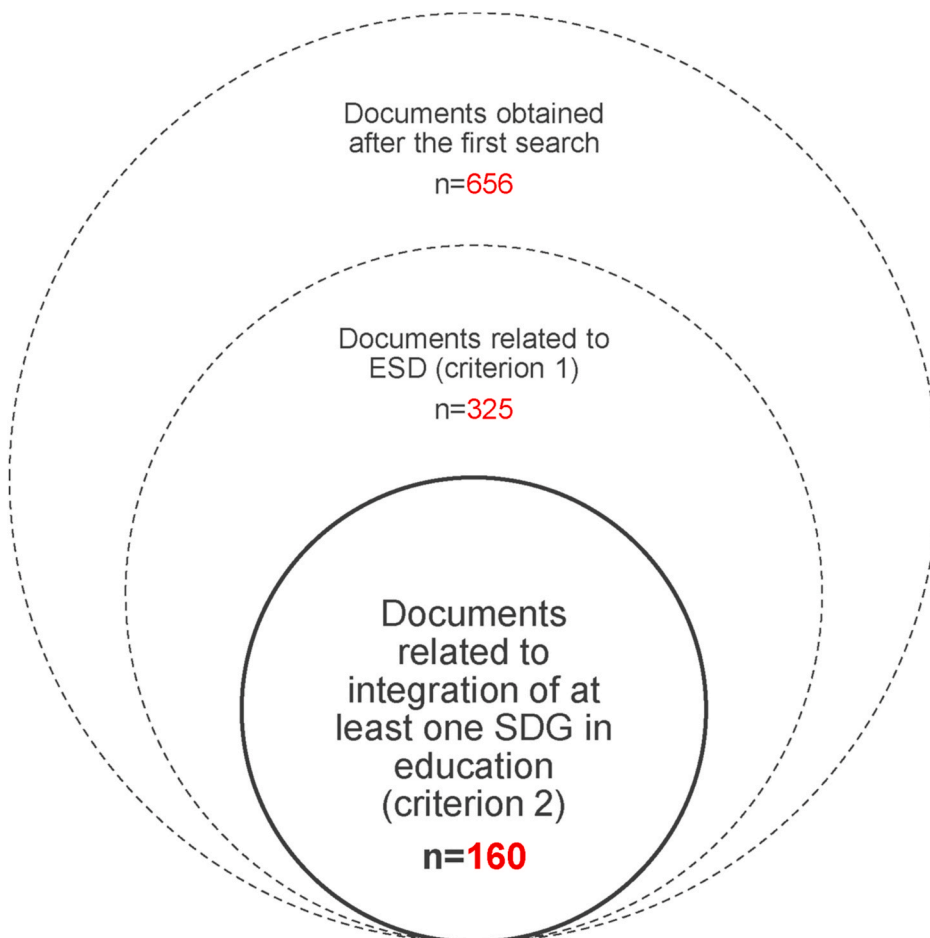


Fig. 2. Criteria for selecting the final sample.

- Analysis of the number of articles published by institution
- Analysis of the content of the ten most cited articles on the list.
- Analysis of the number of articles published per journal.
- Analysis of the indicators of relevance, impact and prestige of the 10 journals with the most published articles on the list. The indicators analysed were the following: CiteScore, Impact Factor, Normalized Source Factor, and Scimago Journal Rank.

In relation to categorization, a content analysis was carried out in order to detect common points among the documents obtained so that the categories emerged. The system used is inspired by the comparative method (Collier, 1998). To establish these categories, the common points shared by the articles were identified. The fundamental objective of the article and the contributions and advances that it offers to the state of the art were the main factors considered. This classification was taken as a starting hypothesis. After that, the adequacy of the categories to classify all the articles was checked paper by paper. When an article was found that did not fit into any category, the classification was rethought with a view to integrating the dissonant element. Several reviews were performed until all the items on the list were properly distributed in the proposed classification.

## 4. Findings

### 4.1. Bibliometric analysis

#### 4.1.1. Initial results

As can be seen in Fig. 3, although documents published in 2015 were not detected, probably due to the recent publication of the 2030 Agenda in September 2015, the number of publications has increased considerably in five years, and a boom can be highlighted in the last two years.

#### 4.1.2. Author influence

Regarding the authors, there is no author that stands out significantly in terms of the number of publications. This may be a reflection of the small number of experts in the field. There is only one author with three papers and sixteen authors with two papers (see Table 4).

#### 4.1.3. Affiliation statistics

The distribution by countries reveals a leadership of Spain, followed by the United Kingdom and the United States. These three countries account for approximately half of the sample. On the other hand, from a continental point of view, more research can be highlighted in Europe, followed by America (see Table 5).

#### 4.1.4. Analysis by institution

In the analysis of the institutions, none are detected that stand out significantly in terms of the number of publications, so there is no institution with a high degree of specialization in this field (Table 6).

#### 4.1.5. Citation analysis

Table 7 shows the top 10 articles with the highest number of citations. The most cited article has a total of 51 citations, a figure that is not significantly high, which may be related to the recent nature of the research topic or because the papers have been recently published and researchers may not know them.

#### 4.1.6. Sources analysis

In the analysis of the sources, the great weight of the three journals with the most publications must be highlighted: Sustainability Switzerland with 49 publications, followed by the International Journal of Sustainability in Higher Education with 17, and the

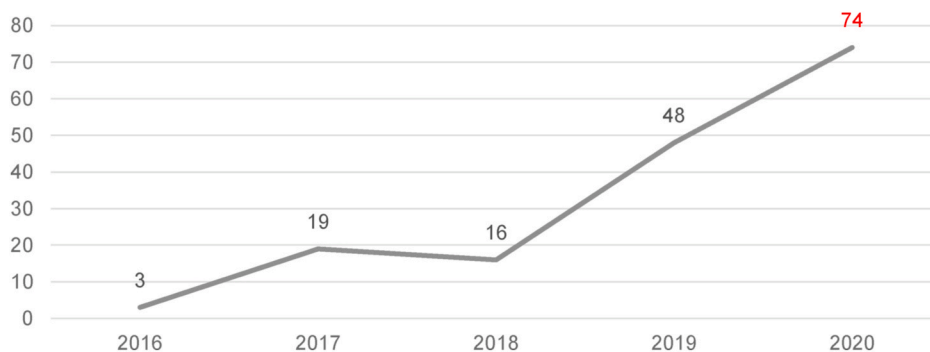


Fig. 3. Trend in the generation of articles.

**Table 4**  
Authors with the most articles.

Author	No. docs
Sánchez-Martín, J.	3
Albareda-Tiana, S.; Azeiteiro, U.M.; Brandli, L.L.; Fernández-Morilla, M.; Leal Filho, W.; Maruna, M.; Molthan-Hill, P.; Vidal-Raméntol, S.; Zamora-Polo, F.; Borges JC; Caldana ACF; Dyllick T; Ferreira, T.C.; Kapalka, A.; Killian, S.; Muff, K.	2

**Table 5**  
Top 11 countries with the most articles.

Country	No. docs
Spain	31
United Kingdom	27
United States	20
Brazil	11
Australia	9
Canada	8
Germany	8
Portugal	7
Italy	6
Austria	4
Mexico	4

**Table 6**  
Institutions with the most articles.

Institution	No. docs
Universidad de Extremadura	5
Universidade de Sao Paulo	4
University of Seville	4
Tecnológico de Monterrey	4
Imperial College London	3
Universidade de Aveiro	3

International Journal of Management Education with 16 (Table 8). These journals, have published approximately half of the publications that are relevant to this area of study.

Three impact indicators have been used to assess the relevance of the journals in question: CiteScore, Source Normalized Impact per Paper (SNIP), and SCImago Journal Rank (SJR). CiteScore measures the average number of citations received per document published in the journal. Values are calculated by counting citations over a year for documents published in the three years prior to the calculation and dividing by the number of documents published in those three years. The SNIP measures the impact of citations in a given context and is based on total citations per field of study. The impact of a citation has a greater value in fields where citations are less likely to occur. SJR takes into consideration the prestige of the journal in which the article is published. It uses an algorithm similar to Google to establish rankings between websites. It also takes into account the citations of the article. The indicators reflected in Table 7 express the degree of impact, relevance and importance of the journal, according to these indicators.

#### 4.2. Data clustering using content analysis

A content analysis of all the articles on the list of studies was carried out to define categories that classify articles based on common elements, in order to bring some order to the research effort that is being made, and to identify future research suggestions in Education and SDGs. The categories obtained are those shown in Table 9.

Table 10 presents the distribution of the 160 papers on the list in each category, and a compilation of the future research suggestions on Education and SDGs, made by a content analysis of the papers in each category. Moreover, it is also interesting to remark that the most cited articles in the field, shown in Table 7, cover all the above categories except category 6 *Bibliographical reviews*, and that half of the articles correspond to category 1 *Maturity models to measure the current situation*.

### 5. Framework

The systematic review of the literature carried out has made it possible to identify one of the main weaknesses hampering the achievement of the integration of the objectives of sustainable development in teaching, namely, the need for a framework that guides educational institutions in the process of using education for the SDGs achievement. A framework is a useful tool for structuring and



**Table 7**  
Top 10 articles with the most citations.

Article	Abstract	Total Citations
<b>Sustainable Development Goals and sustainability teaching at universities: Falling behind or getting ahead of the pack?</b> (Leal Filho et al., 2019)	The study focuses on a global survey with the objective of obtaining data on the SDGs and teaching in different universities. The collection and knowledge of this data provides an overview of the current state, as well as useful data to advance in the implementation of the SDGs in universities.	51
<b>Implementing the sustainable development goals at University level.</b> (Albareda-Tiana, Vidal-Raméntol, & Fernández-Morilla, 2018)	The document explores sustainable development practices in the curricula of the International University of Catalonia (UIC) by means of a mixed method (quantitative and qualitative analysis). The status of the university's situation in relation to the SDGs is shown.	44
<b>Exploring Links Between Education and Sustainable Development Goals Through the Lens of UN Flagship Reports.</b> (Vladimirova & Le Blanc, 2016)	The article analyses 37 global United Nations reports to determine the links between education and the SDGs. The areas that have received the most and the least attention are made visible, offering valuable information to establish political priorities in the educational field.	38
<b>Responsible management education: Mapping the field in the context of the SDGs.</b> (Storey et al., 2017)	The document examines Responsible Management Education (RME) in the context of the SDGs and the United Nations Principles for Responsible Management Education (UN PRME). Conclusions are drawn on how the SDGs and UN PRME are acting in business schools.	36
<b>Teaching for a better world. Sustainability and Sustainable Development Goals in the construction of a change-maker university</b> (Zamora-Polo & Sánchez-Martín, 2019)	The article addresses the sustainability and the SDGs by proposing a conceptual framework to teach it at Higher Education. It also includes a case study which allows authors to remark some practical considerations to build a change-maker University.	31
<b>What do university students know about sustainable development goals? A realistic approach to the reception of this UN program amongst the youth population.</b> (F Zamora-Polo, Sánchez-Martín, et al., 2019)	This paper shows a study to evaluate students' knowledge about sustainability and SDGs through a questionnaire.	28
<b>Implementing sustainability as the new normal: Responsible management education – From a private business school's perspective.</b> (Kolb et al., 2017)	The document aims to explore in depth the relationship between the SDGs and business schools. Starting from the analysis of educational activities, the implementation of the SDGs in business schools is described and, finally, a conceptual model is proposed on how business schools can contribute to the SDGs.	28
<b>The Gap Frame - Translating the SDGs into relevant national grand challenges for strategic business opportunities.</b> (Muff et al., 2017)	The document proposes the introduction of the Gap Frame (normative framework based on the SDGs) as a strategic planning tool for the field of business (also useful in the management of educational institutions) and, in addition, as an educational tool for schools of business.	27
<b>Holistic approaches to develop sustainability and research competencies in pre-service teacher training.</b> (Albareda-Tiana, Vidal-Raméntol, Pujol-Valls, & Fernández-Morilla, 2018)	The document explores suitable teaching methodologies for the development of sustainability competencies.	23
<b>The sustainable development goals: An experience on higher education.</b> (Crespo et al., 2017)	The document evaluates 10 master's degree projects whose theme is within sustainable development through a sustainable holistic rubric, which allows the links of the works with the SDGs to be made visible.	21

**Table 8**

Journals with the most published articles and their impact indicators. Source: SNIP: Source Normalized Impact per Paper. SJR: SCImago Journal Rank.

Source	n	CiteScore	SNIP	SJR
Sustainability Switzerland	46	3.01	1.169	0,549
International Journal of Sustainability in higher Education	17	2.29	1.061	0.542
International Journal of Management Education	16	2.07	1.186	0.571
Journal of Chemical Education	6	1.78	1.099	0.464
Education Sciences	5	1.18	5.305	–
Sustainability United States	4	0.49	0.337	0.171
Policy & Practice: A development education review	4	0.0	Not available	Not available

organizing information that allows a better study or future implementation of the object in question (Succar, 2009; Francisco Zamora-Polo, Luque-Sendra et al., 2019). For this reason, the Integration and Re-Engineering (IRIS) group of the Universitat Jaume I of Castellón has developed the SDG4-IRIS framework. The mission of this research group is to research on how to achieve organizations sustainability improving their management and their information systems. The framework was developed taking into account the findings of the systematic literature reviewed performed, because we want to take advantage of methods, tools, etc. proposed in the literature, and the experience of the IRIS group members both as researchers in the development and implementation of frameworks and methodologies to support managers to innovate in their organizations (some of them related with sustainability, such as the development and implementation of sustainable supply chains or the use of balanced scorecard for business sustainability management) as well as their experience as managers and educators in universities.

**Table 9**  
Research categories.

Categories Name	Number of papers	Description
1. Maturity models	51	This category includes articles that use maturity models to evaluate the status and links of the SDGs in the academic field at different levels (level of knowledge, methodologies and pedagogical approaches, projects, study plans, strategies, etc.). These papers show how to make a diagnosis, and in some cases, to define possible areas for improvement or recommendations for the future implementation of a plan or strategy.
2. Methods for integrating SDGs at the curricular and extracurricular levels	50	This category encompasses articles that make proposals (at the classroom, institution or community levels) about how to promote the SDGs at both the curricular and extracurricular levels. In some cases the SDGs are dealt with through specific disciplines and in other cases courses, projects or initiatives that address the SDGs are shown.
3. Management strategies and processes to integrate SDGs in the academic field	20	This category includes articles that address the integration of the SDGs in the academic field through strategies, management models and case studies. In addition, there are articles dealing with educational governance and the sustainable management of the institution.
4. Teaching methods and pedagogical approaches for SDGs	31	This category comprises articles that present teaching methods and pedagogical approaches that promote learning of the SDGs. These are pedagogical approaches that are aligned with ESD and enhance the acquisition of key sustainability competencies.
5. Fundamental concepts	4	This category includes articles that comment and theorize about the links between SDGs and ESD.
6. Systematic literature reviews	4	This category includes articles that perform a review of the published literature that addresses a subject or area in question (usually bounded by keywords). Other aspects that are analysed include SDGs in business schools, Implementation of the SDGs in education and Knowledge management that concludes with a Knowledge Excellence model linked to the SDGs.

**Table 10**  
Research categories and future research lines.

Categories	Top 5 papers	Future Research Suggestions
1. Maturity models	Leal Filho et al. (2019); Albareda-Tiana, Vidal-Raméntol, and Fernández-Morilla (2018); Storey et al. (2017); Francisco Zamora-Polo, Sánchez-Martín, et al. (2019); Crespo et al. (2017)	Maturity models that comprehensively assess the status of the SDGs in the academic field, including different levels (knowledge, methodologies, etc.). Individual and collective performance reference indicators to measure the impact of the actions.
2. Methods for integrating SDGs at the curricular and extracurricular levels	Zamora-Polo and Sánchez-Martín (2019); Kolb et al. (2017); Kopnina (2018); Borges, Cezarino, et al. (2017); Upvall, M. J., & Luzincourt, G. (2019)	Methods that involve all stakeholders. Engaging board of directors, public administrations and the learning community. Methods to document and communicate the processes. Strategic methods that integrate the SDGs combining the curricular and extracurricular scales.
3. Management strategies and processes to integrate SDGs in the academic field	Muff et al. (2017); Kioupi and Voulvoulis (2019); Purcell et al. (2019); Franco, I., Saito, O., Vaughter, P., Whereat, J., Kanie, N., & Takemoto, K. (2019); Mori Junior, R., Fien, J., & Horne, R. (2019)	Management strategies and processes that integrate the visions and foster the commitment of all stakeholders in education (internal and external). Innovative and comprehensive strategies that promote a cultural change in the academic institution. Strategy impact indicators.
4. Teaching methods and pedagogical approaches for SDGs	Albareda-Tiana, Vidal-Raméntol, Pujol-Valls, and Fernández-Morilla (2018); Mahaffy et al. (2019); Ortiz and Huber-Heim (2017); Neal (2017); Blatti, Jillian L. et al. (2019)	Teaching methods and pedagogical approaches for the acquisition of knowledge and key competencies in sustainability. Guides to implement the new learning methods, Ex. Teacher training.
5. Fundamental concepts	Vladimirova and Le Blanc (2016); Garcia J., da Silva S.A., Carvalho A.S. (2017); Penner and Sanderse (2017); Kopnina (2017)	Analyse the current global links between education and the SDGs. Analyse the connections between the UN reports and the knowledge base available in the SDGs related to education.
6. Systematic literature reviews	García-Feijoo et al. (2020); Ambrosio et al. (2019); Romero, S., Aláez, M., Amo, D., & Fonseca, D. (2020); Barrantes Briceño and Almada Santos (2019)	Greater coverage of information sources. Identification of research categories.

The framework is organized in four dimensions (Fig. 4): Methodology, Resources, Interest Groups, and Maturity Model.

### 5.1. Methodology

The first dimension, Methodology, is the core dimension that guides the process. This consists of five steps (Fig. 5): *Project planning* (S1) to plan, organize and manage the schedule and resources needed to complete the project; *Strategic planning* to assess the educational institution current situation and to define the objectives, action plans and indicators to measure the degree of fulfilment of

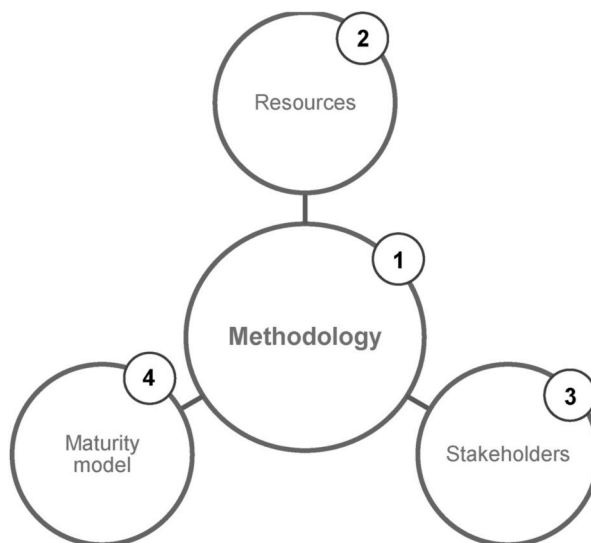


Fig. 4. SDG4-IRIS Framework and its dimensions.

the objectives (S2); *Implementation* of the actions plans (S3); *Measurement* of the indicators (S4); and *Evaluation and decision-making* to establish a continuous improvement process (S5).

The steps of the methodology are based on the Deming cycle, also known as the PDCA (Plan-Do-Check-Act) cycle, which proposes a process for continuous quality improvement and is widely used in management systems. It is a management philosophy that seeks excellence from a continuous process of small improvements (Chase et al., 2004; Lukman & Glavič, 2007; Velazquez et al., 2006). On the other hand, Activity 1: Participatory process, within Step 2: Strategic Planning, is inspired by the Participatory Conceptual Framework for sustainable transformation through Education proposed by Kioupi and Voulvoulis (2019), the stages of which are based on the Back Casting methodology, which is considered a best practice in long-term planning in sustainability transitions (Holmberg & Larsson, 2018). Other activities and tasks are based in the experience of the authors in the development of frameworks and methodologies to innovate in organizations (see for example Chalmeta & Palomero, 2011; Orenga and Chalmeta, 2019). Finally, the identified research categories have been taken into account in the design of the methodology.

Table 11 details the steps of the methodology, including the activities and tasks, the entity or person responsible for carrying them out and the related dimensions.

Finally, regarding the extension of the project, development from Step 1 to Step 5 is planned to last two academic years (Fig. 6). Thus, Step 1 and Step 2 will last for one academic year, while Step 3 should begin in the second. Finally, Step 4 and Step 5 will take

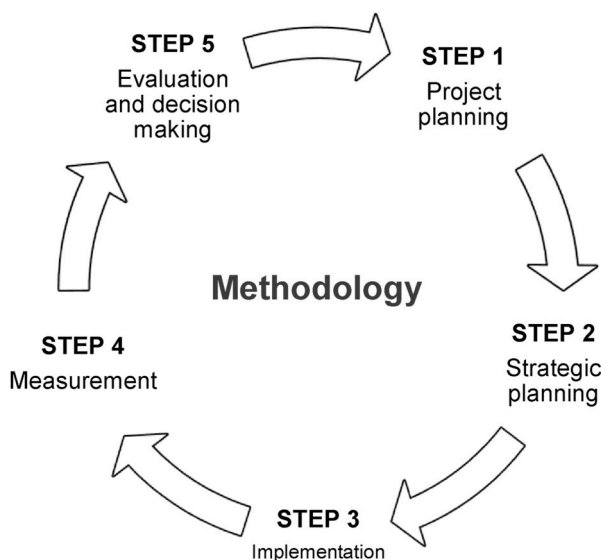


Fig. 5. Steps of the methodology.

**Table 11**  
Methodology dimension.

STEP 1: PROJECT PLANNING				
<b>The objective of this step is to develop the project planning. Leadership and commitment on the part of the board of directors and teachers is essential in the beginning.</b>				
Activity	Task	Responsible	Dim	
1	<b>Acquisition of commitment</b>	1.1 Initial meeting	Directors and teachers	2
	1.2 Public statement of commitment to the SDGs (to be updated with the inclusion of new stakeholders)			
2	<b>Definition of responsibilities</b>	2.1 Creation of a coordination group	Directors and teachers	2
	2.2 Identification of facilitators			
	2.3 Definition of stakeholders participating in Step 2			
3	<b>Step 2 programming</b>	3.1 Definition of the sessions of the Participatory Process (S2)	Coordination group	2
	3.2 Timing of activities and tasks			
4	<b>Development of a communication plan</b>	4.1 Definition of two-way communication channels for all stakeholders	Directors and coordination group	2
	4.2 Communication of the purpose and possible benefits of the project to all stakeholders			
STEP 2: STRATEGIC PLANNING				
<b>This step has a twofold objective: firstly, the integration strategy of the SDGs will be obtained and, secondly, the participating stakeholders will expand their knowledge about the SDGs.</b>				
Activity	Task	Responsible	Dim	
1	<b>Participatory process</b>	1.1 Understand the 17 SDGs and generate collective knowledge. <i>What are the SDGs? (one session with all the SDGs or several grouping them)</i>	Facilitators and participating stakeholders	2,3
	1.2 Identification of the 17 SDGs in the institution and community. <i>What SDGs are most present in the context of the academic institution?</i>			
	1.3 Generate a collective vision of sustainability linked to the SDGs. <i>Where do we want to go? What do we want to achieve? What SDGs and respective goals are we going to contribute to?</i>			
	1.4 Discussion of the state of the situation. <i>How do we currently contribute to the 17 SDGs?</i>			
	1.5 Proposals to achieve the collective vision of sustainability. <i>How are we going to achieve our collective vision of sustainability? What actions can we take to achieve our objectives and goals? Types of proposals: Curricular, Extracurricular and Management model and institutional strategy</i>			
2	<b>Strategy conformation</b>	2.1 Analysis of the results of the participatory process	Coordination group	2
	2.2 Definition of the strategy (SDGs, goal and Action/s)			
	2.3 Definition of the system of indicators (project scorecard, section 5.4.3) for evaluating the strategy			
	2.4 Definition of responsibilities for the programme (internal and external stakeholders)			
3	<b>Validation and institutionalization of the programme</b>	3.1 Communication of the programme to stakeholders	Coordination group	2,3
	3.2 Agreement and validation of the programme by stakeholders	Participating stakeholders		2,3
	3.3 Inclusion of the programme in the Educational Project or Institutional Strategic Plan	Directive		2
	3.4 Redefinition of the objectives (vision, mission and strategy) and culture (politics and values) of the academic institution			2
STEP 3: IMPLEMENTATION				
<b>The objective of this step is to implement the programme or strategy resulting from the strategic planning.</b>				
Activity	Task	Responsible	Dim	
1	<b>Implementation</b>	1.1 Start of the programme or strategic plan	Human Resources and participating stakeholders	2,3
STEP 4: MEASUREMENT				
<b>The objective of this step is to measure the results of the entire process. For this purpose, the maturity model will be used (see section 5.4).</b>				
Activity	Task	Responsible	Dim	
1	<b>Measure</b>	1.1 Use of the maturity model to obtain data	Coordination group	2,4
STEP 5: EVALUATION AND DECISION-MAKING				
<b>The objective of this step is to make the results of the process known to all stakeholders, evaluate the results obtained and make decisions based on them.</b>				
Activity	Task	Responsible	Dim	
1	<b>Communication</b>	1.1 Communication of results to stakeholders	Coordination group	2
	1.2 Publication of results on the web platform			
2	<b>Results evaluation</b>	2.1 Analysis of the results obtained	Directors	2
	2.2 Comparison of results with previous diagnoses (if any)			
3	<b>Decision-making</b>	3.1 Awareness and reflection of progress	Participating stakeholders	2,3
	3.2 Detection of areas for improvement			
	3.3 Writing a results report	Coordination group		

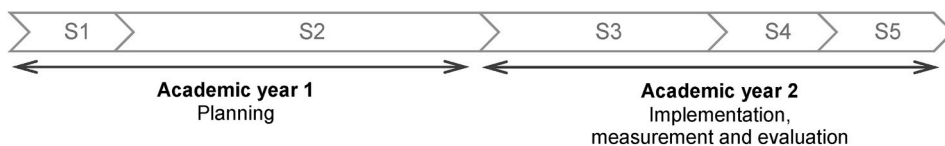


Fig. 6. Schedule for the application of the Framework.

place at the end of the second year. In addition, in a continuous improvement process, Steps 1 and 2 “Planning year” will start again after Steps 3, 4 and 5 “Implementation, measurement and evaluation”.

5.2. Resources

The Resources dimension considers four categories of resources that are necessary for the execution of the methodology: Human resources, Documentary resources, Physical resources and IT resources.

5.2.1. Human resources

This, in turn, consists of four types of human resources: Directive, Coordination group, Facilitators and Action groups. Each of them are described in more detail below:

Directive. The board of directors of the institution, already established before the start of the project, plays a key role in its success. They must lead and commit to the process, as well as support the coordination and facilitation of resources.

Coordination group. This group is constituted at the beginning of the project and its members will be teachers and directors. The objective of this group is to coordinate and manage all the data generated in the different steps of the methodology. In addition, they are responsible for coordinating communication and activities with the different stakeholders and human resources groups.

Facilitators. The mission of the facilitators is to deliver the sessions to the students. Therefore, the facilitators will intervene in the Participatory Process of Step 2 and in the curricular and extracurricular activities resulting from the strategy. The facilitators can be teachers at the institution or agents of external stakeholders. External agents are facilitators who will mostly deliver specific sessions (talks or seminars).

Action groups. These groups will emerge during the project for specific issues or objectives. They can be constituted simultaneously by different stakeholders. For example: an Energy transition group (Climate Action, SDGs13), whose objective is to study the feasibility of energy transition in the institution, could be made up of students from a scientific-technological bachelor’s degree, a facilitator (teacher in the field of technology) and representatives of a Science and Technology Institute.

5.2.2. Documentary resources

To carry out the “Participatory process” activity (Step 2) and to design the curricular and extracurricular activities resulting from the strategy, the facilitators need to be trained. To do so, documentary resources are proposed (Table 12) that will facilitate the understanding of the SDGs, the knowledge of the key sustainability competencies, the identification of specific learning objectives, and the recognition of learning methods and situations.

5.2.3. Physical resources

For the optimal development of the project, a physical space is required where the different stakeholders can develop the programme. This should be a space for dialogue about transformation (Westley et al., 2015). These transformation processes, fully compatible with ESD, help mobilize people towards action around a problem, providing opportunities for learning and reflection in contexts of divergent interests (Ely & Marin, 2016; Sharpe et al., 2016). This space, a Laboratory of transformation through the SDGs, will be a learning environment that boosts innovation, co-creation of solutions, the development of participatory processes, meetings between stakeholders, development of projects or actions, debates, etc.

5.2.4. Information technology resources

For the correct management of the project, the development of a web platform is required. The platform will allow the automation of the documentation, project monitoring and communication process, and in addition it will make the project compatible with online/distance learning situations. There must be two minimum sections of the web: project communication and project administration.

Project communication. The function of this section is to communicate and publicly report on the status and progress of the project.

Table 12  
Documentary resources.

Period	Proposal References
All	Education for Sustainable Development Goals, Learning objectives (Rieckmann, 2017)
Primary	Hendere y el derecho a la educación: los SDGs en la escuela. (Laorga., 2017)
Secondary	El desafío de los SDGs en secundaria. (Jimenez et al., 2018)
Higher education	Cómo empezar con los SDGs en las Universidades (SDSN, 2017)

Furthermore, it will promote information transparency and the awareness of all stakeholders.

Project management. The purpose of this administration section is the management and automation of information flows and activities. Access with a user profile will be allowed to the directors, facilitators and coordination group. This section will contain the following sub-sections:

**PARTICIPATING STAKEHOLDERS IN S2: STRATEGIC PLANNING**

	Directors and teachers	Directors, teachers and students	Internal stakeholders	All the stakeholders	All the stakeholders + networking with other academic institutions
Step 2 is performed but no actions are implemented	1	2	3	4	5
No strategy is defined but specific actions are implemented (curricular and/or extracurricular)	2	3	4	5	6
A strategy is defined combining curricular and extracurricular activities	3	4	5	6	7
<b>S</b> A strategy is defined <b>T</b> combining curricular and <b>R</b> extracurricular activities. <b>A</b> Furthermore, these activities <b>T</b> contribute to the <b>E</b> improvement of the integral <b>G</b> management of the <b>Y</b> institution	4	5	6	7	8
The institution has the SDGs fully integrated into its activity, identity, culture and management processes	5	6	7	8	9
The institution has the SDGs fully integrated into its activity, identity, culture and management processes. In addition, it is in a continuous process of improvement	6	7	8	9	<b>10</b>

Fig. 7. Evaluation matrix.

- Document management system. This section will allow the automated recording of the minutes of the tasks carried out in all phases. The minutes must include at least the following data: (1) Name of the programme; (2) Name of the institution; (3) Date; (4) Phase of the methodology; (5) Activity of the methodology; (6) Task of the methodology; (7) Participating interest groups; (8) Facilitator/s of the activity; (9) SDGs treated; (10) Target; (11) Description; and (12) Results.
- Computer support of the project dashboard (See section 5.4.3).

### 5.3. Stakeholders

The stakeholders can be divided into two groups: internal or external to the educational institution. In Step 1 of Project Planning, the board of directors and teachers will decide which stakeholders will be the participants in Step 2: Strategic Planning. The more stakeholders are included, the higher the quality of the programme will be. As a reference, the following stakeholders are proposed:

- **Internal stakeholders:** Board of directors, teachers, administrative staff and those with other occupations at the institution, students and families.
- **External stakeholders:** civil society, public administrations, companies, organizations and other academic institutions.

### 5.4. Maturity model

Maturity models are widely accepted as a guide for evaluating the business processes of an organization (Ahern et al., 2004). Within the scope of this project, the maturity model will be used to make a diagnosis of the initial situation, and in comparison with successive measurements, an evaluation of progress. This data will make it possible to spot key areas for improvement and will therefore confer the strategy with greater quality and effectiveness. The proposed maturity model is made up of three techniques: Questionnaires, Matrix and Project Dashboard. These techniques allow, respectively, (1) evaluation of the knowledge of the interest groups about the SDGs, (2) evaluation of the quality and scope of the strategy, and (3) evaluation of the achievement of the SDGs integration strategy.

#### 5.4.1. Questionnaires

The objective of the questionnaires is to evaluate the stakeholders' knowledge about the SDGs, since the objective of the framework is not only to obtain a strategy but also knowledge about the SDGs. There are questionnaires in the literature that have been designed and could be used as a reference for the implementation of this framework (Maialen Mugerza & Chalmeta, 2020; Francisco Zamora-Polo, Sánchez-Martín et al., 2019). The questionnaires must be answered by all participating stakeholders, so that the academic institution can measure its contribution to the knowledge and learning of the SDGs in the academic field (internal stakeholders) and in the community environment (external stakeholders).

#### 5.4.2. Matrix

The objective of the matrix (Fig. 7) is to allow evaluation of the quality and scope of the strategy. Strategy quality is measured based on the results obtained in strategic planning, whereas scope refers to the participating stakeholders.

At the crossroads of these variables, the score that assesses the strategy is obtained, with 1 being the minimum score (when managers and teachers carry out Step 2 but no actions are implemented) and 10 is the maximum score (when all stakeholders participate and there is networking with other academic institutions, and the institution has the SDGs fully integrated into its activity, identity, culture and management processes, in a continuous process of improvement). In the case of carrying out Step 2 without implementation, a score equivalent to 5 is obtained, since Step 2 itself is valued as beneficial for understanding the SDGs. Conversely, it is considered that when strategic planning is carried out exclusively by directors and teachers, it cannot exceed 6 points because it contributes to a lesser extent to the participation and empowerment of students and stakeholders.

#### 5.4.3. Project dashboard

The project dashboard is the set of indicators that will make it possible to measure the achievement of the project's objectives and the implementation of the action plans. Indicators such as the number of activities carried out, monitoring the timing or participating stakeholders can be used. In the definition of the indicators, the SDGs must be related to their respective goals and the action plans. Once this relationship has been established, quantitative and/or qualitative criteria must be established to measure achievement. For example: it is proposed to promote Goal 13 Climate action. Thus, two actions can be established: 1) reduce the energy consumption of the institution, and 2) carry out an awareness campaign in the community about climate change. Their respective goals could be: 1) to reduce energy consumption by 10%, and 2) the community knows the basics of climate change. The indicators could be, respectively, 1) percentage reduction in energy consumption (the target is a 10% reduction), and 2) improvement of the community's knowledge about climate change, which will be measured with an initial and a final questionnaire.

## 6. Discussion

### 6.1. Contributions to theory

The work presented in this paper contributes to the literature on Education and Objectives for Sustainable Development, as it extends the existing bibliographical reviews (García, Eizaguirre and Rica, 2020; Ambrosio et al., 2019; Briceno and Santos, 2019): (1)

it increases the period of the systematic review between 2015 and 2020; (2) it has a greater coverage of information sources since it jointly uses the Scopus and Web of Science databases; (3) it identifies the main authors, countries and institutions that contribute in the field of Education and the SDGs, using statistical analysis and bibliometric analysis techniques to obtain and compare the most influential works (response to RQ1); (4) through a content analysis, it identifies and proposes six research categories: Maturity models to measure the current situation; Methods to integrate the SDGs at the curricular and extracurricular levels; Strategies and management processes to integrate the SDGs in the Academic Setting; Teaching Methods and Pedagogical Approaches to SDGs; Fundamental Concepts; and Systematic Reviews of the Literature (response to RQ2); and (5) it identifies future research needs in the field of Education and SDGs (response to RQ3).

Furthermore, this work proposes a useful framework to guide the transition process towards sustainability through the SDGs in educational institutions (response to RQ4). The framework, which is based on current advances in the research field, makes it possible to: (1) help to eliminate the compartmentalized or annexed view of ESD in the curriculum design, so that ESD becomes the essence of teaching and learning, which is one of the great shortcomings detected by researchers (Rieckmann, 2017); (2) help solve the problem of poor teacher training, since the framework is designed to ensure they learn by doing; (3) integrate the vision of the different stakeholders from the education sector; (4) guide educational institutions in the process of incorporating the SDGs, ensuring that the process is easily adaptable to the context and level of commitment of the institution; (5) help educational institutions to integrate the SDGs in their activity; and (6) promote continuous improvement by understanding sustainability as a process, not as a goal in itself. The framework promotes continuous improvement, thanks to a maturity model that combines the measurement of stakeholders' knowledge and the diagnosis of programmes, plans and institutions, resulting in a diagnosis of the situation and results that are broader than other existing frameworks.

Therefore, this work covers an important research gap: the scarcity of systematic and extensive reviews of the recent research on Education and Objectives for Sustainable Development, which could limit its impact. As a result of the study, some conclusions can be drawn regarding the literature on Education for SDGs achievement. First, it was seen how the number of publications is still limited although the trend is clearly rising, both in the number of publications per year and in the number of citations per year. From this, it can be deduced that there is a growing interest in this area, although due to papers have been recently published, researchers may not know them and for this reason the number of citations is still low. Second, sub-sections authors' influence and analysis by institution do not reveal any trend and pattern. Third, in terms of productivity, Sánchez-Martín, J. is identified as the author with the most publications in the field of study, and Spain, United Kingdom and USA are the countries that have contributed with the greatest number of publications. This shows that the two regions that are more productive are Anglo-Saxon and Europe. This may be due to a major encourage with sustainability in this regions. Fourth, regarding the source analysis, the main sources are educational journals that include Education for sustainable development or for advancing in UN SDGs, and journals that are partially or fully addressed on sustainability. Sustainability Switzerland is the source with the most papers published. Fifth, a comparative analysis of the content made it possible to put forward a classification by categories that include all the papers on the list. This classification in six research categories facilitates the future work of researchers interested in this field because it identifies common shared patterns and elements in every category, and shows those aspects that were addressed to a lesser extent and need future research.

Finally, another important contribution of this work is that due to there are no frameworks to support educational institutions in how to use Education for the achievement of the SDGs, a new framework to cover this research gap has been developed based in the results of this systematic literature review. It was already proved in the literature that conceptual frameworks can be derived from systematic literature reviews (Zimon et al., 2019).

## 6.2. Contributions to managerial practice

This works offers different opportunities to practitioners. This study can offer managers of educational institutions and consulting firms different schools of thought that will enable them to use Education for the SDGs achievement. Furthermore, through the classification of the literature in six categories, practitioners can: (1) assess the current state of the art in integrating Education for the SDGs achievement in educational institutions, in terms of conceptualization, methods, tools, impact, specific solutions, and case studies; (2) identify the future requirements in the six categories to make appropriate decisions on whether to invest and improve current tools/methods; (3) analyse the implications of using education for the SDGs achievement. Finally, the framework offers practitioners a guide with the different activities, tasks, methods, and tools to carry out in the process of using education for the SDGs achievement.

## 7. Conclusion

Since the Rio Summit in 1992, education has been considered fundamental for the achievement of sustainable development. Today, almost 30 years later, ESD is still considered a complement to traditional education, and specific actions and a lack of global sense tend to prevail in academic institutions.

To advance in this line of knowledge, in this paper, a bibliographical analysis of the literature on Education and SDGs published since 2015 has been carried out. A sample of 114 papers were analysed in order to identify the evolution over time of the number of articles included on the list, the evolution of the number of citations generated by these articles, the number of articles published by author, the number of articles published by country, the number of articles published by institution, the content of the 10 most cited articles on the list, the number of articles published per journal, the indicators of relevance, impact and prestige of the 10 journals with the most articles published on the list, and the established and emerging research categories on the topic.

The bibliographical analysis has confirmed the initial hypothesis that an analysis of current research could facilitate the



advancement of future research in this field. The main conclusion is that the area of study requires more research and a higher number of annual publications. Although the number of publications has increased considerably in the last two years, the citation of the main papers is still low. It is also necessary to improve the relevance of the research carried out, something that could be achieved by accessing journals of greater impact. It has also showed that the regions that are more productive are Anglo-Saxon and Europe. Finally, the research conducted in three of the six categories identified should also be improved, since the majority of papers have been published in the other three categories: maturity models, integration of the SDGs, and educational and pedagogic methods.

On the other hand, based on the analysis of the existing bibliography, the need to develop a framework to guide academic institutions towards the achievement of the SDGs and the promotion of sustainable development has been detected. The framework makes it possible to cover the existing need for frameworks that guide the global process of change towards sustainability in educational institutions. It is a tool available for educational institutions that wish to contribute to the scope of the SDGs and make the institution and the community more sustainable places in which to live.

Finally, it is important to highlight the limitations of the study. This research was limited mainly by (1) the biases introduced by studying only two bibliographical databases: the Web of Science and Scopus. There was also a language bias, due to the fact that these databases include mostly articles that were written in English, and the search was conducted only in English. Other databases could be used to improve and compare the results; (2) choosing a series of specific keywords introduced another bias by default. Other keywords could have been used and might have yielded different results; (3) the bibliometric analysis for reviewing the literature based on Misha (2019) was used. Other methods, such as network analysis, might be used for such an analysis; and finally, (4) the literature was classified in six research clusters. Other methods may result in other classifications.

In relation to the limitations of the framework, this research could benefit from the application of the framework to educational institutions, thereby generating case studies that could be used as a reference for practitioners. Further future research could address the adaptability of the framework in non-academic institutions in order to raise awareness among stakeholders about the SDGs and generate business strategies in a participatory manner. Another limitations that could have improved the results are that chapters and books have not been included in the sample, and that sustainability as a term has not been considered in the keywords. Finally, future research could be focused in analysing more the qualitative findings of every category.

## Author Contributions

María Ferrer-Estévez: methodology, bibliometric analysis, framework development

Ricardo Chalmeta: Conceptualization, methodology, supervision, writing-original draft preparation, review and editing

All authors have read and agreed to the published version of the manuscript.

## Declaration of competing interest

None.

## References

- Adelman, S. (2018). The sustainable development goals, anthropocentrism and neoliberalism. In D. French, & L. Kotzé (Eds.), *Sustainable development goals: Law, theory and implementation*. Cheltenham, glos; northampton, Massachusetts: Edward Elgar (pp. 15–40). ISBN 9781786438751.
- Ahern, M., Clouse, A., & Turner, R. (2004). *CMMI distilled. A practical introduction to integrated process improvement*. Sei. Addison Wesley.
- Albareda-Tiana, S., Vidal-Raméntol, S., & Fernández-Morilla, M. (2018). Implementing the sustainable development goals at University level. *International Journal of Sustainability in Higher Education*, 19(3), 473–497. <https://doi.org/10.1108/IJSHE-05-2017-0069>
- Albareda-Tiana, S., Vidal-Raméntol, S., Pujol-Valls, M., & Fernández-Morilla, M. (2018). Holistic approaches to develop sustainability and research competencies in pre-service teacher training. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85055007870&doi=10.3390%2Fsu10103698&partnerID=40&md5=2c78cad1447169fd82646fd7ee490ae>.
- Ambrosio Avelar, A. B., & da Silva-Oliveira, K. D. (2019). Education for advancing the implementation of the sustainable development goals: A systematic approach. *International Journal of Management in Education*, 17(3). <https://doi.org/10.1016/j.ijme.2019.100322>
- António Guterres. (2019). *The sustainable development goals report 2019*. In *United Nations publication issued by the Department of economic and social Affairs*.
- Barrantes Briceño, C. E., & Almada Santos, F. C. (2019). Knowledge management, the missing piece in the 2030 agenda and SDGs puzzle. *International Journal of Sustainability in Higher Education*. <https://doi.org/10.1108/IJSHE-01-2019-0019>
- Beck, U., Giddens, & Lash, S. (1997). Modernización reflexiva Política, tradición y estética en el orden social moderno. *Documenta magazines*.
- Bolstad, R. (2003). Environmental education: Roots in the past, visions of the future, opportunities in the present. *SET: Research Information for Teachers*, 3, 10–14.
- Bonnett, M. (2007). Environmental education and the issue of nature. *Journal of Curriculum Studies*, 39(6), 707–721. <https://doi.org/10.1080/00220270701447149>
- Borges, J. C., Capellaro Ferreira, T., Silveira Borges de Oliveira, M., Macini, N., & Ferreira Caldana, A. C. (2017). Hidden curriculum in student organizations: Learning, practice, socialization and responsible management in a business school. *International Journal of Management in Education*. <https://doi.org/10.1016/j.ijme.2017.03.003>
- Borges, J. C., Oranges-Cezarino, L., Capellaro-Ferreira, T., Travençolo Muniz, S. O., Lehr Unglaub, D., & Ferreira Caldana, A. C. (2017). Student organizations and communities of practice: Actions for the 2030 agenda for sustainable development. *International Journal of Management in Education*. <https://doi.org/10.1016/j.ijme.2017.02.011>
- Brundtland, G. H., Khalid, M., Agnelli, S., Al-Athel, S. A., Chidzeron, B., Fadika, L. M., Hauff, V., Lang, I., Ma, S., Botero, M. M., & Singh, N. (1987). *Our common future - WCDE. (\'Brundtland report\')*.
- Bybee, R. W. (1991). Planet earth in crisis: How should science educators respond? *The American Biology Teacher*. <https://doi.org/10.2307/4449248>
- Chalmeta, R., & Palomero, S. (2011). Methodological proposal for business sustainability management by means of the balanced scorecard. *Journal of the Operational Research Society*, 62(7), 1344–1356. <https://doi.org/10.1057/jors.2010.69>
- Chase, R., Jacobs, R., & Aquilano, N. (2004). *Operations Management for Competitive Advantage 11e*. McGraw Hill.
- Collier, D. (1998). Comparative method in the 1990s. In CP newsletter of the comparative politics organized section of the American political science association. <https://doi.org/10.2139/ssrn.1757219>.

- Crespo, B., Míguez-álvarez, C., Arce, M. E., Cuevas, M., & Míguez, J. L. (2017). The sustainable development goals: An experience on higher education. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85026637190&doi=10.3390%2Fsu9081353&partnerID=40&md5=5b241515d0ebf3928d84dcecf1240f6a>.
- Crutzen, P. J. (2006). The anthropocene. In *Earth system science in the Anthropocene*. [https://doi.org/10.1007/3-540-26590-2\\_3](https://doi.org/10.1007/3-540-26590-2_3)
- Ely, A., & Marin, A. (2016). Learning about 'engaged excellence' across a transformative knowledge network. *IDS Bulletin*. <https://doi.org/10.19088/1968-2016.200>
- Fien, J. (1995). Teaching for a sustainable world: The environmental and development education project for teacher education. *Environmental Education Research*. <https://doi.org/10.1080/1350462950010102>
- García-Feijoo, M., Eizaguirre, A., & Rica-Aspiunza, A. (2020). Systematic review of sustainable-development-goal deployment in business schools. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85082551392&doi=10.3390%2Fsu12010440&partnerID=40&md5=ef54a2477daf691567242196b51962bc>.
- García, J., da Silva, S. A., Carvalho, A. S., & de Andrade Guerra, J. B. S. O. (2017). Education for sustainable development and its role in the promotion of the sustainable development goals. In J. Davim (Ed.), *Curricula for sustainability in higher education. Management and Industrial Engineering*. Springer. Cham. [https://doi.org/10.1007/978-3-319-56505-7\\_1](https://doi.org/10.1007/978-3-319-56505-7_1).
- Glavič, P. (2020). Identifying key issues of education for sustainable development. *Sustainability*, 12(16), 6500. <https://doi.org/10.3390/su12166500>
- de Haan, G. (2010). The development of ESD-related competencies in supportive institutional frameworks. *International Review of Education*. <https://doi.org/10.1007/s11159-010-9157-9>
- Holmberg, J., & Larsson, J. (2018). A sustainability lighthouse-supporting transition leadership and conversations on desirable futures. *Sustainability (Switzerland)*. <https://doi.org/10.3390/su10113842>
- Jiménez del Llano, J., Martín Álvarez, J. M., Rico Donovan, E., Rivera Reyes, V., Vidal Silva, M. D., & Aneas Franco, M. (2018). *El desafío de los SDGs*. (Secretaría). In Ministerio Español de educación, cultura y deportes.
- Kahn, R. (2008). From education for sustainable development to eco-pedagogy: Sustaining capitalism or sustaining life? *Green theory & praxis: The journal of eco-pedagogy*, 4(1) (16).
- Kioupi, V., & Voulvoulis, N. (2019). Education for sustainable development: A systemic framework for connecting the SDGs to educational outcomes. *Sustainability (Switzerland)*, 11(21). <https://doi.org/10.3390/su11216104>
- Kolb, M., Fröhlich, L., & Schmidpeter, R. (2017). Implementing sustainability as the new normal: Responsible management education – from a private business school's perspective. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85020824078&doi=10.1016%2Fj.ijme.2017.03.009&partnerID=40&md5=b3554e6c2d7cd5a1910209b433ac5516>.
- Kopnina, H. (2017). Envisioning futures for environmental and sustainability education. *Envisioning Futures for Environmental and Sustainability Education*, 129–140. <https://doi.org/10.3920/978-90-8686-846-9>
- Kopnina, H. (2018). Teaching sustainable development goals in The Netherlands: A critical approach. *Environmental Education Research*, 24(9), 1268–1283. <https://doi.org/10.1080/13504622.2017.1303819>
- Kopnina, H. (2020). Education for the future? Critical evaluation of education for sustainable development goals. *The Journal of Environmental Education*, 51(4).
- Laorga, M., Nuñez, J. R., Salinas, R., Sánchez, M., & Simón, A. I. (2017). *Hendere y el derecho a la educación: Los SDGs en la escuela (secretaría)*.
- Leal Filho, W., Shiel, C., Paço, A., Mifsud, M., Ávila, L. V., Brandli, L. L., Molthan-Hill, P., Pace, P., Azeiteiro, U. M., Vargas, V. R., & Caeiro, S. (2019). Sustainable Development Goals and sustainability teaching at universities: Falling behind or getting ahead of the pack? *Journal of Cleaner Production*, 232, 285–294. <https://doi.org/10.1016/j.jclepro.2019.05.309>
- Leicht, A., Heiss, J., & Byun, W. J. (2018). *Issues and trends in education for sustainable development*. Paris, France: UNESCO.
- Lukman, R., & Glavič, P. (2007). What are the key elements of a sustainable university? Clean technologies and environmental policy. <https://doi.org/10.1007/s10098-006-0070-7>.
- Mahaffy, P. G., Matlin, S. A., Whalen, J. M., & Holme, T. A. (2019). Integrating the molecular basis of sustainability into general chemistry through systems thinking. *Journal of Chemical Education*, 96(12), 2730–2741. <https://doi.org/10.1021/acs.jchemed.9b00390>
- Maialen Muguerra, A., & Chalmeta, R. (2020). *Educación para el Desarrollo Sostenible: Análisis del centro de secundaria Iturrama*.
- Manterola, C., Astudillo, P., Arias, E., & Claros, N. (2013). Revisión sistemática de la literatura. *Qué se debe saber acerca de ellas. Cirugía Española*. <https://doi.org/10.1016/j.ciresp.2011.07.009>
- Martínez-López, F. J., Merigó, J. M., Valenzuela-Fernández, L., & Nicolás, C. (2018). Fifty years of the European journal of marketing: A bibliometric analysis. In *European journal of marketing*. <https://doi.org/10.1108/EJM-11-2017-0853>.
- Meadows, D. H., Meadows, D. L., Randers, J., & Behrens, W. (1972). *The limits to growth - club of rome*. New York, Universe.
- Miller, G. A., Beckwith, R., Fellbaum, C., Gross, D., & Miller, K. J. (1990). Introduction to wordnet: An on-line lexical database. *International Journal of Lexicography*. <https://doi.org/10.1093/ijl/3.4.235>
- Mishra, D., Gunasekaran, A., Papadopoulos, T., & Childe, S. J. (2016). Big data and supply chain management: A review and bibliometric analysis. *Annals of Operations Research*, 270, 313–336.
- Muff, K., Kapalka, A., & Dyllick, T. (2017). The Gap Frame - translating the SDGs into relevant national grand challenges for strategic business opportunities. *International Journal of Management in Education*. <https://doi.org/10.1016/j.ijme.2017.03.004>
- Murga-Menoyo, M.Á. (2015). Competencias para el desarrollo sostenible: Las capacidades, actitudes y valores meta de la educación en el marco de la Agenda global post-2015. *Foro de Educación*. <https://doi.org/10.14516/fde.2015.013.019.004>
- Neal, M. (2017). Learning from poverty: Why business schools should address poverty, and how they can go about it. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85018510076&doi=10.5465%2Famle.2014.0369&partnerID=40&md5=55222c8ee94839b06feaa1865b93d316>.
- Nevin, E. (2008). Education for sustainable development. *Policy & Practice, a Development Education Review*, 6, 49–62.
- Orenga-Rogla, S., & Chalmeta, R. (2019). Framework for implementing a big data ecosystem in organizations. *Communications of the ACM*, 62(1), 58–65, 15.
- Ortiz, D., & Huber-Heim, K. (2017). From information to empowerment: Teaching sustainable business development by enabling an experiential and participatory problem-solving process in the classroom. *International Journal of Management in Education*, 15(2), 318–331. <https://doi.org/10.1016/j.ijme.2017.03.008>
- Penner, J., & Sandser, J. (2017). The role of economic citizenship education in advancing global citizenship. *Policy & Practice - a Development Education Review*.
- Purcell, W. M., Henriksen, H., & Spengler, J. D. (2019). Universities as the engine of transformational sustainability toward delivering the sustainable development goals: "Living labs" for sustainability. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85068115251&doi=10.1108%2FJLSHE-02-2019-0103&partnerID=40&md5=f0e2ce41ea9fd6b3880189b87a4e25d6>.
- Ramos-Rodríguez, A. R., & Ruíz-Navarro, J. (2004). Changes in the intellectual structure of strategic management research: A bibliometric study of the strategic management journal, 1980-2000. *Strategic Management Journal*. <https://doi.org/10.1002/smj.397>
- Rieckmann, M. (2012). Future-oriented higher education: Which key competencies should be fostered through university teaching and learning? *Futures*. <https://doi.org/10.1016/j.futures.2011.09.005>
- Rieckmann, M. (2017). Educación para los Objetivos de Desarrollo Sostenible: Objetivos de Aprendizaje. In *Isbn 978-92-3-300070-4*. UNESCO.
- Robertson, R. (2000). Glocalización: Tiempo-espacio y homogeneidad-heterogeneidad. *Zona Abierta*.
- Rowley, J., & Slack, F. (2004). Conducting a literature review. In *management research news*. <https://doi.org/10.1108/01409170410784185>.
- Sdsn. (2017). Getting started with the SDGs in universities: A guide for universities, higher education institutions, and the academic sector. *Australia, New Zealand and Pacific Edition*. <https://doi.org/10.1109/ICNDS.2010.5479229>
- Sharpe, B., Hodgson, A., Leicester, G., Lyon, A., & Fazey, I. (2016). Three horizons: A pathways practice for transformation. *Ecology and Society*. <https://doi.org/10.5751/ES-08388-210247>
- Storey, M., Killian, S., & O'Regan, P. (2017). Responsible management education: Mapping the field in the context of the SDGs. *International Journal of Management in Education*. <https://doi.org/10.1016/j.ijme.2017.02.009>
- Succar, B. (2009). Building information modelling framework: A research and delivery foundation for industry stakeholders. *Automation in Construction*. <https://doi.org/10.1016/j.autcon.2008.10.003>
- UNESCO. (2017). Education for sustainable development goals: Learning objectives. <https://unesdoc.unesco.org/ark:/48223/pf0000247444>.

- UNESCO. (2014a). Sustainable development begins with education: How education can contribute to the proposed post-2015 goals. <https://unesdoc.unesco.org/ark:/48223/pf0000230508>.
- UNESCO. (2014b). Hoja de Ruta 2050 para la ejecución del Programa de acción mundial de Educación para el Desarrollo Sostenible. *Ministerio de Energía*.
- UNESCO. (2014c). UNESCO roadmap for implementing the global action programme on education for sustainable development. <https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=1674&menu=35>.
- Unidas, N. (2012). El futuro que queremos. *Río+20*.
- Velazquez, L., Munguia, N., Platt, A., & Taddei, J. (2006). *Sustainable university: What can be the matter?* *Journal of cleaner production*. <https://doi.org/10.1016/j.jclepro.2005.12.008>
- Verhulst, E., & Lambrechts, W. (2015). Fostering the incorporation of sustainable development in higher education. Lessons learned from a change management perspective. *Journal of Cleaner Production*, 106, 189–204.
- Vladimirova, K., & Le Blanc, D. (2016). Exploring links between education and sustainable development goals through the lens of UN flagship reports. *Sustainable Development*, 24(4), 254–271. <https://doi.org/10.1002/sd.1626>
- Washington, H. (2015). In Sustainability, K. Issues, H. Kopnina, & E. Shoreman-Outimet (Eds.), *Is 'sustainability' the same as 'sustainable development'?* (pp. 359–376). London, UK: Routledge. New York, NY, USA.
- Westley, F., Laban, S., Rose, C., McGowan, K., Robinson, K., Tjornbo, O., & Tovey, M. (2015). Social innovation lab guide. In *New directions for youth development*.
- Weybrecht, G. (2017). From challenge to opportunity—management education's crucial role in sustainability and the Sustainable Development Goals—an overview and framework. *International Journal of Management in Education*, 15, 84–92.
- Wiek, A., Withycombe, L., & Redman, C. L. (2011). Key competencies in sustainability: A reference framework for academic program development. In *sustainability science*. <https://doi.org/10.1007/s11625-011-0132-6>.
- Zamora Polo, F., Luque-Sendra, A., Aguayo-Gonzalez, F., & Sanchez-Martin, J. (2019). Conceptual framework for the use of building information modeling in engineering education. *International Journal of Engineering Education*.
- Zamora-Polo, F., & Sánchez-Martín, J. (2019). Teaching for a better world. *Sustainability and Sustainable Development Goals in the construction of a change-maker university*. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85070474282&doi=10.3390%2Fsu11154224&partnerID=40&md5=5894eba59c77b55eedd06ca330a77d22>.
- Zamora-Polo, F., Sánchez-Martín, J., Corrales-Serrano, M., & Espejo-Antúnez, L. (2019). What do university students know about sustainable development goals? A realistic approach to the reception of this UN program amongst the youth population. *Sustainability (Switzerland)*. <https://doi.org/10.3390/su11133533>
- Zimon, D., Tyan, J., & Sroufe, R. (2019). Implementing sustainable supply chain management: Reactive, cooperative, and dynamic models. *Sustainability*, 11, 7227.