Sustainability implementation and management in organizations.

Proposal of framework, methodologies and business intelligence computer tools.

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Acronyms

BI	Bussines Intelligence
BSC	Balanced Scorecard
CRM	Customer Relationship Management
ESD	Education for Sustainable Development
SBSC	Sustainability Balanced Scorecard
SCRM	Sustainable Customer Relationship Management
SDG	Sustainable Development Goals

Chapter 1. Introduction

This chapter introduces the central theme explored in this Ph.D. thesis. It begins by offering a concise overview of the research problem, outlining the core objectives that guide the study. Subsequently, the chapter delineates the research methodology employed. Lastly, it outlines the structure of the thesis and offers a brief overview of the individual chapters that comprise it.

1.1. Problem Statement

More than half a decade ago, humanity encountered the planetary boundaries (Richardson, et al., 2023), driven by an economic development model that relentlessly exploits a finite system: Planet Earth. While rooted in environmental preservation, sustainability has emerged as a key concept in addressing the social, environmental, and economic challenges of contemporary societies (Jan et al. 2021).

In 1987, the publication of Our Common Future also known as the Brundtland Report (United Nations, 1987), marked a pivotal moment by globally defining sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". However, there is no single definition of sustainability or sustainable development. Research in the field has rapidly proliferated, yielding numerous definitions (Kirkby et al. 2023; Santillo, 2007) but not all of them approach sustainable development holistically. Embracing sustainability requires simultaneous consideration of its interconnected elements, including environmental, economic, and social sustainability, as acknowledged by Li et al. (2015), to address

present and future negative impacts through a holistic perspective (Hjorth & Bagheri, 2006; Lozano, 2008). This comprehensive approach is essential for achieving a prosperous and sustainable future, as emphasized by Ikram et. Al (2020), Mebratu (1998) and Vázquez et al. (2015).

As indicated by Mustapha et al. (2017), the concept of sustainability applies at various scales, including global sustainability (Liu, et al., 2015), country sustainability (Wagner, 2015), and organizational sustainability (Beasley & Scott Showalter, 2015), with organizations playing a pivotal role in driving sustainability (Danter et al. 2000; Holliday et al. 2017; and Jennings & Zandbergen, 1995). This study particularly focuses on the concept of organizational sustainability.

Defining sustainable organizations and establishing their role in sustainability is challenging. Despite the growing interest in organizational sustainability over the past decades (Danter et al. 2000), there have been few attempts to define sustainable organizations. There is still a need to establish principles for how organizations address and contribute to sustainability (Lozano, 2018). Incorporating, integrating, and implementing sustainability in organizations is a complex and multidimensional process (Langer & Schön, 2003) that requires the involvement of stakeholders (Rodríguez-Olalla & Avilés-Palacios, 2017). Transitioning from the conventional economist's perspective (Lozano, 2008), where profitability and competitiveness are the core elements of the bottom line, to a holistic perspective implies adopting a triple bottom line approach (Elkington, 1998), encompassing the environmental, social, and economic perspectives within the management structure without compromising the needs of future generations.

Sustainability often remains a conceptual construct, lacking tangible applications and clear implementation and management guides. Organizations invest resources, including financial ones, in the pursuit of sustainability integration (Falle et al., 2016; Longoni & Cagliano, 2018; Lozano, 2015). However, despite increasing practical endeavors, sustainability predominantly resides within the conceptual domain, with numerous studies dissecting the concept and its merits and demerits (Del Mar Alonso-Almeida et al., 2014; Hahn et al., 2015). Regarding sustainability implementation, it necessitates not only further research within various organizations and their systems (Lozano, 2018) but also the provision of practical application examples and well-defined roadmaps (Rodríguez-Olalla & Avilés-Palacios, 2017). Existing roadmaps may appear superficial to practitioners (Morioka & Carvalho, 2016). When it comes to sustainability management, while many view the integration of multidisciplinary objectives as an initial step (Epstein, 2008; Esquer-Peralta et al., 2008), it may not, as Naudé (2011) has highlighted, offer a comprehensive solution when integrating existing management systems. Although sustainability's importance is widely recognized by organizations and top-level management, the lack of a precise definition, a holistic framework for sustainability management encompassing environmental, economic, and social systems,

and the absence of practical tools aimed at implementing theoretical sustainability management models present formidable challenges to effective sustainability management within these entities (Waqas & Muammer, 2017).

To bridge this research gap and contribute to the state of the art and managerial practices in implementing and managing sustainability in organizations, this present study propose practical tools to guide organizations in their sustainability transition.

1.2. Objectives

Within the topic of organizational sustainability and recognizing the need for further research into the implementation of sustainability and sustainability management across different organizations and systems, the overall aim of the thesis is to provide practical tools to guide organizations in their journey towards sustainability implementation and management (Figure 1).

Figure 1 Thesis objectives and structure

Thesis core objective
*Provide **practical tools** to guide organizations in their journey towards **sustainability implementation** and **management***

| Chapter 1 Introduction | Chapter 2 Article 1 | Chapter 3 Article 2 | Chapter 4 Article 3 | Chapter 5 Article 4 | Chapter 6 Conclusions |

Objective 1
Examine the state of the art and propose a useful framework for implementing sustainability in educational institutions

#Implementation

Objective 2
Develop a business intelligence tool for sustainability management in higher education institutions

#Implementation
#Management

Objective 3
Investigate the current state of the art and propose a methodology for sustainable customer relationship management

#Management

Within the overarching scope of this research endeavor, the thesis delineates three specific objectives:

1. Examine the state of the art and propose a useful framework for designing and implementing sustainability strategies linked to the Sustainable Development Goals (SDGs) in educational institutions (Objective 1)
2. Develop a business intelligence tool for sustainability management in higher education institutions (Objective 2)

3. Investigate the current state of the art and propose a methodology for sustainable customer relationship management (Objective 3)

1.3. Research Methodology

This work relies on exploratory and constructive research methods, respectively allowing for the identification and structuring of new problems (Stebbins, 2012) as well as the development of solutions to these issues (Lukka, 2003).

Chapters 2 and 4 apply exploratory research through the systematic literature review method, focusing on the existing literature related to education and SDGs and Sustainable Customer Relationship Management (SCRM), respectively. In both cases, the results enabled a bibliometric analysis that provided valuable insights into the research topics, including the most relevant authors, countries, institutions, and papers. Furthermore, the reviews helped structure the research field into distinct categories.

Chapters 2, 3 and 5, although using different techniques, employ constructive research to propose a framework and a methodology. The framework SDG4-IRIS for the integration of SDGs in educational institutions (Chapter 2) takes into account the findings of the literature review and the experiences of the IRIS group members, who have expertise as researchers in the development and implementation of frameworks and methodologies to support innovation in organizations, as well as experience as managers and educators in universities. The proposed methodology for integrating sustainability within the management systems of organizations (Chapter 3) is based on a qualitative multiple-case study method, following the recommendations outlined by Yin (2009) for inductive analysis of qualitative data, along with the guidelines detailed by Walsham (1995) for enhancing an existing theory using interpretive case studies in the information systems field. Finally, the Sustainable CRM-IRIS methodology (Chapter 5), supported by the systematic literature review on SCRM (Ferrer-Estévez & Chalmeta, 2023) (Chapter 4), is a supplemented, adapted and updated version of the CRM methodology proposed by Chalmeta (2006).

1.4. Structure

The thesis is organized into five chapters (Figure 1), with the first and last chapters serving as introductory and conclusion sections, respectively. Chapters 2 to 4 constitute the main body of the research. Although they deal with related topics, Chapters 2 to 4 are three complete and independently published papers, each addressing different objectives proposed for this thesis.

1. ***Chapter 1: Introduction.*** This chapter presents a brief general description of the research topic analyzed and presented in this thesis. It introduces the problem

statement, the research methodology employed, the proposed objectives, and the results obtained in this work. It also provides an overview of the document's organization.

2. *Chapter 2: Integrating Sustainable Development Goals in educational institutions.* This chapter presents research categories and a framework for integrating SDGs in educational institutions. The study conducts a systematic review of 160 articles published over the past decade in this area to identify influential authors, countries, papers, journals, and challenges researchers encounter in studying this relationship. Based on these findings, the chapter makes two main contributions. First, it proposes six research categories and outlines future research directions to guide further academic work. Second, it introduces a framework designed to assist educational institutions in integrating SDGs into their activities. This framework considers the perspectives of various stakeholders within the learning community, facilitating the development of a comprehensive strategy for continuous improvement and enabling the implementation of action plans with measurement and evaluation of results.

3. **Chapter 3:** *Developing a Business Intelligence Tool for Sustainability Management.* This chapter explores Business Intelligence (BI) and the Balanced Scorecard for decision-making, introducing the Sustainable Balanced Scorecard for sustainability integration. It presents a phased methodology illustrated by case studies, employing qualitative multiple-case studies with seven phases. Findings reveal an organized approach for sustainability integration into management systems. This study contributes to Sustainable Balanced Scorecard literature, sustainability measurement, and computer decision support systems.

4. **Chapter 4:** *Sustainable customer relationship management.* This chapter classifies the current state of knowledge on SCRM into research categories, analyzing major research streams and identifying a future research agenda in each category. The systematic review and bibliometric analysis allow for assessing the trend in the number of papers published and their citation counts, identifying the top contributing countries, authors, institutions, and sources, revealing findings from major research streams, developing a classification framework composed of seven research categories for expanding Sustainable Customer Relationship Management research, and establishing future research challenges.

5. *Chapter 5: Methodology and Computer Architecture for Sustainable Customer Relationship Management .* Based on findinds in Chapter 4, the purpose of the chapter is to address the recent and limited research on SCRM by introducing a methodology and computer architecture that guide the development and implementation of SCRM in companies, encompassing all dimensions of sustainability and aligning business strategy, processes, and human resources while utilizing various information technologies and systems.

6. ***Chapter 6: Conclusions***. This chapter outlines the general conclusions and the main contributions of the thesis. It discusses the limitations of the present work and suggests possible directions for further research.

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Chapter 2. Integrating Sustainable Development Goals in Educational Institutions

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.

2.1. 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 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.

2.2. Institutional background

2.2.1. 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.

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

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 (Antonio Guterres, 2019).

2.2.2. 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.

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 *The future we want* (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 EDS for 2030 is to create a more just and sustainable world by achieving the 17 SDGs.

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 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 (Kopnina, 2017; Kopnina, 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.

2.3. 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 (Figure 2): (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.

Figure 2 Research methodology steps
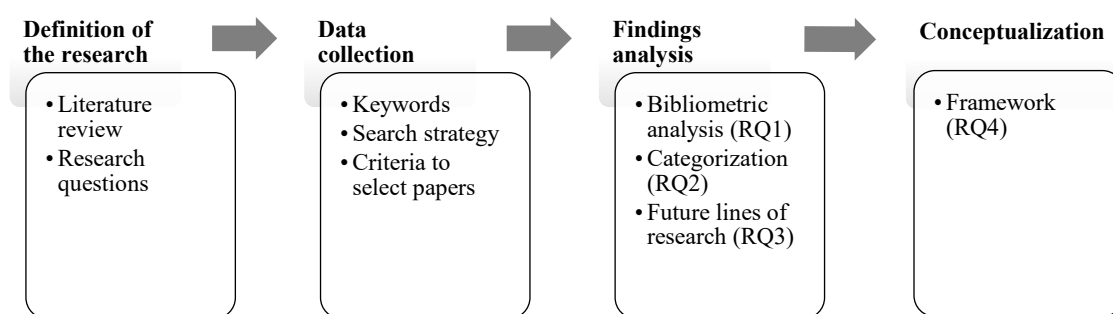
2.3.1. Definition of the research

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.

2.3.2. 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 and reviews since they are considered certified knowledge (Ramos-Rodrígue & Ruíz-Navarro, 2004). The search period was set to the period between 2015, since that is when the 2030 Agenda was established, until 31th December 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 3). 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.

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" 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")	TITLE ABS KEY	2015-20	Articles Reviews	All (There is no Education Category)
Web of Science					Education Educational Research

The search strategy 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 (Figure 3).

Figure 3 Criteria for selecting the final sample
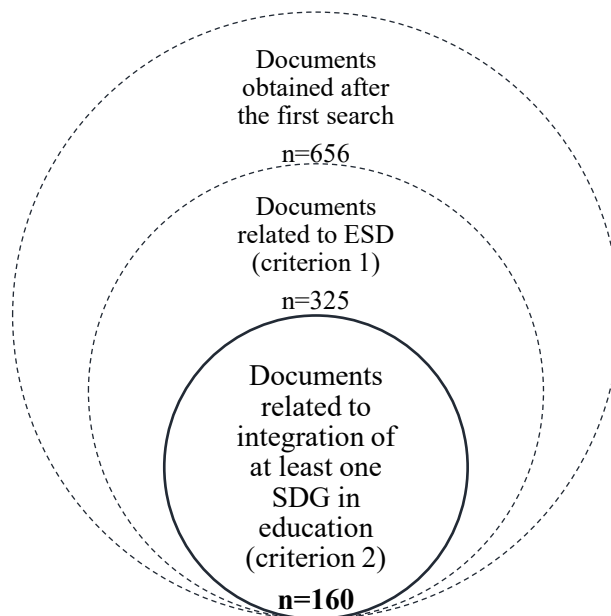
2.3.3. Findings analysis

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.
- 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.

2.4. Findings

2.4.1 Bibliometric Analysis

Initial Results

As can be seen in Figure 4, 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.

Figure 4 Trend in the generation of articles
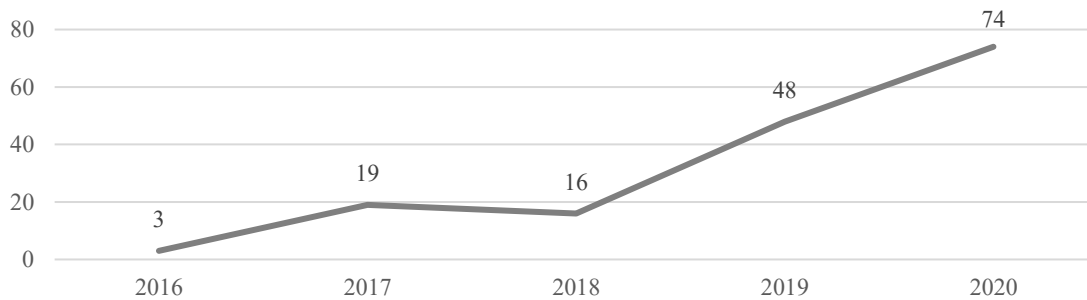
Author influence

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).

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

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).

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

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).

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

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.

Table 7 Top 10 articles with the most citations

Article	Abstract	Total Citations
Sustainable Development Goals and sustainability teaching at universities: Falling behind or getting ahead of the pack? (Leal Filho, Shiel, Paço, Mifsud, Ávila, Brandli, Molthan-Hill, Pace, Azeiteiro, Vargas, & Caeiro, 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**
Implementing the sustainable development goals at University level. (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**
Exploring Links Between Education and Sustainable Development Goals Through the Lens of UN Flagship Reports. (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**
Responsible management education: Mapping the field in the context of the SDGs. (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**
Teaching for a better world. Sustainability and Sustainable Development Goals in the construction of a change-maker university (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**

Article	Abstract	Total Citations
What do university students know about sustainable development goals? A realistic approach to the reception of this UN program amongst the youth population. (F Zamora-Polo et al., 2019)	This paper shows a study to evaluate students' knowledge about sustainability and SDGs through a questionnaire.	**28**
Implementing sustainability as the new normal: Responsible management education – From a private business school's perspective. (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**
The Gap Frame - Translating the SDGs into relevant national grand challenges for strategic business opportunities. (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**
Holistic approaches to develop sustainability and research competencies in pre-service teacher training. (Albareda-Tiana, Vidal-Raméntol, Pujol-Valls, et al., 2018)	The document explores suitable teaching methodologies for the development of sustainability competencies.	**23**
The sustainable development goals: An experience on higher education. (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**

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 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 8 express the degree of impact, relevance and importance of the journal, according to these indicators.

Table 8 Journals with the most published articles and their impact indicators.

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

Source: SNIP: Source Normalized Impact per Paper. SJR: SCImago Journal Rank

2.4.2. 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 SGDs. The categories obtained are those shown in Table 9.

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 shows 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 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*.

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, & 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 & 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 & 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, et al., (2018); Mahaffy et al., (2019); Ortiz & 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 & Le Blanc, (2016); Garcia J., da Silva S.A., Carvalho A.S., (2017); Penner & 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 & Almada Santos, (2019)	Greater coverage of information sources. Identification of research categories.

2.5. 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 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 researches 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.

The framework is organized in four dimensions (Figure 5): Methodology, Resources, Interest Groups, and Maturity Model.

Figure 5 SDG4-IRIS Framework and its dimensions
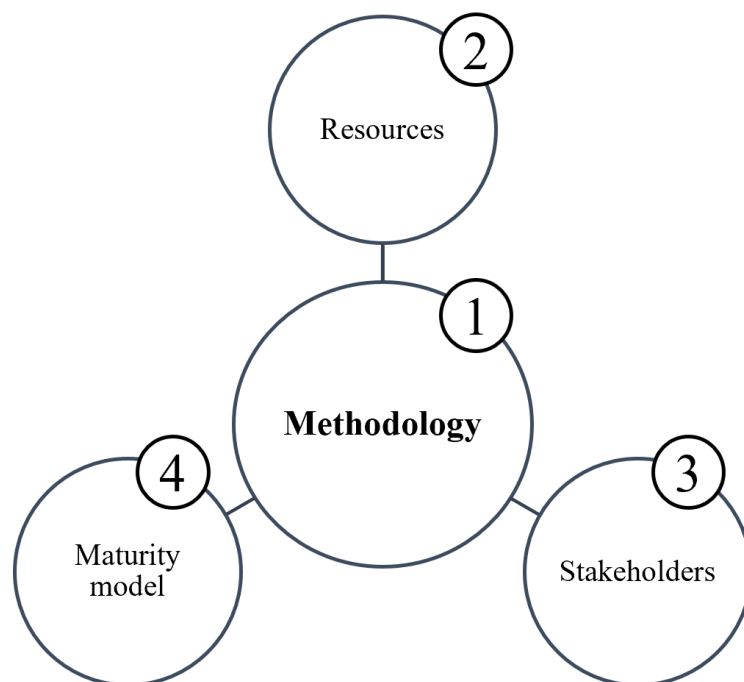
2.5.1. Methodology

The first dimension, Methodology, is the core dimension that guides the process. This consists of five steps (Figure 6): *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 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).

Figure 6 Steps of the methodology
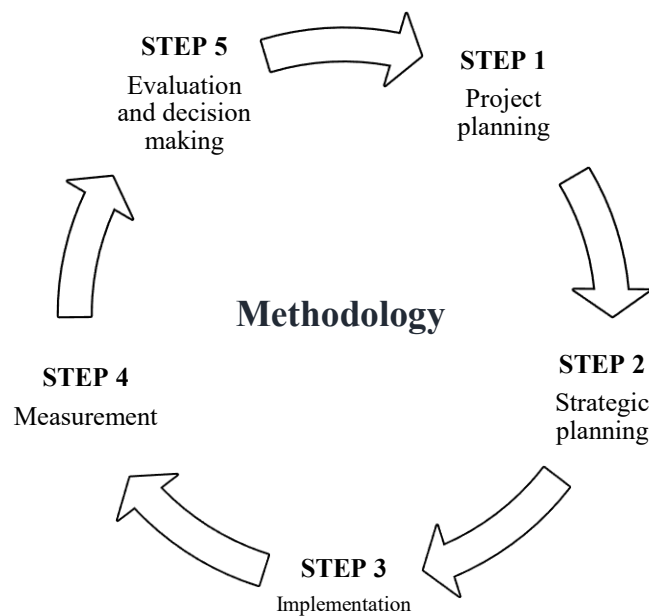
The steps of the methodology are based on the Deming Cycle, also known as the PDCA (Plan-Do-Check-Act) cycle, which proposes a process for continuous quality improvement and is widely used in management systems. It is a management philosophy that seeks excellence from a continuous process of small improvements (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 Orenga and Chalmeta, 2109; Chalmeta & Palomero, 2011). 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.

Table 11 Methodology dimension

STEP 1: PROJECT PLANNING

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.

	Activity		Task	Responsible	Dim
1	**Acquisition of commitment**	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	**Definition of responsibili-ties**	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	**Step 2 programming**	3.1	Definition of the sessions of the Participatory Process (S2)	Coordination group	2
		3.2	Timing of activities and tasks		
4	**Development of a communica-tion plan**	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

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.

	Activity		Task	Responsible	Dim
1	**Participatory process**	1.1	Understand the 17 SDGs and generate collective knowledge. *What are the SDGs?* (one session with all the SDGs or several grouping them)	Facilitators and participating stakeholders	2,3
		1.2	Identification of the 17 SDGs in the institution and community. *What SDGs are most present in the context of the academic institution?*		
		1.3	Generate a collective vision of sustainability linked to the SDGs. *Where do we want to go? What do we want to achieve? What SDGs and respective goals are we going to contribute to?*		

				Dim
	1.4	Discussion of the state of the situation. *How do we currently contribute to the 17 SDGs?*		
	1.5	Proposals to achieve the collective vision of sustainability. *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		
2 Strategy conformation	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 Validation and institution-alization of the programme	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

The objective of this step is to implement the programme or strategy resulting from the strategic planning.

Activity		Task	Responsible	Dim
1 Implementa-tion	1.1	Start of the programme or strategic plan	Human Resources and participating stakeholders	2,3

STEP 4: MEASUREMENT

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).

Activity		Task	Responsible	Dim
1 Measure	1.1	Use of the maturity model to obtain data	Coordination group	2,4

STEP 5: EVALUATION AND DECISION-MAKING

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.

	Activity		Task	Responsible	Dim
1	**Communi-cation**	1.1	Communication of results to stakeholders	Coordination group	2
		1.2	Publication of results on the web platform		2
2	**Results evaluation**	2.1	Analysis of the results obtained	Directors	2
		2.2	Comparison of results with previous diagnoses (if any)		2
3	**Decision-making**	3.1	Awareness and reflection of progress	Participating stakeholders	2,3
		3.2	Detection of areas for improvement		2,3
		3.3	Writing a results report	Coordination group	2

Finally, regarding the extension of the project, development from Step 1 to Step 5 is planned to last two academic years (Figure 7). 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 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".

Figure 7 Schedule for the application of the Framework

S1	S2	S3	S4	S5

Academic year 1

Planning

Academic year 2

Implementation, measurement and evaluation
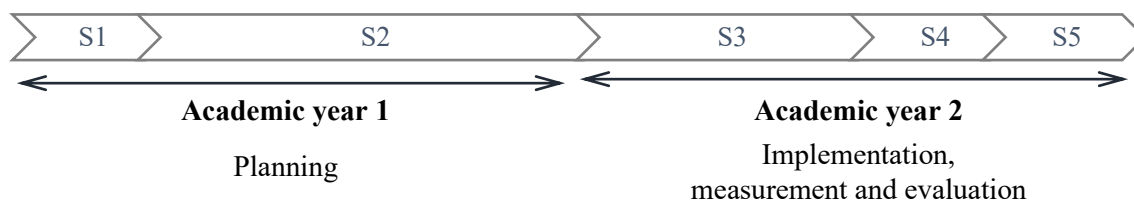
2.5.2. Resources

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.

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.

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.

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)

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.

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. 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:

- 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).

2.5.3. 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.

2.5.4. 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.

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 Muguerza & 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).

Matrix

The objective of the matrix (Figure 8) 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.

**PARTICIPATING STAKEHOLDERS IN
S2: STRATEGIC PLANNING**

		Directors and teachers	Directors, teachers and students	Internal stake-holders	All the stake-holders	All the stake-holders + network-ing with other academic institu-tions
	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
S	A strategy is defined combining curricular and extracurricular activities	3	4	5	6	7
T **R** **A** **T** **E** **G**	A strategy is defined combining curricular and extracurricular activities. Furthermore, these activities contribute to the improvement of the integral management of the institution	4	5	6	7	8
Y	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	**10**

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.

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.

2.6. Discussion

2.6.1. 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).

2.6.2. 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 conceptualisation, 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.

2.7. 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.

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Chapter 3. Developing a Business Intelligence Tool for Sustainability Management

Business intelligence (BI) is a combination of computer systems and managerial processes to support decision making. The Balanced Scorecard is a kind of Business Intelligence tool for performance measurement and management control aimed at balancing financial and non-financial as well as short- and long-term measures. The Sustainable Balanced Scorecard is a modification of the original Balanced Scorecard developed to expressly consider governance, social, environmental and ethical issues, and therefore to allow sustainability concepts to be included within the strategy and the management of the organization. However, although the Sustainable Balanced Scorecard is one of the most suitable tools for integrating sustainability within management, there are few examples of how to develop and implement it that can be used as reference models. To help solve this problem, this paper proposes a methodology for the development of a Sustainable Balanced Scorecard, considering different phases such as planification, analysis, design, or computer tool implementation, and describes the findings of three case study.

The research was conducted using the qualitative multiple-case study method. This made it possible to establish the methodological issues regarding the performance and reporting of this study. Therefore, the research method for the conceptualization and execution of the case studies was divided into seven phases: Definition of research goals and questions; Proposed theoretical model; Identification of units of analysis. Case selection; Definition

of research methods and resources; Fieldwork; Data collection, classification of information and triangulation; Formulation of the enhanced theory, model or methodology; and Verification of the rigour and quality of the study.

Paper shows a methodology organized in phases, activities and tasks that allows a sustainable balanced scorecard to be planned, designed, built, computerized, and controlled in order to integrate sustainability within the management systems of organisations.

This study contributes to the currently emerging Sustainable Balanced Scorecard literature and practice and, more generally, to research on sustainability measurement and management. The methodology for Sustainable Balanced Scorecard development and implementation showed in this paper contributes to the management and information systems theory because it makes it possible to overcome the shortcomings identified to date: it considers all the sustainability dimensions, it describes all the project life-cycle activities, it encourages stakeholders' participation, and it has been proved to work in real situations.

3.1. Introduction

Business intelligence (BI) is a combination of computer systems, knowledge management, and managerial processes for data gathering, storage, analysis, and visualization to offer complex internal and competitive organizational information to support both operative and strategic decision-making (Nuseir, 2021). BI facilitate non-expert computer users to analyse and visualise linked data, thus generating actionable information by means of reporting, OLAP analysis, dashboards or data mining (Corrales-Garay, et al., 2022). Thanks to this information, organizations can track their performance comparing indicators with business objectives and competitors, analyse consumer behaviour, discover problems, and predict success, which allows them to make better decisions to improve processes and results (Al-Okaily et al., 2023).

BI implementation must be addressed from two perspectives: the technological view and the managerial view (Attar-Khorasani, et al., 2023). The technological view is focused on the tools, software, and computer to find, collect, organize, and access a wider range of information from disparate data sources. On the other hand, the managerial view is focused on the coordination and management of the processes to offer timely, actionable, high-value, and accurate business insights from data stored in different information sources (inside and outside the company) (Chee at al., 2009).

The Balanced Scorecard (BSC) (Kaplan & Norton, 1996) is a kind of Business Intelligence tool (Nuseir et al., 2021; Olszak et al., 2022) that allows strategy to be translated into action. It is structured in four perspectives (Financial, Customers, Processes and Training). In developing the BSC, a hierarchical structure is employed to

define long-term strategic objectives and to calculate the indicators with which to measure the degree of achievement of the objectives, for each perspective. The top-down process of the Balanced Scorecard ensures that all the business processes and action plans are aligned with the achievement of the business strategy. This feature of the BSC, together with its relative simplicity to deal with organization intangibles, makes it suitable to manage the concepts of sustainability (Figge et al., 2002).

Integrating sustainability into management has recently known a great debate in literature and has been covered by the new business management style called Re-engineered 4th Generation Management (Hallioui et al., 2022), a new businesses generation oriented towards sustainability and customer, to make businesses more contemporary in a landscape of industry 4.0 (Smiari et al., 2020), circular economy (Tjahjadi et al., 2023), smart cities; competitiveness, and diverse stakeholders (Addazi et al., 2021).

As pointed out by (Baumgartner, 2014; Gond et al., 2012), to develop sustainability strategies managers need to be perfectly aware of the consequences of their decisions. This requires an accurate calculation of key performance indicators and the evaluation of their alignment with the goals. Hence, the BSC is a suitable performance measurement and management control tool for implementing the dimensions of sustainability in the strategic management of organizations (Küçükbay & Sürücü, 2019).

The Sustainability Balanced Scorecard (SBSC) is an evolution of the BSC (Mamudu et al., 2023), combining the four classical BSC perspectives with sustainability ethical, environmental, social, governance and other concerns, as well as sustainability objectives and performance measures. There are four possible ways to do this (Mio et al., 2021): To integrate sustainability concepts within the four classic BSC perspectives; to incorporate sustainability concepts within the Customer Perspective; to define a new perspective; or to develop a new BSC with only the sustainability dimensions.

The SBSC can support companies in the implementation of a sustainable strategy, which involves promoting sustainability management and decision-making, supporting regulatory data requirements and meeting stakeholders' information demands (Schaltegger & Wagner, 2006). However, although the SBSC is a suitable Business Intelligence Tool for integrating sustainability and strategy in businesses (Hansen & Schaltegger, 2016) and is attracting growing interest from academia and practitioners (Hansen & Schaltegger, 2018), there is a need for research on SBSC frameworks and methodologies to support their development and application (Shreyanshu et al., 2023; Mio et al., 2021).

This scarcity of research on SBSC development is especially relevant in universities (Fuchs et al., 2020). Universities play a fundamental role in sustainable and inclusive development based on the transfer of knowledge and innovation through their curricula and research projects (Filho et al., 2023; Hurtado, 2019). Universities are aware that

sustainability is a factor of university quality and creates a favourable reputation and enhances employees' commitment, morale and productivity in internal business processes (Saeidi et al., 2015). Universities worldwide are changing their mission, vision, infrastructure (Mac-lean, et al., 2022; Lee & Lee, 2021) and educational practices to better cope with growing concerns about social and environmental issues and to respond to growing public demand for a sustainable society (Lin et al., 2016). Indeed, the top universities in the international rankings are now increasingly institutionalizing sustainability practices within their curricula, research, business process, outreach and assessment (Salvioni et al., 2017).

Therefore, it is important to know the lessons learned from universities' experiences in adopting the SBSC as a support for the integration of sustainability in their strategy and day-to-day management. This understanding will foster the adoption of sustainability by university managers around the world.

To support university managers in the management of sustainability using an SBSC, this paper describes an exploratory study conducted on the lessons learned by three universities that included sustainability within their strategic definition and implementation using the SBSC. The findings obtained make it possible to identify key aspects in the process of employing the SBSC as a tool for integrating sustainability in the management of the university. The study seeks to contribute to the recent, scarcely investigated research challenge concerning how organizations address sustainability through performance measurement tools, such as the SBSC (Wu et al., 2021; Yaakub & Mohamed, 2020).

This paper is organized as follows. Section two shows the research method used to carry out the research. Section three presents the findings obtained from the multiple-case study conducted at three universities with the aim of obtaining a methodology that can be used to develop an SBSC. Lastly, section four discusses the results and shows the conclusions.

3.2. Research methodology and findings

The research was conducted using the qualitative multiple-case study method, which has been developed by different authors. In this research, the recommendations set out in Yin (1994) for inductive analysis of qualitative data were followed, together with the recommendations detailed in Walsham (1995) for improving an existing theory using interpretive case studies in the information systems field. This made it possible to establish the methodological issues regarding the performance and reporting of this study.

Therefore, the research method for the conceptualization and execution of the case studies was divided into seven phases:

1. Definition of research goals and questions.

2. Proposed theoretical model.
3. Identification of units of analysis. Case selection.
4. Definition of research methods and resources.
5. Fieldwork. Data collection, classification of information and triangulation.
6. Formulation of the enhanced theory, model or methodology.
7. Verification of the rigour and quality of the study.

In the following sections, the results obtained in each phase of the application of the research method are outlined.

3.2.1. Definition of research goals and questions

The goals of this case study were: (a) to test a methodology to integrate sustainability concepts into the management systems of educational institutions using a sustainable balanced scorecard; (b) to analyse the findings in order to determine the improvement offered by the methodology; (c) to improve the initial methodology with the aid of the lessons learned and the conclusions drawn from the case study; and (d) to develop practical examples that can be used as reference models in other implementations.

A research question, which will be evaluated while the case study is being carried out, was developed: *How can universities incorporate sustainability within their management system, thereby aligning their strategy and action plans with sustainability?*

3.2.2. Proposed theoretical model

Firstly, to gain a better understanding and clearer vision of the topic, a literature review was carried out. Then, the theoretical model that would be applied to different universities was defined. The theoretical model is a methodology organized in phases, activities and tasks that allows a sustainable balanced scorecard (Table 13) to be planned, designed, built and controlled in order to integrate sustainability within the management systems of educational institutions. The phases are typical of the development of an information system, but the activities and tasks are specific to the development and implementation of an SBSC.

Table 13 Proposed theoretical model.

Phase	Activity	Task
BI Planning	Project Planning	Creation of project teams
		Project scope and objectives
		Project activities and resources
		Project communication plan
BI Analysis and Design	Business Re-Design	Internal and external analysis of the organization
		Mission, Vision, Values, Strategy
		Identification of critical success factors

	Strategic Balanced Scorecard Design	Definition of perspectives, objectives and indicators, at a strategic level
		Strategic cause-effect map
	Business Process Re-Engineering	Process analysis. AS-IS model
		Process redesign. TO-BE model
		Determine the key business processes for success
		Business processes improvement plan
	Tactical and Operational Balanced Scorecard Design	Definition of indicators at the operational level
		Indicators cause-effect map
	Balanced Scorecard Validation	Indicators system validation
		Cause-effect relationships validation
BI Implementation	BI Computer System Implementation	BI software implementation and integration with other enterprise systems
	Human Resources	Training seminars
BI Control	Project Monitoring and Continuous Improvement	Monitoring of the achievement of the BSC goals
		Action Plans

3.2.3. Identification of units of analysis. Case selection

Following Walsham's (1995) proposal concerning the generalization of a theory from an interpretative investigation of case studies, the proposed theoretical model was applied to three universities to integrate sustainability into their management systems using a sustainable balanced scorecard.

In accordance with the purposive sampling approach for the identification and selection of information-rich cases with the most effective use of limited resources (Patton, 2002), the criterion of selecting only universities was adopted. This selection was made because it satisfied the following criteria: (1) Universities stated their availability, interest, cooperation and access to required information, which are necessary requirements to participate in this kind of research (Palinkas et al., 2016); (2) In multi-case studies, the cases need to have a standard variable, for example a set of companies in the same industry (Diop & Liu, 2020). In this case, the three case studies belong to the same business activity: the research and education field; (3) Proposed theoretical model application to these universities had the potential capacity to generate the necessary enhancement of the basic theory, which is another necessary requirement (Crowe et al., 2011); (4) Homogeneous and typical case sampling, like the one used in this study offer greater depth in the findings. Therefore, the results of the theoretical model application to the three universities can be used as reference models for academics and practitioners interested in improving the sustainability of other universities, a business activity where there is a scarcity of research on SBSC implementation; and (5) The homogeneity of the case studies make it easier to arrange meetings, create templates for gathering data, etc. and simplify the process of analysing the findings.

University 1 (UNI 1) is a young Spanish university founded at the beginning of the 90s. It has around 15,000 students, 1500 teachers and 480 employees. University 2 (UNI 2) is a Spanish university also founded at the beginning of the 90s, with around 200.000 students, 1500 teachers and 1400 employees. Finally, University 3 (UNI 3) is a South American university founded at the beginning of the 90s with around 22,000 students, 1300 teachers and 500 employees.

3.2.4. Definition of research methods and resources

After selecting the three universities, the fieldwork was prepared and begun. To carry out the application of the proposed theoretical model, mixed work teams were set up, whose members were the authors and staff of the participating universities. Throughout seminars and meetings, department managers and middle management staff of the different universities related to the project were informed of the goal of the project, the phases of the proposed theoretical model, and the aspects related to sustainability that had to be worked on in each of those phases.

After executing each phase of the methodology, data were collected through interviews using a combination of templates and questionnaires, as well as copies of the reports and documents used in the universities. Interviews were carried out after executing each phase to solve any problems and/or apply the improvements suggested before starting execution of the next phase. The objectives of the interviews at each phase were: to analyse the findings, to obtain feedback from the experience of the interviewees, to detect problems and errors encountered, and to collect proposals for improving the methodology. The questions asked in the interviews were adapted to the specific characteristics of each phase and were the same for each interviewee.

3.2.5. Fieldwork. Data collection, classification of information and triangulation

Data collection consisted in gathering the results of applying the proposed theoretical model in each of the universities. The next step was to classify the different suggestions for improving the proposed theoretical model put forward by each of the mixed work groups as a result of their experience.

In accordance with Yin (1989), multiple data sources (primary data from semi-structured interviews and questionaries) and secondary data (from universities' documents and information disclosure on the web and social networks) were chosen to ensure the research could be replicated theoretically. Other sources used in qualitative studies, such as images and videos, were not used because they were considered of lesser value.

Following the principle of triangulation, the criterion adopted in this research was that of incorporating into the initial SBSC methodology any proposal for improvement reviewed and agreed on by the members of the mixed work teams.

3.2.6. Formulation of the enhanced theory, model or methodology

Next, the most important improvements suggested by the three universities are shown, organized according to the activities displayed in Table 13, together with examples of the application of the methodology.

Project Planning activity

The first activity consists of project planning and aims to create project teams, determine the scope, carry out a project plan and create a communication plan.

Team building. In the three cases, the first proposal is to create a coordinating team and several organizational units made up of personnel from the university itself. Each team and individual member must know their roles, responsibilities and objectives. To this end, an analysis of the organizational structure of the university is carried out and the key units of the university that must participate in the project are identified. In addition, the profiles required to undertake the project are identified, namely, specialists in finance, human resources, computer engineering and quality management. In the case of UNI 3, profiles specialized in CSR and sustainability, and workers' representatives are also included.

In the three cases, the teams will have access to training and information actions to promote the skills and commitment of the participants that make up the team. Voluntary participation and transparent selection of team members are also promoted. There should be a balanced representation of men and women in the teams. UNI 2 highlights the importance of the involvement of senior management as of this initial phase for the success of the project.

Finally, the stakeholders that must be taken into account are defined. UNI 3 defines stakeholders classified on three levels, according to the model proposed by Jancic (1999): 1) stakeholders with whom an unavoidable relationship is maintained: students, employees and suppliers; 2) stakeholders with whom a necessary relationship is maintained: media, environment, other universities, local population, companies, public administration, alumni; and 3) stakeholders with whom a desirable relationship is maintained: neighbours' associations, sports associations, NGOs, social action groups, cultural action groups. UNI 1 also includes the creation of a Stakeholders Committee that will actively collaborate in the development of various project activities and in the validation of project results.

Project scope. The scope of the project is broken down in financial, social and environmental terms. UNI 3 also emphasizes the need to consider the academic, research and management fields of the university.

Project Plan. In the three cases, the project plan includes objectives, responsibilities, phases, activities and timing.

Communication plan. In the case of UNI 1 and UNI 2, the communication plan is internal to disseminate the project to all internal university stakeholders. However, in the case of UNI 3, an internal and an external communication plan are defined. In addition to the communication plan, it is defined who will be responsible for preparing and disseminating the communication material, and the communication mechanisms and channels to be used (meetings, emails, web content, etc.).

Table 14 shows a summary of the proposed improvements to the Project Planning activity.

Table 14 Improvements to the Project Planning activity.

Task	Improvements	Who	How
Creation of project teams	Definition of a coordinating multidisciplinary team (CT)	Management Staff	-
	Definition of multidisciplinary teams at the operational level (OT)	CT	
	Definition of objectives per team	CT and OT	Meeting
	Definition of roles and responsibilities per team and member	OT	
	Definition of dialogue mechanisms between the different teams	CT	-
	Training actions in the team prior to the start of the project		
	Stakeholder mapping		
	Creation of a Stakeholders Committee (SC)	Management Staff	
Definition of the scope of the project	Definition of the economic scope	Management Staff, CT and SC	Round table
	Definition of the social scope		
	Definition of the environmental scope		
	Definition of the organizational scope (academic, research and management)	Management Staff and CT	Meeting
Realization of the project plan	Definition project goals	Management Staff, CT and SC	Round table
	Timing of the phases and activities of the project including those responsible in each case	CT	-
Create a project communication plan	Internal communication plan		-
	External communication plan		
	Definition of communication managers and channels		

Mission, Vision, Values, Organizational Strategy. In all three cases, the Mission, Vision, Values and Organizational Strategy were re-defined from a Triple Bottom Line perspective, including economic, environmental and social aspects, and considering the relevant stakeholders.

- In the case of UNI 1, it was considered essential that the Stakeholders Committee created in the first phase actively participated in the re-definition of the university Mission, Vision, Values and Strategy.
- UNI 2 included within its mission facilitating access to university education as much as possible… always in favour of sustainability.
- UNI 3 included within its vision being socially recognized for its University Social Responsibility.

Internal and external analysis of the university and the identification of the key success factors.

- The three universities used a SWOT analysis (Table 15). In the comparison, although all the universities consider different sustainability aspects, little emphasis is placed on the environmental dimension.
- In addition to the SWOT analysis, UNI 1 used other techniques such as the PESTEL (political, economic, social, technological, environmental, and legal) analysis, and the Porter (1985) value chain analysis.
- In UNI 3 the SWOT analysis was complemented with another technique, the CAME (Correct, Confront, Maintain, Export) analysis.

Examples of critical success factors identified are: 1. The quality and the social and environmental commitment of the teaching provided; 2. Efficiency in economic, social and environmental management; and 3. Having a socially responsible research and development (R&D) programme.

Table 15 Comparison of the SWOT of each University.

SWOT	D.I.M.	UNIT 1	UNI 2	UNI 3
S	**ECO**	• High-quality technological infrastructure	• Increase in technological resources	
	SOC	• High commitment to promoting equal opportunities between women and men	• Continuous improvement of services • Commitment to Social Responsibility • Increase in the number of qualified personnel	• New policy for the integration of students in vulnerable situations. • Implementation of the Transparency and Information Law
	ENV			
	E&R	• High quality of teaching • Permanent increase in international cooperation agreements • Attractive offer of undergraduate and postgraduate studies	• Integrated and well-structured system • Large size and deployment of the university with centres in all provinces and abroad • Implementation of the Balanced Scorecard	• Graduate students tracking system
W	**ECO**	• Difficulty in obtaining funds for R&D&I • Need to improve infrastructures	• Limited financial resources	
	SOC		• Distant relationship between students and university • Lack of social presence and attention to students	• Limited accessibility of data to stakeholders
	ENV			
	E&R	• Need to improve students' skills (communication, leadership, public speaking, etc.) • Improvement of the transfer process in research • Need to improve language teaching	• The students have a limited perception of the university's work (administration, teaching, etc.) • Results in satisfaction surveys could be improved • Stagnation in the promotion of research	• System for collecting student satisfaction ratings could be improved
O	**ECO**	• European funds for R&D&I	• GDP growth	

	DIM			
			• Increased demand for study due to high unemployment rate • Low bargaining power of suppliers	
	SOC		• Increased social mobility • Increased cultural interest • Better reputation through CSR	• Becoming one of the most advanced universities in CSR
	ENV		• Increased environmental awareness	
	E&R	• Selection system for the best students • Companies demand lifelong learning • Improved collaboration with the private sector to expand job opportunities	• Technological improvements facilitating distance study • High barriers to entry	• Talent attraction through graduate tracking system • Increased demand for access
T	ECO	• High competitiveness with surrounding universities	• Cuts due to non-compliance with the deficit • Lower public investment in R&D&I • Increase in potential competitors • High rivalry between competitors • Increased customer bargaining power	• Reduction of public subsidies for the financing and maintenance of the university due to the economic crisis
	SOC	• Declining industrial environment • Legislative uncertainty	• Demographic ageing • Political uncertainty	• Increased dropout and repetition rates among its students • Loss of qualified staff on a voluntary basis • Drop in staff performance
	ENV	• Weather conditions in winter		
	E&R			• Termination of work placement agreements with companies and institutions

Note: S: Strengths; W: Weaknesses; O: Opportunities; T: Threats; DIM: Dimension; ECO: Economic; SOC: Social; ENV: Environmental; E&R: Education and research

Table 16 shows a summary of the proposed improvements to the Business Re-Design activity.

Table 16 Improvements to the Business Re-Design activity.

Task	Improvements	Who	How
Vision, Mission, Values and Strategy	Redefinition of the Vision, Mission, Values and Organizational Strategy from the Triple Bottom Line	Management, CT and SC	Round table
Internal and external analysis of the company	Analysis economic perspective		Round table, SWOT, PESTEL, CAME and value chain analysis
	Analysis social perspective		
	Analysis environmental perspective		
Identification of critical factors for success	Critical factors for economic success	Management and CT	–
	Critical factors for social success		
	Critical factors for environmental success		

Strategic Balanced Scorecard Design activity

In this activity, the strategic map of the university is built, which includes the strategic objectives organized by perspectives and their relationships; the indicators proposed to measure the degree of achievement of the strategic objectives; and the cause-effect relationships between the indicators.

Each university has considered different perspectives to classify the indicators:

- UNI 1 establishes four perspectives: knowledge transfer, transparency & accountability, governance, and relations with the environment and society.
- UNI 2 establishes five perspectives: funders, customers & suppliers, internal processes, employees & training, and society & environment.
- UNI 3 defines seven perspectives: financial, customers & suppliers, processes, technology, training & labour relations, social, and environmental. Once the perspectives have been defined, in all three cases the strategic objectives and the indicators for their measurement are identified.

Regarding the definition of indicators, UNI 2 uses a template to detail the characteristics of each indicator, the maximum and minimum acceptable values for the indicator, the frequency of measurement, the degree of importance, as well as the corrective actions in the event that the indicator is out of range.

Regarding the representation of the strategic map:

- UNI 2 uses a table that includes perspectives, objectives and indicators, without showing the relationships between the different objectives.
- However, UNI 1 and UNI 3 have made a graphic model that organizes the perspectives hierarchically, and establishes the relationships between the different strategic objectives of each perspective.

Figure 9 shows an example of part of the strategic map of a university, showing the definition of objectives and indicators by perspective, and the cause-effect relationships between the indicators.

Figure 9 Example of the strategic map of a university, and the cause-effect relationships.

Table 17 shows a summary of the proposed improvements to the Strategic Balanced Scorecard Design activity.

Table 17 Improvements to the Strategic Balanced Scorecard Design activity.

Task	Improvements	Who	How
Define objectives and indicators by perspective at the strategic level	Inclusion of social and environmental perspectives	Management, CT and SC	Round table
	Definition of strategic objectives based on the triple bottom line		
	Definition of indicators for each strategic objective	Management and CT	Template
Cause-effect strategy mapping	Detect, define and represent cause-effect relationships using a graphic model	CT	-

Business Process Re-Engineering activity

In this phase, the university's business processes are analysed and a redesign is carried out, incorporating the necessary improvements to achieve the previously defined strategic sustainability objectives.

- In all three cases, templates are used to collect different aspects of the process, such as the name of the process, description, type of process, objectives, indicators, critical factors for success, inputs, outputs, relationship with other processes, deficiencies and improvement plans.
- In UNI 1, a graphic modelling of the processes is also carried out to facilitate their understanding and analysis.
- In UNI 3, templates are also proposed to document the improvement actions.
- In the case of UNI 1 and UNI 3, a proposal was put forward to define a periodic evaluation system based on internal and external audits, and internal stakeholders' satisfaction surveys.

Examples of the business processes identified and improved at the three universities are: Teaching, Research, Research transfer, Student placement assistance, Human resources management, Technological development, Purchases, Design of the training offer, and Infrastructure and equipment.

Table 18 shows a summary of the proposals put forward to improve the Business Process Re-Engineering activity.

Table 18 Improvements to the Business Process Re-Engineering activity.

Task	Improvements	Who	How
Analysis and re-design of processes: AS-IS →To-BE	Business process modelling	CT	Templates, modelling
Process improvement plan	Establishment of a periodic evaluation system		Internal and external audits, satisfaction surveys

Tactical and Operational Balanced Scorecard Design activity

In this phase, the objectives and indicators at the operational level and their cause-effect relationships are defined. To this end, the three universities define a set of responsibility centres (for example, office of the rector, administration and services staff, teaching staff, etc.) and establish tactical and operational objectives. All these objectives are aligned with the previously defined strategic objectives, establishing a hierarchy of objectives. In addition, the indicators that will make it possible to measure its degree of compliance are defined. Table 7 shows an example of this hierarchy of indicators.

Table 19 Example of the hierarchy of indicators.

	Strategic	Tactical	Operational
Goal	Promote the environmental responsibility of the university	Improve waste management on university campuses	Reduce waste generated Reduce consumption of paper in administrative posts
Indicator	Percentage of waste generated according to type (paper, plastic, glass, organic)	Number of waste disposal points established per campus	Number of orders for paper placed per year by the university centre

In all three cases, it stands out that each unit and person in the university must know the importance of their work in achieving the strategic objectives of the university. Therefore, they can also participate in defining the indicators at the tactical and operational level.

Table 20 shows a summary of the proposed improvements to the Tactical and Operational Balanced Scorecard Design activity.

Table 20 Improvements to the Tactical and Operational Balanced Scorecard Design activity.

Task	Improvements	Who	How
Definition of objectives and indicators at the tactical and operational level	Definition of responsibility centres	Management and CT	–
	Definition of the levels to be included in the scoreboard according to the project objectives and the structure of the university	CT and OT	
Cause-effect strategy mapping	Detect, define and represent cause-effect relationships using a graphic model	CT	–

Balanced Scorecard Validation activity

In this phase, the entire system of indicators, the goals established, and the cause-effect relationships are validated, making any adjustments that might be required. To validate the relationship between indicators and to define the goals:

- UNI 1 uses data from previous periods, and the participation of the Stakeholders Committee.
- UNI 2 proposes the participation of stakeholders through dialogue tables for validation through a triangulation analysis of the indicators and their relationships.
- UNI 3 uses data from previous periods and proposes the periodic validation of the BSC and its indicators, so that the cause-effect relationship can be verified and, where appropriate, modified.
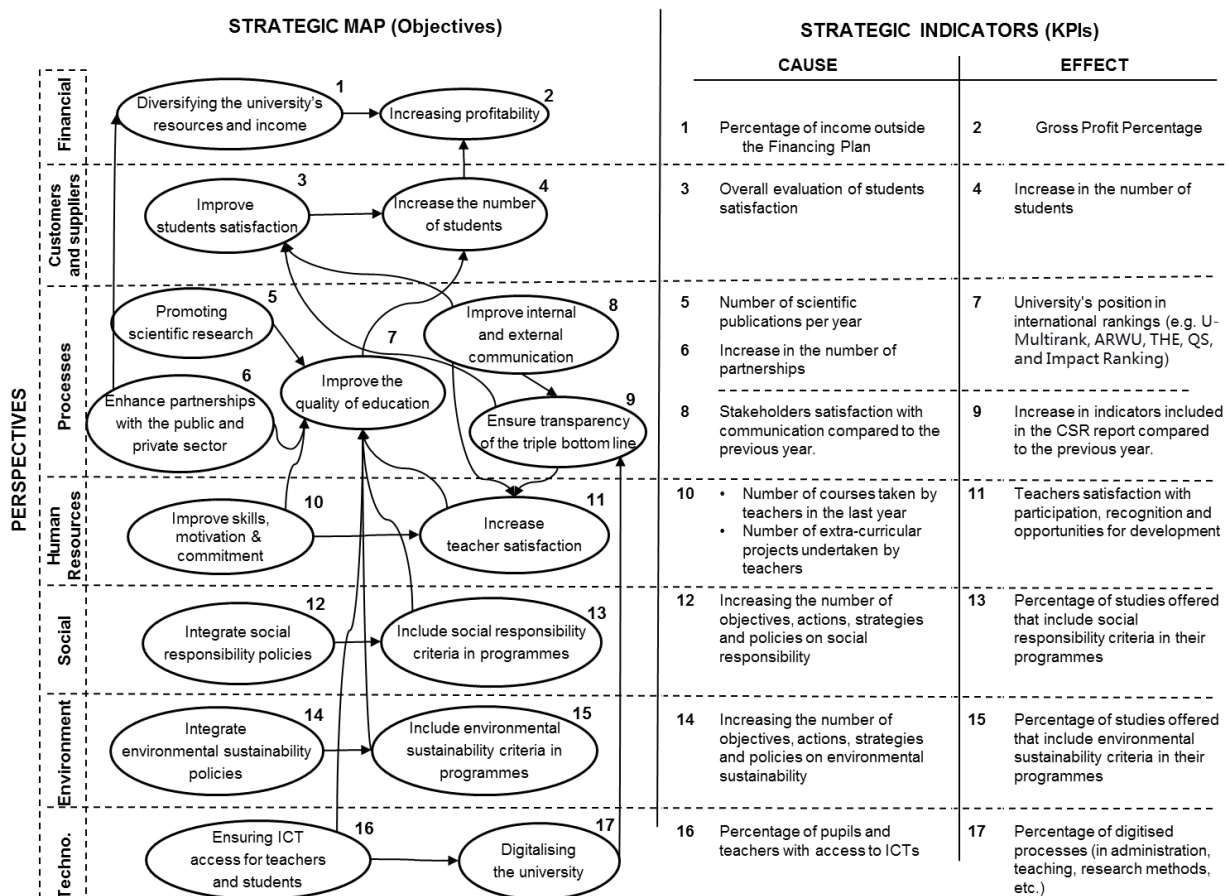
Table 21 shows a summary of the proposed improvements to the Balanced Scorecard Validation activity.

Table 21 Improvements to the Balanced Scorecard Validation activity.

Task	Improvements	Who	How
Validation of the indicator system	Identification of relevant indicators	CT and SC	–
	Periodic validation of relevant indicators		
Validation of cause-effect relationships	Historical Data / subjective estimations	CT, OT and SC	Computer program Triangulation
	Stakeholder opinions		

Implementation of Business Intelligence System activity

Digital tools are needed to facilitate the implementation of SBSCs (Olawumi & Chan, 2022). They automatically allow the collection and processing of data to calculate the indicators, and their subsequent visualization.

- In all three cases, the implementation of the Business Intelligence computer system requires a project led by a person in charge of the Information Systems department.
- Also, in all three cases, the purchase of an existing Balanced Scorecard Business Intelligence software package is chosen. To select it, at UNI 2 the functional requirements that must be fulfilled were previously defined and classified in seven areas: administration, monitoring, decisional, alert, general, human resources and technological (Table 22).
- In all cases, it is necessary to develop the ETL processes (extraction, transformation and loading) to obtain data from the source systems (for example, the ERP of the university) and to load them in a data warehouse.

Table 22 Software functionalities of the balanced scorecard BI software.

Aspects	Functional requirements
Administration	Capacity to easily set up perspectives, objectives, action plans, indicators and cause-effect relationships
Monitoring	Monitor strategy implementation in real time, with detailed analysis reports on objectives and indicators
Decisional	Include mechanisms to verify the behaviour of indicators based on the decisions and the action plans drawn up
Alert	Provide warning signals if indicators are behaving outside the established limits
General	Users can easily design reports and graphic representations
Human Resources	Analyse the performance of each employee by verifying the achievement of their objectives and goals for the fulfilment of the strategy
Technological	Facilitate mechanisms to distribute and exchange information among all members of the university Integration with other existing IT systems

Table 23 shows a summary of the proposed improvements to the Computer System Implementation activity.

Table 23 Improvements to the Computer System Implementation activity.

Task	Improvements	Who	How
Design, implement/ parameterize BI software	Definition of requirements	CT	Template
Integrate the application with ERP and other systems	Creation of a Data Warehouse		-
	Develop ETL processes		

Human Resources Implementation activity

In all three cases, emphasis is placed on the importance of human resources (HR) training for correct change management, the use of the balanced scorecard BI software, the execution and management of the university business project, and obtaining information from the stakeholders to support decision-making.

- At UNI 1, two communication and training plans are established, one for the SBSC development and the other for change management. Therefore, all university units and employees are aware of the SBSC implementation and adapt their work to the new strategic, tactical and operational objectives.
- UNI 2 points out the need to extend training to all relevant stakeholders.
- In the case of UNI 3, they implement a communication and change management plan, establish a group of specialists to support university staff in the use of the balanced scorecard BI software, promote staff training, and introduce a continuous improvement system based on users' suggestions (for example, a suggestions box).

Table 24 shows a summary of the proposed improvements to the Human Resources Implementation activity.

Table 24 Improvements to the Human Resources Implementation activity.

Task	Improvements	Who	How
Training seminars for HR	Establishment of a training team (TT)	Management	-
	Definition of a training plan for SBSC development and another for change management, including stakeholders		
	Development of a BI software management guide for the implementation of the SBSC	TT	
	Establishment of dialogue mechanisms to obtain feedback and implement improvements in the user experience of the BI software		

Project Monitoring and Continuous Improvement activity

- At UNI 1, the monitoring phase begins with the establishment of a plan for communicating the project results to the stakeholders. A strategy monitoring committee is then established to periodically analyse the indicators, identify risks and define improvement action plans.
- In the case of UNI 2, in the different associated centres such as schools and faculties, there is a person in charge of monitoring the SBSC. They are responsible for analysing the result of the indicators, assessing deviations and making proposals for improvement when appropriate. The results will be made public on the university website.

Suggestions for improvement from the various internal and external stakeholders will be taken into account to draw up action plans.

- In UNI 3, different monitoring periods are defined at the strategic and operational levels. In the first case, the indicators will be evaluated every six months and in the second case, monthly. The strategic objectives and the indicators to measure them will be valid for a maximum of 4 years, coinciding with the strategic plans of the university. After this period, their validity will be reviewed. In the case of the operational objectives and the indicators to measure them, a validity period of one year is established. After this period, its continuity will be reviewed.

Table 25 shows a summary of the proposed improvements to the Project Monitoring and Continuous Improvement activity.

Table 25 Improvements to the Project Monitoring and Continuous Improvement activity.

Task	Improvements	Who	How
Monitoring of the achievement of the SBSC goals	Establishment of an evaluation team (ET)	Management	
	Establishment of review periods for the validity of strategic objectives and indicators	CT and ET	⌐
	Establishment of review periods for operational objectives and indicators		
Action plans	Establishment of internal and external dialogue mechanisms to obtain feedback and implement improvements	ET	–
	Internal and external communication plan for accountability / sample of results and improvements made		

3.2.7. Verification of the rigour and quality of the study

Lastly, findings were evaluated to check their degree of confidence and validity using the model developed by Yin (1998). This model proposes four tests to ensure the consistency and reliability of research based on case studies: construct validity, internal validity, external validity, and the reliability tests. Therefore, to ensure the validity of the results, each of the four tests was checked according to Yin (1998) recommendations. Construct validity has been proved because data collection was carried out using multiple data sources, and the final methodology was decided by agreement from the members of the different team works. Internal validity has been proved because triangulation was applied to the analysis of the information gathering from semi-structured interviews, direct observations and review of documentation. External validity has been proved applying the methodology to more than one case. This has proved its theoretical replication, a fundamental issue in external validity

achievement. Finally, reliability has been proved because a strict protocol has been followed for data collection, the Walsham (1995) protocol. Therefore, the study can be repeated with the same results. So, the validity and quality of the study that was carried out can thus be confirmed.

3.3. Discussion

Existing SBSC research lacks a systematic methodology that can be used by universities to integrate sustainability concepts into their management systems, along with practical examples that can be used as reference models. Therefore, this study contributes to the development of SBSC since the proposed methodology covers the following gaps in current SBSC applications in universities:

1. Existing SBSC methodologies focus only on specific sustainability issues such as supporting university green marketing strategies (Fuchs et al., 2020), to implement and monitor environmental education programmes in universities (Guerra et al., 2018), to foster industrial academic cooperation (Lin et al., 2016) or to achieve university economic sustainability (Yaakub & Mohamed, 2020) instead of adopting a holistic approach that would enable them to improve all the environmental, social and economic university performance. Therefore, they offer limited sustainability information to effectively address the stakeholders' needs (Nejati & Nejati, 2013). This is the ***first contribution*** of the methodology proposed in this study. The methodology addresses a comprehensive vision of the concept of sustainability, considering all sustainability dimensions in the project planning, Business Re-Design, Balanced Scorecard Design, business process reengineering, human resources, and technology development.

2. It is necessary to develop methodologies to guide the implementation of SBSC throughout the whole project life-cycle. Existing methodologies consider only part of the SBSC project life-cycle, such as (Hurtado et al., 2019), who focus only on the University Key Performance Indicators design. This is the ***second contribution*** of the proposed methodology. The methodology covers this gap in the literature since it guides practitioners in SBSC implementation, considering, aligning, and integrating different aspects that must be taking into account in the SCRM project such as project planning, Business Re-Design, Balanced Scorecard Design, business process reengineering, human resources, and technology.

3. Finally, there is a lack of empirical verification (Hubbard, 2009). This is the ***third contribution*** of this study. The methodology has been tested and debugged by means of a study of three real-life cases.

Therefore, the methodology for SBSC development and implementation showed in this study contributes to the management and information systems theory because it makes it possible to overcome the three above mentioned shortcomings identified to date in sustainability management implementation in universities. Thus, it considers all the sustainability

dimensions, it describes all the project life-cycle activities, it encourages stakeholders' participation, and it has been proved to work in real situations.

On the other hand, findings demonstrate that the classical BSC, which has been widely proved and tested in real business situations, can be used to integrate sustainability aspects into the strategy and the management system of universities, thereby aligning their strategy objectives and action plans with sustainability (answer to the research question in section 3.1), which is in line with claims made by other authors (Al-Bahi et al., 2021; Leal et al., 2018; Mohd & Hairuddin, 2018), but it needs to be modified to address stakeholder and sustainability aspects simultaneously.

3.3.1. Impact of the research in the universities

The application of the methodology has led to changes in the values and organization of the different universities where the methodology was applied. These changes are summarized in a greater commitment from the governing bodies to social and environmental sustainability; the improvement of transparency and accountability; the analysis and reduction of the environmental impact posed by the establishment and development of an infrastructure like that of the University on the territory and its biodiversity; the enhancement of well-being, quality of life, and coexistence within the university community; the utilization of the institution's physical, human, and scientific resources in a collaborative manner to serve the nearest society and those communities most in need; and in the necessity of establishing mechanisms to identify and respond to the interests and expectations of stakeholders.

As a consequence, new objectives, action plans to achieve them, and indicators, which were not previously present in the performance measurement systems of the three universities, have been proposed. They are mainly related to the governance, social and environmental sustainability dimensions. However, they also will have positive financial impact in the universities in the medium term because some of them lead to increased incomes and to the reduction of costs such as energy costs.

Table 26 shows a compilation of the new objectives, action plans and indicators related to sustainability due to the application of the methodology. They are measurable results of the benefits of applying the methodology.

Table 26 New Objectives, Action Plans, and Indicators related to Sustainability.

Objectives (O) and Action Plans (AP)	Indicators
O: Contribute to social progress and sustainable development. AP: Develop a university model that contributes to the dissemination of ethical values and promotes respect for the environment. UNI 1	• Number of academic programs that incorporate ethical and values education into their curriculum (UNI 2). • Number of R&D projects per year related to sustainable development and contribution of the business world to generate a positive impact on the environment (UNI 2).

O: Establish mechanisms for external communication to receive and process the needs and expectations of external stakeholders. AP: Implement an online communication system to receive suggestions and complaints from various stakeholder groups. Establish a department to filter requests and redirect them to the appropriate body.	• Number of queries-responses processed through the online platform, differentiated for each stakeholder group (UNI 1; UNI 3). • Satisfaction survey with feedback from stakeholders, differentiated for each stakeholder group (UNI 1).
O: Achieve a sustainable and stable funding model. AP: Increase alternative sources of funding beyond government funding.	• Volume of income from self-financing sources (academic courses, Research & Development & Innovation Projects funded by public and private organizations) (UNI 2; UNI 3). • Volume of income from donations (UNI 3).
O: Publish economic, social, and environmental results. AP: Enhance transparency and facilitate access to information through a material and relevant accountability process for various stakeholder groups.	• Increase in sustainability indicators included in the sustainability report compared to the previous year (UNI 1; UNI 2). • Increase in fulfilled expectations of stakeholder groups compared to the previous year (UNI 1; UNI 3). • Number of improvements introduced in communication channels and tools for processing information from dialogues with stakeholder groups (UNI 1; UNI 2).
O: Drive new governance models in the university. AP: Disseminate the purpose and focal point of the organization as well as principles and conduct through the existence of a Code of Conduct.	• Number of periodic reviews/evaluations of Mission, Vision, and Strategic Objectives (UNI 1). • Number of issues incorporated into the ethical, conduct, and good governance Codes (UNI 1). • Number of periodic evaluations of the effectiveness of ethical policies (UNI 1). • Number of gender equality training courses (UNI 1; UNI 2).
O: Integrate environmental sustainability policies into institutional policy and university management. AP: Increase institutional involvement in sustainability policies. Translate institutional commitment into daily actions led by the university. Establish environmental sustainability policies in supplier contracting. Create an environmental office.	• Number of governance agreements including sustainable policies compared to the previous period (UNI 1). • Increase in the percentage of contracts with suppliers meeting environmental requirements compared to the previous period (UNI 1; UNI 2; UNI 3). • Environmental certification of processes (UNI 1; UNI 2).
O: Strengthen the quality and social content of teaching. AP: Enhance support for groups with specific needs.	• Number of teachers and students with disabilities (UNI 2; UNI 3).
O: Minimize the most common environmental impacts of university activity resulting from consumption (energy, water, and materials) and their subsequent pollution	• Increase in the number of university facilities powered by renewable energy sources and the percentage of such facilities compared to the previous year (UNI 1; UNI 2).

(mainly in commuting to university facilities in private vehicles). AP: Quantify and analyze consumption in all facilities to subsequently carry out efficient improvement actions. Increase the use of renewable energies generated by the university itself. Promote initiatives to encourage the use of public transportation and carpooling,	• Decrease in energy consumption compared to the previous year (UNI 1). • Increase in the percentage of university community members using public and shared transportation (data obtained from internal staff surveys and student enrolment forms) (UNI 1; UNI 3). • Percentage of direct and indirect greenhouse gas emissions (UNI 3).
O: Environmental education and awareness for the entire university community. AP: Environmental volunteering programs that provide training and awareness through practical activities in contact with the environment where the universities are located.	• Increase in the number of environmental awareness activities, volunteer programs, biodiversity characterization programs of the environment, cross-cutting environmental education content in curricula, training actions for staff and faculty, etc., compared to the previous period (UNI 1; UNI 2; UNI 3).
O: Engage the 'university community' in supporting charitable causes. AP: Development of actions that facilitate volunteering and collaboration with NGOs, and promotion of applying knowledge to charitable causes.	• Increase in the number of volunteer promotion plans among the 'university community' (UNI 1). • Increase in the number of international cooperation projects involving the university, agreements, and active projects in collaboration with NGOs (UNI 1; UNI 2).
O: Strengthen the presence of the university in its surroundings. AP: Bring the local community closer to the University.	• Increase in the number of sports and cultural activities held for the population and projects carried out between the University and local authorities, compared to the previous year (UNI 1). • Increase in the number of contracting with geographically close supplier companies (UNI 3).

3.3.2. Limitations

This research is based on three cases within a specific sector. The small sample size and case method approach limits the ability to generalize the findings. Therefore, the results may not be necessary generalizable to other business and industry settings. Some case specific features such as the sector or company size might influence the generalizability. Nonetheless, the preliminary results, the use of primary data (interviews and questionnaires) and secondary data (documents), and the rich understanding of the phenomenon provided by the three in-depth real case studies suggest that it could be considered as a representative case of companies of the time and its findings sufficiently generalizable. On the other hand, another limitation is that any quantitative positive or negative financial impact was observed during the research.

3.4. Conclusion

In this paper, the authors have presented a methodology that enables university managers to implement the three sustainability dimensions in their day-to-day university management, using a sustainable balanced scorecard. The proposed methodology describes all the phases, activities and tasks of the whole university SBSC project life cycle, integrating the improvement of the university sustainability strategy; fulfilling the stakeholders' requirements and needs, and at the same time encouraging and involving them in the establishment of the university's objectives and action plans; the re-engineering of the university business processes; the development of the computer system for the calculation and visualization of indicators; and human resources training.

Findings can be useful for academics, who can complement the methodology by new theoretical contributions, and can adapt the methodology for the application to other business sectors. It can also be helpful for practitioners (university managers, computer engineers, sustainability managers), who can use the methodology and the examples of the application of the methodology to the three case studies as a guide for SBSC development in other universities.

Finally, future research should be lead to avoid the main paper limitation, the necessity to prove the generalization of the findings. To do so, more cases with similar and different contexts would provide more insights about the cross-sectional application of the proposed methodology. Only analytical generalisation is claimed rather than any statistical generalisation. On the other hand, quantitative analysis of the financial impact of a Sustainable Balanced Scorecard implementation could be addressed.

Disclosure statement

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Chapter 4. Sustainable customer relationship management

Sustainable customer relationship management (SCRM) is a combination of business strategy, customer-oriented business processes, and computer systems that seeks to integrate sustainability into customer relationship management. The purpose of this paper is to contribute to the body of knowledge of marketing, business management, and computer systems research domains by classifying in research categories the current state of knowledge on SCRM, by analysing the major research streams, and by identifying a future research agenda in each research category.

To identify, select, collect, synthesise, analyse, and evaluate all research published on Sustainable Customer Relationship Management, providing a complete insight in this research area, the PRISMA methodology, content analysis and bibliometric tools are used.

139 papers were analysed to assess the trend of the number of papers published and the number of citations of these papers; to identify the top contributing countries, authors, institutions, and sources; to reveal the findings of the major research streams; to develop a classification framework composed by seven research categories (CRM as a key factor for enterprise sustainability, SCRM frameworks, SCRM computer tools and methods, Case studies, SCRM and sustainable supply chain management, Sustainable marketing, and Knowledge management) in which academics could expand Sustainable Customer Relationship Management research; and to establish future research challenges.

This paper have an important positive social and environmental impact for society because it will lead to an increase in the number of green and socially conscious customers with an ethical

behavior, while also transforming business processes, products and services, making them more sustainable.

Customer Relationship Management in the age of sustainable development is an increasing research area. Nevertheless, to the authors' knowledge, there are no systematic literature reviews that identify the major research streams, develop a classification framework, analyse the evolution in this research field, and propose a future research agenda.

4.1. Introduction

Enterprises worldwide are being pushed to be more socially responsive and environmentally sustainable, while increasing company value and continue being customer-oriented (Das & Hassan, 2021). This has forced to an evolution in Customer Relationship Management (CRM) towards Sustainable Customer Relationship Management (SCRM). SCRM can be defined as taking into account social, economic, and environmental impacts when creating long-term fruitful customer relations. Moreover, SCRM aims to engage sustainability-conscious customers, and to increase consumer awareness of corporate sustainability issues (Müller, 2014).

To implement SCRM, an enterprise has to transform its CRM business processes in new sustainability orientated processes (Chalmeta & Barqueros-Muñoz, 2021). However, development of the research on SCRM is still limited, and there are few examples of SCRM applications to real cases (Gil-Gomez et al., 2020); and hence practitioners have problems integrating sustainability in Customer Relationship Management (Gil-Gomez et al., 2020). Existing SCRM literature usually consider sustainable as a synonym of a long-term business activity or analyse only one of the sustainability dimensions (economic, environmental, or social) with little research that provides an integrated perspective on how sustainability influence customer relationship management (Jang & Lee, 2021). Therefore, sustainability in CRM is presented as a mutilated concept lacking a holistic view. In addition, SCRM is commonly focused only on marketing, without taking into account other CRM areas such as sales or post-sales (Ližbetinová et al., 2019). Consequently, more research is needed in this field (Liu & Chen, 2022).

The above shortcomings could limit its impact. To overcome the research gap between the increasing interest in the integration of sustainability in customer relationship management, and the scarcity of systematic literature reviews on this subject, this paper proposes the following research objectives: (1) to analyse the current state of the SCRM research, (2) to define a classification framework that organises research developed identifying significant common items, and (3) to highlight gaps in the existing knowledge. The hypothesis is that a study of current SCRM research can systematise the scientific knowledge of the phenomenon and set directions for future research. In this context, the below research questions (RQs) are developed:

RQ1: Which are the most relevant institutions, sources, authors, countries, and the most cited papers in the field of Sustainable Customer Relationship Management?

RQ2: Is it feasible to classify SCRM research papers on the basis of relevant common points?

RQ3: Which are the future challenges in the research area of Sustainable Customer Relationship Management?

The increasing number of papers in the SCRM research area need to be studied and analysed to identify research topics, main findings and gaps that can be approached in future research. Therefore, to answer the above research questions, this paper (1) carry out a systematic literature review on Sustainable Customer Relationship Management, since it has been validated as an effective research tool that enables an accurate evaluation of the findings to date (Breslin, & Gatrell, 2020); (2) gives a deep insight into the research area by using content analysis and bibliometric tools to analyse 139 papers and to identify the most relevant institutions, countries, sources, authors, and research categories related to SCRM; (3) identifies and analyses the most cited papers; (4) proposes seven topics that would push academics to expand research on SCRM; and (5) identifies the future research challenges in every research topic. To perform the bibliographic analyses, the PRISMA approach was used (Bandyopadhyay & Ray, 2020).

This paper is organized in the following way: Section 2 shows a review of the background related to SCRM. Section 3 describe the research methods and tools used to perform the systematic literature review and the categories identification. Section 4 presents the findings of the bibliographical and content analyses. Section 5 discusses the findings, and finally, section 6 shows the conclusions, with the future work and research limitations.

4.2. Background

4.2.1. CRM

Customer Relationship Management (CRM) is a change in the enterprise strategy that moves from a product-focused strategy to a customer-focused one (Cierna & Sujova, 2022). Previously, business strategies were focused on the product or service, and the goal of marketing was to convince customers to buy them. This change, together with the development of new information and communication technologies, and new forms of business organization has converged in what it is currently known as CRM, which transforms the relationships between companies and clients (Lokesh et al., 2022). The aim is create value for customers, understand their needs and offer value-added services (Meha, 2021).

CRM does not have a single definition. In the literature, it has been analysed from different academic disciplines such as Marketing, Business, Management, Information Technology (Migdadi, 2020); and it has been conceptualised from five different viewpoints: (1) Process,

(2) Strategy, (3) Philosophy, (4) Capability, and/or (5) Technological tools (Meena & Sahu, 2021). Therefore, CRM is not just technology. A suitable implementation of CRM requires an integrated and balanced approach to people, process and technology. Despite this different approaches, many definitions agree that the main business areas of CRM are marketing, sales, and after-sales support (Sun & Wang, 2022), and that the objective is to establish long-term relationships with customers in order to generate value between customers and company.

CRM allows enterprises (1) to have an integrated, single view of customers, by using analytical tools; (2) to manage customer relationships in a single way, regardless of the communication channel; and (3) to improve the effectiveness and efficiency of the processes involved in customer relationships (Li & Xu, 2022). Therefore, CRM provides multiple benefits to the company and to customers, such as greater customer satisfaction, better service, better customer segmentation, personalized service, etc (Chalmeta, 2006).

4.2.2 Sustainable Customer Relationship Management

Sustainable has become a key strategic objective worldwide. It can be defined as satisfy humanity current needs without compromising future generations needs (Brundtland, et al., 1987). However, there are other numerous definitions of the sustainability concept (Langa et al., 2021) which can be classified into 5 categories (Lozano, 2008): (1) conventional economists' perspective; (2) non-environmental degradation perspective; (3) integrational perspective, i.e. encompassing the economic, environmental, and social aspects; (4) inter-generational perspective; and (5) holistic perspective.

The awareness about sustainable development has generated a new paradigm in the enterprise values and policies and in the way of understanding business, and has triggered new management models that take into account the economic, social and environmental impact of their decisions (Luu et al., 2019; Yu & Xu, 2022). The aim is to generate long-term shared value (de Villiers et al., 2022) between the enterprise and its internal and external stakeholders, combining economic and social value (Blackburn et al., 2018).

In this context, the Sustainable Customer Relationship Management arises as an evolution of the CRM (Tian et al., 2021). Müller (2014) states that SCRM means become aware of environmental, social, and economic impact of customer-oriented business process, as well as to communicate corporate sustainability issues among their customers, which will increase corporate value among its sustainability-conscious customers.

SCRM is a consequence of (1) the sustainability awareness in companies (Ceccarini et al., 2022) ; (2) the information technologies evolution such as Digitalization, Big Data, etc. that allows the re-engineering of the CRM business processes, making them more sustainable (Chalmeta & Barqueros-Muñoz, 2021); and (3) the increase of highly responsible consumers (Papadopoulou et al., 2022) who, aware of the negative impacts of the current model of consumption and production, seek more sustainable lifestyles (Figure 10)

Figure 10 Evolution of the CRM concept to Sustainable CRM
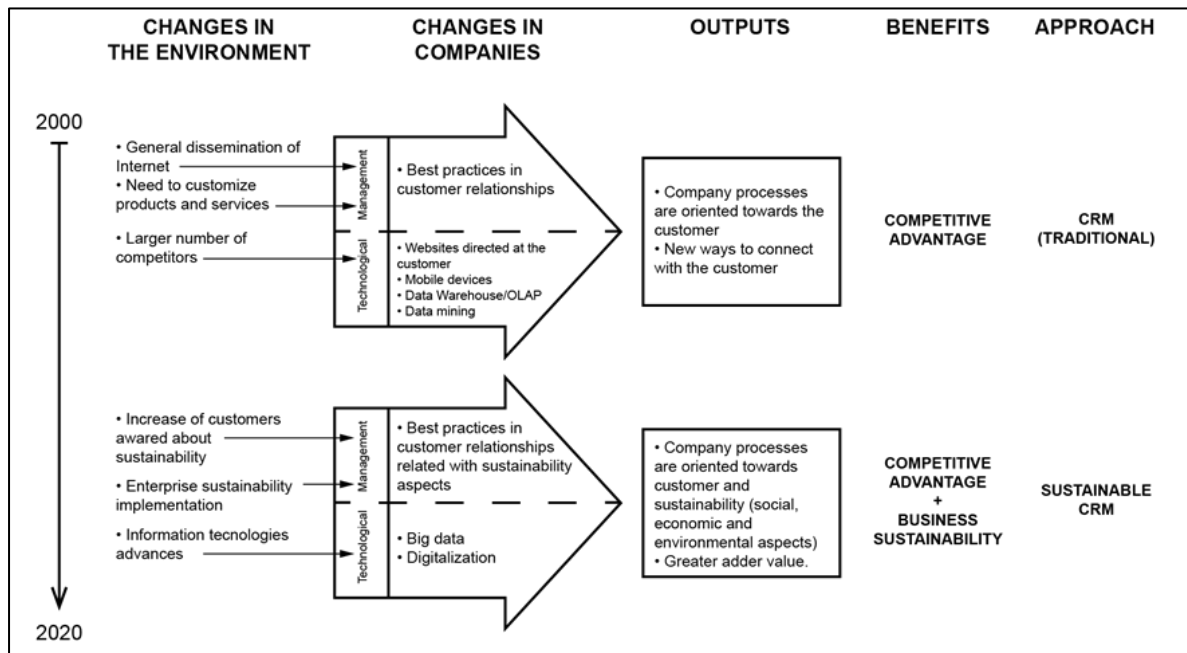
4.3. Research methodology

To answer the three research questions, RQ1, RQ2, and RQ3, a systematic literature review has been carried out. Systematic literature review is a research method that allows to identify, select, collect, synthesise, and evaluate all research published on a particular research area. The results obtained are showed in Section 4.

The research was conducted following the criteria of preferred reporting items for systematic reviews and meta-analysis (PRISMA) (Liberati et al., 2009). These include the following steps: (1) eligibility criteria; (2) information sources; (3) search terms; (4) study selection; and (5) data collection process and synthesis (Figure 11).

Figure 11 Research methodology steps

1. Eligibility criteria

- Research papers, review papers and conference/congress papers
- English
- Published in peer-reviewed journals

2. Information sources

- Scopus
- Web of Science

3. Search terms

(customer relationship management" OR "CRM") AND ("sustainable" OR "sustainability")

4. Study selection

643 papers
[Web of Science (364) and Scopus (279)]

↓

462 papers
[Web of Science (183), Scopus (98), papers published in both Web of Science and Scopus (181)]

→ **181 duplicated papers**

↓

139 papers. Final sample
[Web of Science (30), Scopus (40), papers published in both Web of Science and Scopus (69)]

→ **323 papers out of topic**

5. Data collection process and synthesis

- Identification of the top contributing countries, authors, institutions, and sources in the area of Sustainable CRM (RQ1)
- Identification of research categories (RQ2)
- Identification of future research challenges (RQ3)

4.3.1 Eligibility criteria

Studies were eligible for inclusion if they were: research papers, review papers and conference/congress papers since they are regarded true knowledge (Ramos-Rodrígue & Ruíz-Navarro, 2004); directly relevant to sustainable customer relationship management; they were written in English; and published in peer-reviewed journals.

We excluded studies if they were: not written in English; books, thesis and conference proceedings; papers that focused on other sustainability domains such as supply chain, education sustainability; and papers that were not available in full text.

4.3.2. Information sources

We conducted an organised, systematic and comprehensive wide-ranging search of two online databases: Web of Science and Scopus. These two databases were selected because they combine both a rigorous selection process and wide interdisciplinary coverage. For this reason, they are the main sources of bibliographic citations used for bibliometric analyses (Martínez-López et al., 2018).

4.3.3. Search terms

The collection of papers was conducted by selecting those papers that had specific keywords related to our research aims and questions in the title, in the abstract or in the keywords section (Table 27). These keywords were customer relationship management, CRM, sustainable, and sustainability.

Logical operators were connected with different sets of keywords and designed as follows: ("customer relationship management" OR "CRM") AND ("sustainable" OR "sustainability")

Table 27 Search strategy

Data Base	Keywords	Content	Period	Document	Language
Scopus and Web of Science	("customer relationship management" OR "CRM") AND ("sustainable" OR "sustainability")	TITLE ABS KEY	Until June 2022	Research & Review Journal& Conference Papers	English

4.3.4. Study selection

The study selection process attempts to analyse, evaluate and identify relevant articles based on the goals of our systematic review. This process was independently performed by the two co-authors of this study. Firstly, records are identified through different information sources (online databases) using the keywords. Secondly, once all records are obtained, records are excluded based on duplicates (Linnenluecke et al., 2020). Thirdly, once all duplicates are removed, records are screened based on "title, abstract and keywords". Any studies that did not meet the eligibility criteria were excluded. Finally, a "full-text" screening of all studies was performed. A meeting was carried out to discuss and agree on the final studies that are included in this systematic review.

4.3.3. Data collection process and synthesis

The search concentrated on research papers and review papers published until June 9, 2022. In our initial search, we found 643 papers (364 papers from Web of Science and 279 papers from Scopus.). The number of duplicated papers removed were 181. Applying the eligibility criteria, we excluded papers by screening the title, the abstract and the keywords (for example papers whose CRM acronym is related with Coastal Resource Management; Copper Raw Materials; Coral Reef Management; Clinical Risk Management; Climate Risk Management, etc were excluded). Finally, we excluded papers based on the full text screening. Hence, the final sample consisted of 139 papers.

We used Microsoft Excel 2016 to collect basic publication data such as date, title, authors, publisher, DOI, URL, pages, volume, issues, keywords.

The analysis of the data collection allowed to identify the top contributing countries, authors, institutions, and sources in the area of Sustainable CRM (RQ1), to establish research categories (RQ2) and to identify future research challenges (RQ3).

For the research categories identification, the comparative method proposed by Collier (1998) was used. This method enables the identification of common points shared by the papers through a content analysis, so that the categories emerged. Content analysis is "an effective tool for analysing a sample of research documents in a systematic and rule-governed way" (Seuring and Gold, 2012). It allows an objective identification of the content in a data set, such as selected articles (Sandberg, & Jafari, 2018). It overlaps with the concept of thematic analysis, which is mainly a qualitative method for uncovering different categories within a data set (Fugard and Potts, 2015).

A first categories classification was done taking into account the aim of the paper and its contribution to the state of the art. Then, the capacity of the categories classification to arrange all the papers was checked paper by paper. If a paper did not fit into any research category, the classification was redesigned to integrate the incompatible paper. The categories classification was reconsidered several times until all the papers on the sample were properly distributed.

As a result, seven main SCRM research categories were identified: CRM as a key factor for enterprise sustainability, SCRM frameworks, SCRM computer tools and methods, Case studies, SCRM and sustainable supply chain management, Sustainable marketing, and Knowledge management. We also created a qualitative and quantitative evidential narrative summary for each CRM research category.

Any disagreements between co-authors of this study were settled through consensus.

4.3.4. Finding analysis

Once the final sample of papers had been defined, the analysis tools provided by Scopus and Web of Science and were employed to determine the evolution in the number of papers

published by year; to analyse the number of papers published by author, country, institution, and journal; to analyse the indicators of relevance, impact and prestige of the ten journals with the most published articles on the list; to analyse the content of the ten most cited articles on the sample.

4.4. Findings

4.4.1. Bibliometric Analysis

Trend in the publication of papers

The first article detected in the systematic literature review dates back to 2001. Since then to date, the number of papers has evolved greatly, and a growing trend is observed (Figure 12). The number of papers published in 2022 corresponds to the period between January and June. Therefore, the number of publications at the end of 2022 should exceed the number of publications in previous years.

Figure 12 Trend in the publication of papers
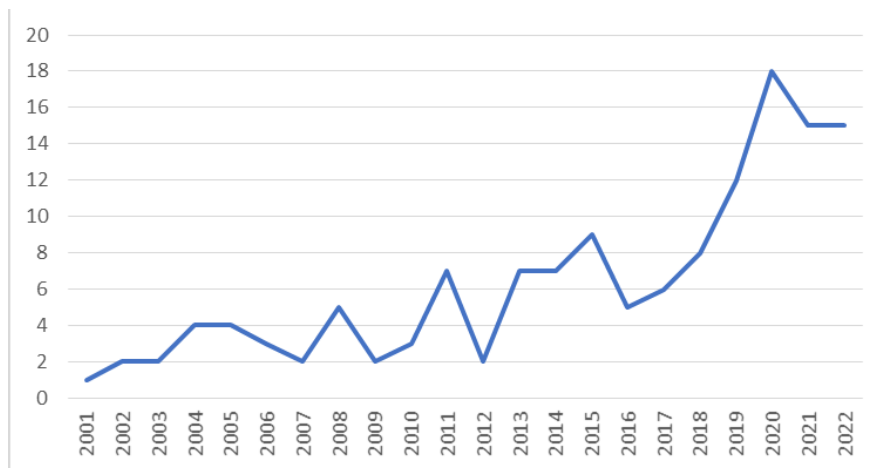
Most influence authors

In the analysis of the authors, there is no one that highlights significantly regarding the number of publications. This can be due to there is limited number of specialists in the area. There are only eight authors with three articles. The rest of the authors have two papers or less.

Table 28 Top contributing authors

Author	No. docs	Total Author Citations (Scopus/WoS)	Date of the first publication of the sample	Citation per article (Scopus/WoS)
Gholami, H.	3	330 / 276	2015	Gholami, et al., 2018 (9/4) Gholami, et al., 2015 (17/12) Gholami, et al., 2020 (4/3)
Saman, M.Z.M.	3	1471 / 1147	2015	
Sharif, S.	3	3829 / 2491	2015	
Zakuan, N.	3	2060 / 1207	2015	
Gomez, J.M.	3	543 / 698	2011	vom Berg et al. 2017 (2/0) vom Berg et al. 2014 (1/0) Memari et al. 2011 (0/0)
vom Berg, B.W.	3	17/5	2011	
Lee, Y.I.	3	220 / 208	2006	Lee & Trim, 2006 (23/13)
Trim, P.R.J	3	408 / 151	2006	Trim & Lee, 2004 (7/0) Trim & Lee, 2008 (16/11)

Most influence countries

Regarding the countries, there is a leadership of India, followed by the United Stated and China. These three countries with higher number of publications account for approximately one third of the total number of publications related to the study area (see Table 29).

Table 29 Top 12 contributing countries

Country	No of docs
India	22
United States	16
China	12
United Kingdom	10
Germany	
Malaysia	8
Italy	6
Taiwan	
Turkey	
Canada	5
Czech republic	
France	

Top contributing institutions

The analysis of the institutions reveals that none highlights significantly regarding the number of publications. Therefore, there is no institution with a high degree of expertise in this research area (Table 30).

Table 30 Top contributing institutions

Institution	No of docs
Universiti Teknologi Malaysia	4
Birkbeck University London	3
Indian Institute of Technology System Iit System	3
University of Nicosia	3
Appl Sci Private Univ	2
Celal Bayar University	2
Dimitrie Cantemir Univ	2
Dokuz Eylul University	2
Indian Institute of Management Lucknow	2
Indian Institute of Technology Iit Kharagpur	2
Insead Business School	2
Institute of Technology Business Ceske Budejovice	2
Kyoto University	2
Nanjing University of Science Technology	2
National Institute of Industrial Engineering Nitie	2
National University of Singapore	2
Royal Holloway University London	2
Technical University of Ostrava	2
Technical University Zvolen	2
Tomas Bata University Zlin	2
Universidade De Sao Paulo	2
Universität Oldenburg	2
Universitat Politecnica De Valencia	2
University of London	2
University of Massachusetts System	2

Institution	No of docs
Zkv Career Sro	2

Most cited papers

Regarding papers citation analysis, the most cited paper has 760 citations, which stands out significantly from the rest of the citations.

Table 31 shows the ten most cited papers.

Table 31 Ten most cited papers

Article	Abstract	Citations (Scopus/WoS)
The customer relationship management process: Its measurement and impact on performance (Azad & Ahmadi, 2015). Published in Uncertain Supply Chain Management	This article conceptualises and validates a construct for the SCRM. It also empirically investigates the consequences of its implementation on business performance.	0/760
Using e-CRM for a unified view of the customer (Pan & Lee, 2003). Published in Communications of the ACM	It discusses the development of e-commerce, and the new business models and business opportunities emerging from e-CRM.	153/100
Green supply chain performance measurement using the analytic hierarchy process: a comparative analysis of manufacturing organisations (Dey & Cheffi, 2013). Published in Production Planning and Control	The objective of the study is the development and implementation of an analytical framework for measuring the environmental performance of manufacturing supply chains. The novelty of this framework is that it integrates supply chain processes (including CRM) with strategic and operational organisational decision levels.	122/101
Measurement of resilience and its application to enterprise information systems (Wang et al., 2010). Published in Enterprise Information Systems	This article proposes a different and unique measure of resilience for CRM information systems. The article ends with an example to illustrate it.	84/70
An exploratory study of implementation of customer relationship management strategy (Osarenkhoe & Bennani, 2007). Published in Business Process Management Journal	The paper provide insights on the core components of CRM and the implementation of a sustainable CRM strategy.	85/45

Article	Abstract	Citations (Scopus/WoS)
Customer relationship management in the hairdressing industry: An application of data mining techniques (Wei et al., 2013). Published in Expert Systems with Applications	The study applies data mining techniques to a RFM (recency, frequency, and monetary) model in a hair salon in Taiwan to segment customers and develop marketing strategies.	70/47
New service bonds and customer value in customer relationship management: The case of museum visitors (Siu et al., 2013). Published in Tourism Management	The study explores the profits of a long-term sustainable customer relationship.	61/56
Sustainability in The Banking Industry: A Strategic Multi-Criterion Analysis (Raut et al., 2017). Published in Business Strategy and the Environment	The paper develop an integrated Multi-criterion Decision Making (MCDM) model for sustainability evaluation of banking services practices. The model evaluates sustainability from four perspectives: financial stability, customer relationship management, internal business processes and environmental management system.	50/44
Customer engagement in a Big Data world (Kunz et al., 2017). Published in Journal of Services Marketing	This research proposes a data-driven framework for strategic value creation and customer engagement.	0/90
Green supply chain management enablers: Mixed methods research (Dubey et al., 2015). Published in Sustainable Production and Consumption	The aim of the paper is to fill the research gap of methodological approaches and techniques that consider the dynamic nature of green supply chains.	0/87

Sources analysis

Regarding publishers, the journal that has most publications is Sustainability with nine papers. The following journals are International Journal of Productivity and Performance Management and Business Process Management Journal, with four and three publications. These three journals have published roughly the 11% of the papers of the sample, so it can be concluded that there is no journal specialized in this research area.

To assess the impact and relevance of the sources, three impact indicators have been used: CiteScore, Source Normalized Impact per Paper (SNIP), and SCImago Journal Rank (SJR). The impact factors correspond to the year 2021 and were collected from Scopus.

Table 32 shows the results of the journals evaluation according to these three indicators.

Table 32 Sources analysis

Source	n	CiteScore	SNIP	SJR
Sustainability	9	5	1.310	0.664
International Journal of Productivity and Performance Management	4	4.9	1.310	0.578
Business Process Management Journal	3	6.2	1.464	0.844
Journal of Cleaner Production	3	15.8	2.444	1.921
Benchmarking an International Journal	2	7.4	1.421	0.894
Economic Research Ekonomska Istrazivanja	2	4.9	1.329	0.565
Enterprise Information Systems	2	8.2	1.557	0.868
International Journal of Supply Chain Management	2	1.0	0.438	0.190
Management of Environmental Quality	2	6.7	1.189	0.816
Mediterranean Journal of Social Sciences	2	-	0.681	0.135
Procedia Manufacturing	2	-	-	-
Quality Access to Success	2	1.8	0.370	0.211

4.4.2. Research categories

A content analysis of the 139 articles was carried out to identify (1) a classification framework composed by seven research categories that organize papers according to common issues, and (2) future research challenges in Sustainable CRM.

The research categories obtained are shown in Table 33. The number of papers in each category is showed in brackets in the first column. The description of the state of existing knowledge in every category has been carried out analysing the five most cited papers in every category.

Table 33 Research categories

Categories and Number of papers	Description
CRM as a key factor for enterprise sustainability (20)	This category includes articles that argue and/or conclude that CRM is a factor that enhances or improves corporate sustainability. For example, Ahuja et al. (2019) demonstrate that, from a multi-automotive company perspective, Customer Relationship Management is a highly significant causal Human Critical Success Factor in efficient adoption of Sustainable Manufacturing practice. On the other

Categories and Number of papers	Description
	hand, Vesal et al., (2021), prove that CRM positively impact micro, small and medium enterprises (MSME) business sustainability and future opportunities. Apart from that, Bahri-Ammari & Soliman (2016) demonstrates the importance of CRM and service quality perception in maintaining a sustainable and profitable relationship with customers. Additionally, Guerola-Navarro et al., (2021) develop a research model for measuring the impact of CRM that demonstrate the correlation between CRM and business sustainability. Bhat & Darzi, (2018) analyse the role of CRM capability towards the goal of sustainable competitive advantage (SCA)–. Finally, Pohludka & Štverková (2019) conducted a marketing survey in small and medium-sized companies, concluding that the need of CRM for long-term business sustainability
SCRM frameworks (4)	This category encompasses articles proposing a framework or model to achieve sustainable CRM. Osarenkhoe & Bennani (2007) propose a process-oriented integrative framework that facilitate successful implementation of a sustainable CRM strategy. Furthermore, Gil-Gomez et al. (2020) developed a framework to assess the effect of each one of the three business areas of CRM (sales, marketing, and services) on the three dimensions of sustainability (economic, environmental, and social). Hasani et al. (2017) prove that CRM plays a significant role in the sustainability of start-up companies and develop and test a framework to asses the technological, organisational, environmental and managerial effects on SCRM adoption in start-up companies. Finally, Shukla & Pattnaik (2019) establish the value of sustainability in CRM and propose a conceptual framework for modern businesses through its integration with various social networking sites that produces volumes of real-time data.
SCRM computer tools and methods (51)	This category comprises articles that explain and/or propose useful techniques or tools for the development of SCRM. Mainly, they are segmentation techniques, computational models, methodologies, and data processing techniques. On the one hand, Reinartz et al. (2004) conceptualize and operationalize (in two cross-sectional studies across four different industries and three countries) a method to measure the degree to which CRM processes have been implemented in order to build sustainable relations with costumer. Apart from that, Pan et al. (2006) introduce the concepts of relational incentive, relational value and relational tool that position indirect communications as an important contender to direct communications for sustainable organizational relationship building. Wang et al. (2010) highlights the relevance of the resilience in service systems (such as CRM) and present a method to measure the resilience based on the recovery ability of the system. Furthermore, Wei et al., (2013) segmentate customers and develop marketing strategies by adopting data mining techniques to apply in RFM (recency, frequency, and monetary). Finally, Kunz et al., (2017) propose a strategic framework based on Big Data to align both the customer and firm perspectives.
Case studies (30)	This category includes case studies where SCRM is applied to specific companies or business sectors. Different business sectors have been considered: tourism industry, manufacturing industry, finance sector, hospitality sector, education sector, etc. For instance, Siu et al. (2013); contribute to the literature on CRM analysing the role of new service bonds (i.e., the newness and meaningfulness of new services provided by organizations) as a relationship tactic for customer value for long-term sustainability, in the context of the museum industry. Moreover, Raut

Categories and Number of papers	Description
	et al. (2017) develop an effective and integrated model for the evaluation of the sustainability practices in banking services, which considers the CRM as one of the model perspectives. Additionally, Güçdemir & Selim (2017) propose a simulation optimization approach that integrates CRM and Production Planning and Control approaches in order to use manufacturing resources of job shops more effectively in satisfying customers and thus gain a sustainable competitive advantage. On the other hand, Racherla & Hu (2008) assert that e-CRM systems provide firms with a sustainable competitive advantage and identify influential factors (classified under the Technology-Organization-Environment framework) that drive hospitality firms to adopt CRM systems. Finally, Gholami et al. (2015) applies CRM for a strategic leadership towards sustainable development in the education sector, concluding with a new concept called Student Relationship Management (SRM).
SCRM and sustainable supply chain management (20)	This category encompasses articles focused on sustainable supply chain management (SCM) that consider CRM as a part of SCM. For example, Dey & Cheffi (2013) consider CRM as a supply chain process in the development of an innovative green supply chain (GSC) performance measurement. Additionally, Dubey et al. (2015) highlights CRM as an enabler for green supply chain management (GSCM). Additionally, Mohanty (2018) found that CRM is an operational factor that enables the integrated logistics for sustainable supply chain. Moreover, Hazen et al., (2020) use the circular economy as method to explore the SCM processes including CRM. Finally, Duque-Uribe et al., (2019) propose a framework to identify sustainable SCM practices composed by 12 categories including CRM
Sustainable marketing (10)	This category comprises articles that propose strategies or models for sustainable marketing. For example, Ližbetinová et al. (2019) states that marketing strategy is a key process to achieve sustainable growth and attracting customers, and prove this analysing three company clusters in Slovakia. Moreover, Lee & Trim (2006) propose, from a retail marketing perspective, the "organizational resilience value system" model that is useful to establish a customer relationship management policy that provides the organization with a sustainable competitive advantage. Additionally, Trim & Lee (2008) highlight the influence that marketers have in the development of sustainable partnership arrangements; and outlines the link between organizational learning and customer relationship management. Hitka et al. (2019) identify the positive changes in company performance, as a result of a re-evaluation of marketing to satisfy customers who care about social and environmental issues. Finally, Mishra & Prasad, (2014) develop a model to understand linkages between consumers' brand loyalty with respect to various product categories and socio demographic variables in order to appreciate customer relationship marketing (CRM) strategies in the Indian context.
Knowledge management (3)	This category includes articles that analyse knowledge management in CRM. Evangelista & Durst, (2015) identify that CRM is one of the three basic elements through which building-up appropriate KM approaches strategies in the area of environmental sustainability. Additionally, Khasawneh & Alazzam (2014) states that knowledge is key for achieve sustainability and competitive advantage, and they develop a model for customer knowledge management. Finally, Fairchild (2011) analyses the sustainability KM metrics proposed in the literature, and proposes a measurement model for KM metrics.

Table 34 shows a summary of the future research challenges on SCRM, made by a content analysis of the papers in each topic. It is interesting to highlight that the most cited papers in the research area, shown in

Table 31, are mainly in the category *SCRM computer tools and methods* (five of the ten articles). The other five papers belong to category *Case stu*dies (two articles), category *sustainable supply chain management* (two articles) and category *SCRM frameworks* (one article).

Table 34 Future research challenges

Categories	Future Research Challenges
CRM as a key factor for enterprise sustainablity	- To explore the link between CRM and the three dimensions of business sustainability (economic, social and environmental). - To evaluate the changes, limitations and benefits between traditional CRM and SCRM implementation in the short, medium and long term, and for each one of the sustainable dimensions. - To define customer-oriented sustainability indicators and to develop SCRM maturity models
SCRM frameworks	- To develop theoretical frameworks that consider all sustainability dimensions to support SCRM implementation in companies. These frameworks should develop specific methodologies and best practices adapted to different business sectors, to facilitate their application in real cases. - Furthermore, these frameworks should consider how to integrate SCRM into existing CRM
SCRM Computer tools and methods	To develop new specific technologies, techniques and tools for SCRM management and implementation. For example, techniques that enable the identification and assess of customers perceptions in terms of social, environmental and economic aspects, such as SCRM Balanced Scorecards, or Big Data analytics.
Case studies	- To carry out more SCRM case studies in different business sectors and different contexts (such as developed and developing countries), that addresses all sustainability dimensions. - To analyse how specific characteristics of a business sector influence the SCRM implementation in a company.
SCRM and sustainable supply chain management	- To explore how the link between SCRM and sustainable Supply Chain Management affects the social and economic sustainability dimensions, because the majority of the research focuses on environmental aspects. - To carry out more case studies to validate the theoretical models.
Sustainable marketing	- To analyse how sustainable marketing decisions influence R&D programs - To explore how sustainable marketing could be an enabler for Corporate Sustainability and Corporate Social Responsibility - To develop cross-industry and cross-cultural studies.

Categories	Future Research Challenges
Knowledge management	• To analyse the link between Knowledge Management (KM) and the three sustainability dimensions in SCRM, because current research only focus on the environmental dimension.

4.5. Discussion

This study has applied the PRISMA systematic literature review approach, which not only categorised and organised the existing literature in a systematic and valid manner, but also identified the main potential areas for future research. The PRISMA approach guarantees a replicable, scientific and transparent process to minimise bias and provides an audit trail of the reviewer's decisions, procedures and conclusions, which is a necessary requirement in systematic reviews (Tranfield et al., 2003).

4.5.1. Contributions to theory

The findings shown in this paper contribute to the theory on sustainable CRM because:

1. According to Paul and Criado (2020) and Paul et al. (2021), a systematic literature review should be written when there is a substantial body of work in the domain (at least 40 articles for review), and no systematic literature review has been conducted in the field in recent years (within the last 5 years). Therefore, this paper covers a gap in the domain of Sustainable Customer Relationship Management, as it updates the only systematic literature review carried out to date (Müller, 2014), expanding the period of analysis up to June 2022. In addition, it analyses papers from the Scopus and Web of Science databases, which follow a more rigorous selection process than the online databases Proquest and ScienceDirect used by Müller (2014).

2. According to Linnenluecke et al. (2020), descriptive statistics (e.g. frequency tables) should be used to summarise the basic information on the topic gathered over time in systematic reviews. This paper uses bibliometric statistical analysis techniques to show significant information in the SCRM domain such as the top contributing countries, authors, institutions, and sources, (RQ1 answer).

3. According to Mukherjee et al. (2022; Linnenluecke, 2017; Post, et al., 2020), to make a theoretical contribution it is not enough to merely report on previous literature. Systematic literature reviews should focus on identifying new frameworks, promoting the objective discovery of knowledge clusters or identifying major research streams. Through a content analysis, this paper proposes a classification framework composed of seven research categories that shows different ways of contributing to the current state of knowledge on the topic: CRM as a key factor for enterprise sustainability, SCRM frameworks, SCRM computer tools and methods, Case studies, SCRM and sustainable supply chain management, Sustainable marketing, and Knowledge

management (RQ2 answer). In addition, instead of an arbitrary selection of evidence for category description, the five most cited papers have been selected to describe the major research streams in the research categories, which contributes to the replicability of the process and the quality of the findings.

4. According to Post et al. (2020), to make a theoretical contribution, systematic literature reviews can focus on identifying a research agenda. However, this research agenda should follow and accompany another form of synthesis, such as a taxonomy or framework. This paper synthesises the future research challenges in each research category of the proposed classification framework (answer to RQ3).

4.5.2. Contributions to managerial practice

This study offer consulting firms and managers of enterprises different lines of thought that will allow them to carry out SCRM in enterprises. Moreover, the literature classification in seven categories, enable practitioners to: (1) understand the current state of the art in SCRM, in terms of conceptualisation, frameworks, models, methods, tools, influence, and business practices; (2) know the future challenges in the seven research topics to make appropriate investment decisions about improving current tools/methods; (3) analyse the consequences of SCRM implementation.

4.5.3. Contributions to society

This paper will make significant progress towards Sustainability-oriented CRM research and implementation. This will have an important positive social and environmental impact for society because it will lead to an increase in the number of green and socially conscious customers with an ethical behavior (Roberts 2003), while also transforming business processes, products and services, making them more sustainable. This will imply, among other benefits, fairer treatment of customers and employees, the hiring and training of local people, more community consultation processes, reduction of carbon emissions or water consumption, etc.

4.6. Conclusion

The growing interests of consumers and companies in sustainability has transformed Customer Relationship Management into Sustainable Customer Relationship Management, with the aim of offering more socially and environmentally sustainable products and services while attracting and retaining sustainability-conscious customers.

To advance in the state of the art in SCRM, in this paper a systematic literature review on SCRM has been carried out. A sample of 139 papers were analysed to assess the trend of the number of papers published and the number of citations of these papers; to identify the top contributing countries, authors, institutions, and sources; to reveal the findings of the ten most cited papers; and to establish research categories and future research challenges in the area.

This study therefore addresses a critical research gap, namely, the lack of extensive systematic reviews of the current research on Sustainable CRM, which could constrain its influence. As a consequence of the study, some conclusions can be drawn: First, the number of papers is still low although the tendency is clearly on the increase, in terms of both the number of citations and the number of publications per year. Second, analyses of the influence of authors and institutions do not reveal any particular tendency or pattern. Third, regarding productivity, Gholami, H., Saman, M.Z.M., Sharif, S., Zakuan, N., Gomez, J.M., vom Berg, B.W., Lee, Y.I., and Trim, P.R.J are the top contributing authors; and India, United States, China and United Kingdom are the countries with the most publications in this field. This shows that the more productive regions are Asia and English-speaking countries. Fourth, the main sources are: Sustainability, International Journal of Productivity and Performance Management Business Process Management Journal, and Journal of Cleaner Production. Sustainability is the journal with the most papers published. Fifth, a classification by categories has been developed through a comparative analysis of the content, so as to bring some order to the research effort that is being made, which includes all the papers in the sample. This classification into seven research categories supports the future work of academics in this research area because it establishes common shared elements and patterns in every research category, and reveals those aspects that have been studied to a lesser extent and are in need of future research. The categorisation revealed that, regardless of the category and despite the volume of research in the area, few studies address a comprehensive vision of the concept of sustainability – conclusions that are in line with those of Muller (2014). In some cases, the concept refers to the economic or long-term sustainability of the company. In others, sustainability is approached only from social and/or environmental perspectives.

The systematic literature review has proved that an analysis of current research could support academics future research in SCRM as well as and practitioners work. The main conclusion is that this research area requires more research and a higher number of annual publications. The majority of papers have been published in four categories: SCRM computer tools and methods, Case studies, SCRM and sustainable supply chain management, and CRM as a key factor for enterprise sustainability; therefore more research is needed in the other three. On the other hand, it is necessary more research that consider jointly the economic, environmental and social sustainability dimensions, because the majority of the SCRM literature focus only in one of these sustainability dimensions.

Finally, it is important to highlight the limitations of this work: (1) only two bibliographical databases have been studied, Scopus and Web of Science. Other databases could be analysed to extent and contrast the findings ; (2) there is a language bias, due to the search was carry out only in English; (3) other keywords could have been used and might have produced other findings; (3) the comparative method proposed by Collier (1998) was used. Other methods, such as network analysis or Latent Dirichlet Allocation (LDA), might be used for research categories identification and may result in other classifications.

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Chapter 5. Methodology and Computer Architecture for Sustainable Customer Relationship Management

Sustainable customer relationship management (SCRM) is a combination of business strategy, business processes and computer systems that seeks to integrate sustainability into customer relationship management. However, despite the growing interest of companies in incorporating social and environmental aspects into their relationship with customers, and the increase in the number of sustainability-conscious customers seeking more sustainable lifestyles, research on SCRM is recent and limited.

This work contributes to the development of SCRM as it proposes a methodology and a computer architecture that guide the development and implementation of SCRM in a company during the whole project life-cycle. The methodology includes all the dimensions of sustainability in customer relationship management, and allows to align business strategy, business process, human resources. The computer architecture combines different information technologies and systems such as Business Intelligence, Big Data, or Online social networks.

5.1. Introduction

At the end of the 1990s, the increase in competition and digitalization generated a new form of business management, called Customer Relationship Management (CRM), where the customer was placed at the centre of corporate strategy (Guerola et al., 2021). CRM involves a combination of practices, technology and people aimed at providing a better understanding of

customers' needs, personalizing its products and services, improving customer satisfaction, sustaining customer loyalty and, thus, differentiating firms from their competitors (Meena & Sahu, 2021).

Companies' awareness of the importance of economic, environmental and social sustainability and, on the other hand, the rise in the number of highly responsible consumers who, aware of the negative impacts of consumption and production, seek more sustainable lifestyles (Anugwom et al., 2022; Lee et al., 2020) have driven CRM to evolve towards what is known as sustainable CRM (SCRM) (Hitka et al., 2019). SCRM means considering economic, environmental and social issues when establishing and maintaining long-term customer relations, as well as to increase consumer information about corporate sustainability issues and to attract and retain sustainability-conscious customers (Müller, 2014; Stekelorum & Laguir, 2021).

However, development of the research on SCRM is still limited, and hence practitioners have problems integrating sustainability into Customer Relationship Management (Gil-Gomez et al., 2020). Existing SCRM literature usually considers sustainable as a synonym of a long-term business activity or analyses only one of the dimensions of sustainability (economic, environmental or social), with little research that provides an integrated perspective on how sustainability influences customer relationship management (Jang & Lee, 2021). Therefore, sustainability in CRM is presented as a mutilated concept lacking a holistic view. In addition, SCRM is commonly focused only on marketing, without taking into account other CRM business process such as sales or post-sales (Ližbetinová et al., 2019).

Consequently, there are different gaps in the research on sustainable CRM that must be covered (Liu & Chen, 2021): (1) it is necessary to develop studies that explore the link between CRM and business sustainability, covering all its dimensions: economic, social and environmental (Bahri-Ammari & Soliman, 2016); (2) it is necessary to develop methodologies and theoretical models that help in the implementation of SCRM as a basis for future empirical analyses (Hasani et al., 2017); (3) it is necessary to identify customer-oriented sustainability metrics based on customer metrics (Das & Hassan, 2021; Müller, 2014), and (4) there is a need for cases of good practices that contemplate different industries and different contexts (such as developed and emerging countries) in order to facilitate the understanding of SCRM (Danubianu & Teodorescu, 2016; Pohludka & Štverková, 2019).

To advance in the state of the art of SCRM, this paper proposes a step-by-step methodology, called Sustainable CRM-IRIS methodology, which can guide the entire life-cycle process of integrating the different perspectives of sustainability (economic, social and environmental) into the different aspects of CRM (strategy, business process and technology). The Sustainable CRM-IRIS methodology is composed of nine phases, each of which contains different activities.

This paper is organized as follows: Section 2 presents a review of the literature related to SCRM. Section 3 outlines the Sustainable CRM methodology proposed here for the implementation of a Sustainable Customer Relationship Management. Finally, the main conclusions and the limitations of this work are analysed and discussed in Section 4.

5.2 Literature review

5.2.1. Customer Relationship Management

Customer Relationship Management (CRM) is a concept that emerged in the 1990s, establishing itself as a research field in the early 2000s (Wahlberg et al., 2009). CRM is the consequence of a change in business strategies. Previously, company strategies focused on the product or service and the objective of marketing was to convince customers to buy them. However, with CRM, the business strategy changed radically and began to focus on customers and their needs. This change, together with the development of new information technologies and forms of organization (Cierna & Sujova, 2022) converge in what is currently known as CRM, which is presented as a customer-focused business strategy that transforms relationships between companies and clients (Liu & Chen, 2022).

CRM does not have a single definition and in the literature it has been treated from different academic disciplines such as Marketing, Business and Management, and Computer Science (Payne & Frow, 2006) as well as from different points of view: (1) Process, (2) Strategy, (3) Philosophy, (4) Capability, and/or (5) Technological tools (Li & Xu, 2022). Despite this, many definitions agree that the main areas of CRM are forecasting, marketing, sales, and after-sales support (Sun & Wang, 2022) and that the goal is to establish long-term relationships with customers in order to generate value between them and the company.

This new way of managing customer relationships, together with the support offered by information technologies, allows companies to (1) have a single, integrated view of customers, (2) manage customer relationships in a personalized way, and (3) improve the effectiveness and efficiency of customer-related business processes (Greenberg, 2001). Therefore, CRM provides both the company and customers with multiple benefits, among which some of the more significant are greater customer satisfaction and better service, better customer segmentation, personalized service and increased trust (Utz et al., 2023; Oluwajana et al., 2021).

5.2.2. Sustainability

The concepts of sustainability and sustainable development emerged in the last decades of the 20th century due to the need for a development model that would be economically, socially and environmentally viable over time. The best-known definition is the one presented in the

Brundtland Report in 1987, which says that sustainable development is that which "satisfies the needs of the present without compromising the needs of future generations".

Society's awareness of the need for sustainable development has generated a new paradigm in the way business is understood and has triggered new management models that try to integrate the three dimensions of sustainability (economic, environmental and social) into decision-making. The objective is the creation of real long-term shared value between companies and their stakeholders (Tourais & Videira, 2023), by implementing changes in companies to reduce their environmental impact and improve the social aspects (Dhar et al., 2020). Therefore, corporate sustainability is not only a useful marketing tool to improve the image and reputation of the company, but also a strategic vision where the creation of shared value (customer value, economic value, environmental value, and social value) and sustainability policies must be placed at the centre of the organization and the business strategy in such a way as to shape a long-term holistic and integrated approach.

To manage sustainability in companies, it is necessary to develop a performance measurement system composed by different sustainability indicators (Guo & Wu, 2022). This system measures the progress and success of sustainable actions and policies, allowing managers to take the appropriate corrective actions to achieve the intended strategic goals, as well as to develop reports in order to communicate company's sustainability to stakeholders, and foster their engagement. However, recent literature on sustainability indicators do not equally consider all three dimensions (economy, environment, and society) of sustainability (Hollauer, 2017) although all three sustainability dimensions should be include in a comprehensive way (Masdar, 2017). While economic performance, such as profitability or sales growth, is thoroughly studied, non-financial performance is treated as a wider concept (Asiaei et al., 2021), and consumer's perspective is rarely considered (White et al., 2019).

5.2.3. Sustainable CRM

Sustainable Customer Relationship Management (SCRM) is a recent concept that has its origins in traditional CRM and is developed contemporaneously with global trends in digitalization and sustainability (Bhat & Darzi, 2018; Vesal et al., 2021). SCRM is a consequence of (1) the awareness of sustainability in companies (Ceccarini et al., 2022); and (2) the increase in the number of highly responsible consumers (Papadopoulo et al., 2022), who, aware of the negative impacts of the current model of consumption and production, seek more sustainable lifestyles. SCRM implementation is facilitated by the evolution of information technologies such as Digitalization, Artificial Intelligence, Big Data, Social media etc. that allows the re-engineering of the CRM business processes, thus making them more sustainable (Rahman et al., 2023; Ding et al., 2022).

Currently, research regarding sustainable CRM is recent and limited (Ahuja et al., 2019). Furthermore, it does not usually adopt a comprehensive perspective, covering only one of the

dimensions of sustainability (Müller, 2014; Petru et al., 2019). In addition, SCRM is commonly treated from sustainable marketing, where "sustainable" is linked to the durability of business activity with long-term customers (Bandyopadhyay & Ray, 2022).

Although these aspects are necessary for business sustainability, SCRM is presented as a mutilated concept that lacks a holistic character. As a consequence, it is necessary to develop methodologies that help organizations to implement an SCRM considering all the dimensions of sustainability and the different points of view of CRM (strategy, processes and technology) (Gil-Gomez et al., 2020; Shukla & Pattnaik, 2019).

5.3. Methodology for sustainable customer relationship management

One of the main weaknesses hampering the achievement of the integration of sustainability into CRM systems is the need for a methodology that helps companies and organizations in the process of managing costumer relationships in a sustainable way. To cover this gap in the research, in this paper the Sustainable CRM-IRIS methodology is described. First, an initial version of the Sustainable CRM-IRIS methodology was developed based on the CRM methodology proposed by Chalmeta (2006). This methodology was supplemented, adapted and updated based on the review of the existing literature on CRM and sustainability, as well as on the experience of the authors. The CRM-IRIS methodology has been developed for companies manufacturing final products. The methodology has eight phases and helps throughout all the project life-cycle of developing and implementing a sustainable CRM (Figure 13).

Figure 13 Sustainable CRM-IRIS methodology

PROJECT PLANNING
- Project coordination team establishment
- Definition of objectives to be pursued with sustainable CRM
- Follow-up and monitoring

SUSTAINABLE ORGANIZATIONAL FRAMEWORK
- Revision of mission, vision, strategy, policy and values considering sustainability aspects

CUSTOMER STRATEGY
- Customer value analysis based on economic profitability, purchase preferences for socially and environmentally sustainable products and services, and customer impact on society and the environment
- Definition of customer objectives
- Definition of a strategic sustainability communication plan

SUSTAINABLE CRM PERFORMANCE MEASUREMENT SYSTEM
- To monitore customer satisfaction in economic, social and environmental terms
- To compare the sustainability of company products/services with other purchase choices
- To analyse customers' knowledge about company sustainability

BUSINESS PROCESS RE-ENGINEERING
- Analysis of the current situation (AS-IS) to detect economic, social and environmental improvements in the company's way of working
- Business process redesign (TO-BE) to achieve the proposed sustainability objectives

HUMAN RESOURSES
- Analyse the employees' capacities to achieve the new corporate sustainability objectives
- Developing an internal communication plan (why, what, how, who and when)
- Employees' training
- Define indicators and methods for assessing change management success

SCRM COMPUTER SYSTEM
- Operational SCRM computer system
- SCRM Customer Communication computer system
- Big Data SCRM computer system
- Business Intelligence SCRM computer system
- Strategic SCRM computer system

MONITORING
- Quality assurance
- Continuous improvement plan

Each of the phases of the methodology are described below.

5.3.1. Project planning

The implementation of the sustainable CRM-IRIS must be managed and monitored as an engineering project. Within this phase, the following activities must be carried out:

- ***Establishment of the project coordination team*** (must include representatives from the information technology and sustainability departments). Within the team, a coordinator or person in charge of the project must be appointed.
- ***Definition of the objectives of the implementation of sustainable CRM***. The company must ask itself how the sustainable CRM will benefit and enhance the acquisition of business objectives and, based on this, it must establish the objectives to be pursued with the implementation of the sustainable CRM system.
- ***Follow-up and monitoring***. This follow-up should consider aspects such as time deviations, resistance to change, staff motivation, the degree of participation and evaluation of the results to see if the planned objectives have been achieved. To do this, a system of indicators must be defined to measure success in the different phases of development and implementation of the project.

5.3.2. Sustainable Organizational Framework

In this phase, the company's mission, vision, objectives, strategy, policy and values have to be reviewed. The following key aspects of Sustainable CRM should be taken into account in this review: (1) corporate strategy has to consider the sustainable customers' needs; (2) the relationship between the enterprise and its sustainability-oriented customers has to be focused on engagement and commitment, not just on management or sales; (3) all enterprise departments should manage customers' relationships, because sustainability affects all business processes and departments; and (4) the sustainability-conscious customer expects transparency and corporate social responsibility from the company.

5.3.3. Customer strategy

Until now, CRM systems have been implemented in companies to achieve economic objectives by creating value for their customers (Azad & Ahmadi, 2015). However, in a sustainable CRM, the company must also seek to achieve social and environmental objectives when managing customer relationships. For this reason, the definition of the customer's strategy must include (1) economic, social and environmental objectives, and (2) the establishment of the necessary communication flows to inform and make customers aware of the company's sustainability. This phase consists of three activities.

- **Customer value analysis.** Establishing relationships with inappropriate customers is one of the main reasons for the failure of CRM systems (Garai & Roy, 2020). Therefore, it is necessary to analyse the value that a customer represents for the company and to focus actions only on customers that really add value. In traditional CRM, a valuable

customer is one that can generate greater profitability or economic benefit for the company. In sustainable CRM, a valuable customer is one that (a) is economically profitable, (b) has a preference for purchasing socially and environmentally sustainable products and services, and (c) carries out activities with a positive impact on society and the environment.

To perform customer analysis, it is very useful to segment them. To do so, a multivariable matrix is proposed, which analyses customers according to four variables:

- o Variable 1: Customer environmental and social impact, coded as positive, neutral, negative or unknown. To calculate it, two main sources will be used: the customers' sustainability report and their stakeholders' opinions on the internet.
- o Variable 2: Customer profitability, coded as high, medium or low. To calculate it, a cost/benefit model will be used.
- o Variable 3: Socially sustainable purchasing preferences.
- o Variable 4: Environmentally sustainable purchasing preferences. These last two variables are calculated from the history of purchases or customer demands and will be coded as high, medium or low.

Therefore, a multivariable matrix is obtained that shows the value of the company's customers. Figure 14 shows an example for six clients of the company. In the "High-high value" cell, there is a customer with high preferences for environmental and social sustainable purchasing but whose social and environmental impact is negative (in red) and the profitability that it brings to the company is low (small circle size). On the other hand, in the "Medium-medium value" cell, there is a highly profitable customer in economic terms (large size of the circle), with medium-level social and environmental purchasing preferences, and with a positive social and environmental impact (in green).

- **Definition of customer objectives.** The multivariable matrix in Figure 14 allows SCRM managers to establish differentiated objectives by groups of clients or individual customers. Instead of traditional CRM that focuses on sales or customer loyalty objectives, SCRM customer objectives are focused on moving customers in the matrix with the final objective of moving all customers to variable 1 positive and variables 2, 3 and 4 high. Short, medium and long term customer objectives are stablished by SCRM managers according to customers' requirements and characteristics, and company context analysis. The analysis of the evolution of the clients in the matrix allows to verify if the decisions made have had the expected results.

Figure 14 Multivariate customer value analysis matrix
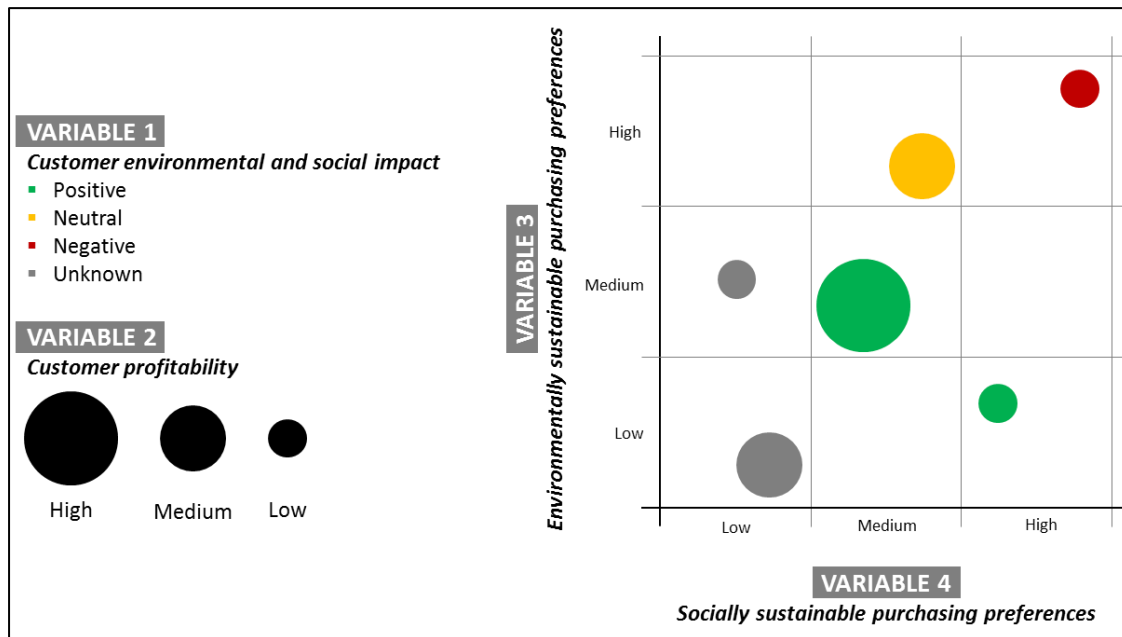
- **Definition of a strategic sustainability communication plan.** The objective of this plan is to inform customers and raise awareness about different aspects of corporate sustainability. This plan must be based on the customer value analysis previously carried out and should include specific actions for each customer segment or individual customer. For example, suppose that a company that implements Sustainable CRM has the objective of reducing the carbon footprint of the company. Customers with high environmental sustainable purchasing preferences, and medium or high economic profitability, would receive a *communication campaign*. However, highly economically profitable customers with low or medium purchasing preferences would receive an *awareness campaign* to increase their interest in products with a reduced carbon footprint. In this way, the loyalty of both groups of clients could be achieved through a corporate objective of environmental sustainability, the reduction of the company's carbon footprint and, consequently, long-term economic benefit.

Different communication channels such as face-to-face or online meetings, web information, mailing, online social networks, etc. can be used. Among these tools, online social networks play an important role in SCRM. They allow (1) collaboration and interaction with customers in a simple and immediate way; and (2) better alignment between the company's sustainability strategy and actions and customers' needs. But, they have to be used to know the demands of its customers, and not just to disseminate information for creating a positive image of the company.

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5.3.4. Sustainable CRM performance measurement system

To determine the degree of achievement of the objectives, it is necessary to develop a performance measurement system. However, the specific characteristics of Sustainable CRM compared to traditional CRM require the definition of new indicators that are not in the performance measurement system of traditional CRM. These indicators should help to assess not only the degree of compliance with the needs and expectations of customers in terms of product quality or after-sales service, as traditional CRM does, but also new aspects related to sustainability. Therefore, new indicators are needed:

- To monitor customer satisfaction with the company's products and services in economic, social and environmental terms. These indicators will make it possible to evaluate the degree of effectiveness of the customers' strategy. Examples of these indicators are the number of complaints or positive opinions from customers in each of the three aspects of the company's sustainability.

- To compare the degree of sustainability of the company's products or services regarding other purchase choices of other companies. These indicators will be used within the strategic sustainability communication plan to help customers to make more informed and responsible purchasing decisions. Examples of these indicators are: the amortization period of the company's products through a cost/benefit study, or long-term savings due to the greater durability of the company's products compared to competitors (economic dimension); the amount of material, water, energy, or CO_2 emissions generated in the manufacture of the company's products or services compared to those offered by other companies (environmental dimension); or indicators related to the equity and safety of the company's workers, such as the salary difference between workers, or the percentage of men and women who work in the company (social dimension).

- To analyse the degree of customer awareness about the company's sustainability. This set of indicators will be useful to assess the effectiveness of the strategic sustainability communication plan. In addition, it will allow the company to detect whether the level of customer satisfaction is correlated with the extent of its knowledge about different aspects of the company's sustainability. Useful indicators could be the number of customers who are aware of the company's environmental risk management plan, the company's policy about reused and recycled materials, the number of web interactions in the Corporate Sustainability section, or the number of customers who make responsible purchasing decisions thanks to the information available about the products, services or company sustainability.

5.3.5. Business Process Re-engineering

The objective of this phase is to redesign the business processes to achieve the objectives defined in phase 3. This will require:

- *Analysis of the current situation (AS-IS)*. This analysis will make it possible to detect economic, social and environmental improvements in the company's way of working that promote the achievement of the sustainability objectives established with clients. Ideally in this type of analysis there should be a reference model with the best work practices, which facilitates benchmarking. However, the novelty of sustainable CRM hinders the availability of these models, which opens up a future line of research in the field of SCRM.

- *Business process redesign (TO-BE)*. After detecting the improvements needed to achieve the proposed sustainability objectives, the business processes must be redesigned. In a traditional CRM system, the main business processes to be redesigned are marketing, sales and after-sales. However, the holistic vision of sustainable CRM opens up the need to redesign all the processes involved in the life-cycle of products or services. These processes, therefore, could encompass research, design, manufacturing, communication, etc. (Kakhki & Nemati, 2022).

Table 35 shows an example of the changes that would be made in five company processes in the event that an objective of the customer strategy was to increase the customers' interest in products with a reduced carbon footprint, distinguishing between traditional CRM and sustainable CRM.

Table 35 Example of differences between traditional and sustainable CRM

Business Process	Traditional CRM	Sustainable CRM
Marketing	Marketing campaigns aimed at increasing the economic profitability of the company	Marketing campaign aimed at environmental objectives
Sale	Invoices are issued with the economic amount	Invoices are issued with the economic amount and the carbon footprint of the product or service
Post-sales	There are no actions	Customer satisfaction surveys are carried out about the reduction in the company's carbon footprint
Manufacturing	There are no actions	Relevant aspects for the customer are considered, such as savings in raw materials, CO2 emissions or the use of artisanal techniques that allow traditions to be valued
Design	There are no actions	Consider the opinion and expectations of clients during the design process, for example, through interviews and surveys

5.3.6. Human Resources

The people who make up the company are in charge of carrying out any process or activity that happens in it. Therefore, they must know the importance of this new customer-focused strategy that encompasses economic, social and environmental aspects. It is necessary not only to obtain their commitment and ensure that they know what their new role is and the objectives to be fulfilled but also to ensure that they have the necessary skills to carry out the new business processes. The individual goals set for each employee must be aligned with the goals set for each customer and customer segment, and with corporate sustainability goals. In this phase, the Project Coordination Team together with the Human Resources Department should:

- Analyse the employees' capacities to identify training needs or the necessity of recruiting new staff to achieve the new corporate sustainability objectives
- Draw up an internal communication plan that helps to promote a change in the corporate culture and achieves the commitment of managers and employees. The plan must consider the why (what objectives are pursued), what (what information and messages are used), how (what language, media and communication channels are used), who (who is responsible for implementing it and to whom is it addressed) and when (when and how often).
- Lead the training of employees so that they recognize their role and responsibility in achieving the customer strategy and carry out the improvements proposed in phase 3.5 properly, for each of the business processes.
- Define indicators and methods for assessing change management success, e.g. percentage of employees who have completed the training courses or conducting surveys to identify the degree of employees' awareness of corporate and customer sustainability objectives.

5.3.7. SCRM Computer System

Computer systems play an important role in the development and implementation of SCRM. The computer system architecture to support SCRM is made up of five components (Figure 15):

- **Operational SCRM computer system**: It will support the execution of the company's business processes, once redesigned to achieve sustainability objectives. The Operational SCRM computer system will be a combination of Enterprise Resource Planning (ERP) and other more specific software that the company has, since the SCRM affects not only the traditional CRM processes (marketing, sales and post-sale), but also others such as design, research & innovation, manufacturing, etc.
- **SCRM Customer Communication computer system**: It will allow the implementation of the strategic sustainability communication plan for customers proposed in section 3.3., achieving a bidirectional interaction between the company and its customers in

real time and in a simple and immediate way. Therefore, the different interests of real and potential customers will be identified, thereby promoting the generation of new knowledge and developing collective intelligence. Two tools should be used for this: the company website and the company's online social networks. These tools were chosen because: they allow a greater capability to disseminate information more quickly and effectively than the traditional means; their content is constructed by both the company and the customers; they allow for a rapid answer about doubts regarding the company sustainability issues; they allow immediate, permanent and visible feedback with the customers, which makes it possible to achieve better alignment between the company's strategy and the needs of its real and potential customers; and in the case of crisis management, they offer the capacity to react rapidly so as to minimize the consequences.

- ***Big Data SCRM computer system***: Big Data tools can be used to listen to and learn from the internet activity and apply the insights (1) to obtain a 360° customer view, showing the relevant customer information performed through any channel and format; (2) to generate predictive models of trends (purchase, abandonment, non-payment, etc.); (3) to identify possible *sustainability-conscious* customers; and (4) to make commercial recommendations suggesting the product or service with a greater probability of success for each real and potential customer (Orenga & Chalmeta, 2016). The Big Data SCRM computer system will allow both structured and unstructured data to be gathered from different sources, applying the filters and patterns needed to obtain only customer data that is valuable for the company. Different advanced data analysis techniques can be used with these data to Inquire (query, hyperlink), Interact (profiles, agents, etc.), Investigate (term analysis, automatic query guidance, parametric search, etc.) and Improve (classification by sentiment analysis, automatic language detection, feature classification, etc.) (Orenga & Chalmeta, 2016). Like the SCRM Customer Communication computer system, the Big Data SCRM computer system will contribute to the enterprise in terms of branding, development or improvement of sustainable products or services, and suitable commercial recommendations.

- ***Business Intelligence SCRM computer system***: It will automate the Sustainable CRM performance measurement system proposed in section 3.4, collecting, storing and processing the data and displaying the indicators. The Business Intelligence SCRM computer system will be made up of software for calculating and visualizing indicators and a Data Warehouse that, through Extract, Transform and Load (ETL) Tools, will obtain the data to generate the indicators from the operational SCRM computer system, the SCRM Customer Communication computer system, and the Big Data SCRM computer system.

- ***Strategic SCRM computer system***: It will automate the calculation of the value of the customer, generating the multivariable matrix proposed in section 3.3, while allowing both individual customers or groups of customers to establish and manage objectives.

To do this, it will incorporate a cost/benefit calculation module to analyse the customer's economic profitability; a module for calculating customers' social and environmental sustainable purchasing preferences; a module to assess the sustainability of the customers, evaluating, through sentiment analysis, the opinions that are made about them on the Internet using the method proposed by Barbeito-Caamaño and Chalmeta (2020); and a module to define and manage objectives and actions by customer and customer segment. Thanks to the Strategic SCRM computer system, a company will be able to: Segment its customers based on their sustainability; Calculate economic, social and environmental benefits by segment and by individual customers; Evaluate the profitability of the strategy of relations with the customers from the social, environmental and economic points of view; Construct a historical multivariate matrix of customer value and simulate forecasts of customer flow in this matrix; and focus actions only on customers who really add value.

Figure 15 SCRM computer system architecture
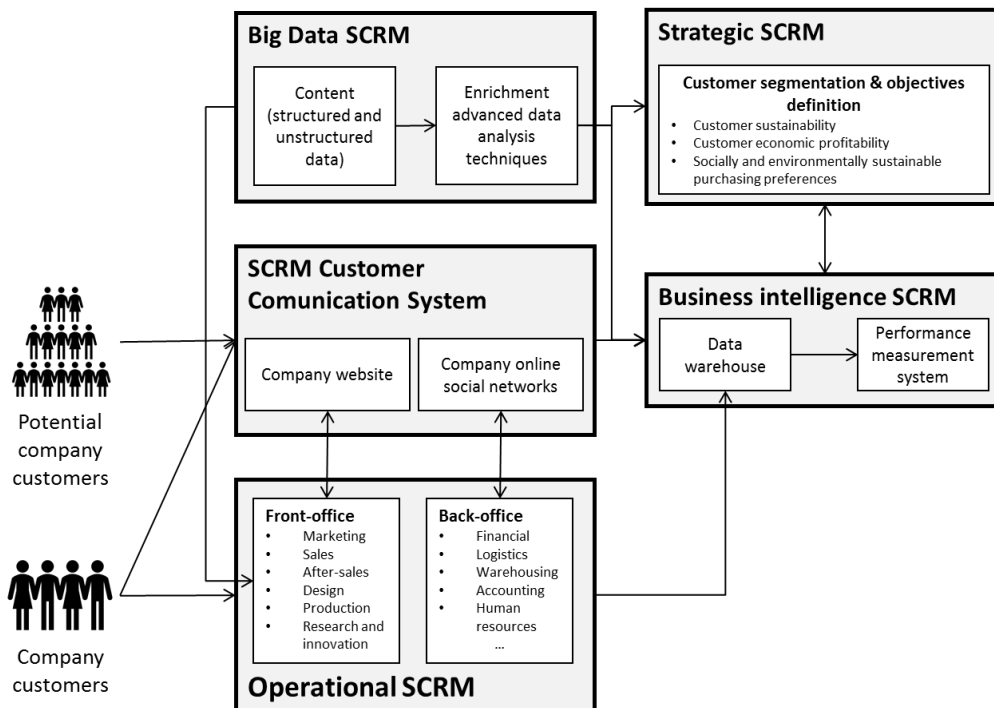
5.3.8. Monitoring

During the implementation of the project, the indicators that were defined at the initial Project management stage (phase I) are monitored and actions are taken as a consequence of any mismatches that may occur. In addition, a quality assurance and continuous improvement method must be established to check that the desired changes have been implemented effectively.

5.4. Validation

A qualitative evaluation of methodology was carried out by three academics and three practitioners with extensive experience in customer relationship management and enterprise sustainability. The opinions of the experts were collected through individual, open and semi-structured interviews. Therefore, any response and improvisation were allowed. Their opinions were based on their experience and knowledge.

Interviews lasted around 40 minutes, and were carried out by one interviewer. Interviewees were interrogated about the practical utility of the methodology; the adequacy of the presentation and structure of the methodology; the completeness, intelligibility and level of detail of the phases of the methodology; whether the methodology cover the whole SCRM project life cycle; the accuracy of the relation among phases and tasks; the errors and problems encountered; and proposals for improving the SCRM-IRIS methodology. Interviewees were also asked to identify the main strengths and weaknesses of the SCRM-IRIS methodology, comparing it with the heuristics procedures they employ in their companies. A report was written based on the interviewees' feedback and was analysed to improve the methodology with the suggestions proposed.

The interviews highlighted that the methodology is a useful guide for developing and implementing SCRM in companies, as well as acknowledging, with minor shortcomings, the completeness, intelligibility, level of detail and correctness of the methodology. The main strengths of the methodology emphasized by the experts were: the overall understanding of the SCRM that is provided; the clarity in the tasks to carry out in each phase of the methodology; and the consideration of a continuous improvement process. On the contrary, the main shortcomings found were: the necessity of giving some examples of the indicators of the sustainable CRM Performance Measurement System; and the necessity of considering the customer environmental and social impact in the multivariable matrix. The methodology was modified considering these suggestions.

5.5. Discussion

This study contributes to the development of SCRM since the proposed methodology covers the following gaps in the state of the art of SCRM identified by different authors.

1. It is necessary to develop methodologies to guide the implementation of SCRM throughout the whole project life-cycle (Danubianu & Teodorescu, 2016; Pohludka & Štverková, 2019), aligning company's sustainability strategy, company business processes, and smart information technologies (Saunila et al., 2019). However, according to the systematic literature review on SCRM carried out by Ferrer-Estevez & Chalmeta (2023), none of the existing SCRM studies propose such step-by-step methodologies. Only four papers address the proposal of methods or frameworks for

SCRM development, but they are focused on different parts of the SCRM project: Osarenkhoe & Bennani (2007) propose a framework to define the SCRM strategy; Gil-Gomez et al. (2020) propose a guide to assess the effect of each one of the three business areas of CRM (sales, marketing, and services) on the company' sustainability; and Hasani et al. (2017) and Shukla & Pattnaik (2019) propose methods to assess the effects on SCRM adoption. This is the ***first contribution*** of the SCRM-IRIS methodology. The SCRM-IRIS methodology covers this gap in the literature since it guides practitioners in SCRM implementation, considering, aligning, and integrating different aspects that must be taking into account in the SCRM project such as strategy, customer segmentation, performance measurement system, business process reengineering, or technology.

2. Different studies have remarked the necessity of considering the three sustainability dimensions (economic, environmental, and social) unitedly in SCRM (Bahri-Ammari & Soliman, 2016; Müller, 2014; Petru et al., 2019). In some cases, SCRM refers to the economic or long-term sustainability of the company (Vesal et al., 2021). In others, sustainability is approached only from social and/or environmental perspectives. This is the ***second contribution*** of the SCRM-IRIS methodology. The methodology addresses a comprehensive vision of the concept of sustainability, considering all sustainability dimensions in the strategy, customer segmentation, performance measurement system, business process reengineering, and technology development.

3. The majority of existing SCRM studies focused on business process redesign consider mainly marketing as the key business process to be redesigned (Ližbetinová et al., 2019), and only a few studies expand this consideration to sales and post-sales, the other two traditional CRM business process (Ahuja et al., 2019). However, SCRM also implies the redesign of other processes involved in the life-cycle of products or services, (not only marketing, sales and post-sales), such as supply chain management or design (Mohanty, 2018; Hazen et al., 2021). This is the ***third contribution*** of the SCRM-IRIS methodology. The SCRM-IRIS methodology enhances the necessity of analyse all company business process (phase five of the methodology).

4. Companies uses different indicators to measure their sustainability and to report information to diverse stakeholders about their environmental and social performance, mainly through sustainability reports elaborated by the companies themselves, information disclosure on corporate websites, and posts on online social networks. Different guides, such as the Global Report Initiative (GRI, have been developed to assist companies in this process (Halkos & Nomikos, 2021). However, this company sustainability communication is not actively used in SCRM practices to attract and retain sustainability-conscious customers (Tian et al., 2021), and to increase consumer awareness about company sustainability issues (Papadopoulo et al., 2022). This is because company sustainability communication is primarily unidirectional/expositive, instead of being bidirectional, measuring also customer expectations and interests about

company sustainability, and therefore acquiring new knowledge and gaining full company value (Rodríguez & Chalmeta, 2020). To do this, in addition to a change in company customer strategy, it is necessary to develop new specific customer-oriented sustainability metrics (Müller, 2014).

5. This is the ***fourth contribution*** of the SCRM-IRIS methodology. The SCRM-IRIS methodology propose a SCRM performance measurement system with new customer-oriented sustainability metrics that, instead of being only informative about the company's sustainability issues, collect information about sustainability in customer experience and expectations, and is used for companies' decisions making. The SCRM performance measurement allows (1) monitoring customer satisfaction with the company's products and services in economic, social and environmental terms, (2) the effectiveness of the customers' strategy, (3) the degree of customer awareness about the company's sustainability, and (4) to compare the degree of sustainability of the company's products or services with purchase choices of other companies. This information, along with the strategic sustainability communication plan (phase three of the SCRM-IRIS methodology), allows companies to better satisfy the requirements of sustainable customers, attracting and retaining them as well as increasing consumer awareness about corporate sustainability issues.

6. SCRM requires segmenting clients on the basis of sustainability criteria, not only economic ones (Wassouf et al., 2020; Sarti et al., 2018). This is the ***fifth contribution*** of the SCRM-IRIS methodology. The SCRM-IRIS methodology proposes the multivariable matrix, which analyses customers according to four variables: Customer environmental and social impact; Customer profitability; Socially sustainable purchasing preferences; and Environmentally sustainable purchasing preferences.

7. Different studies have proposed technologies to support SCRM such as e-CRM, Big Data or AI (Kumar et al., 2023; Kuz et al., 2017). However, they have been proposed in isolated way to solve specific SCRM problems (Yadav et al., 2020). Therefore, it is necessary to combine and integrate them to support all the functionality that the SCRM requires. This is the ***sixth contribution*** of the SCRM-IRIS methodology. The SCRM-IRIS proposes an integrated computer system architecture to support the SCRM requirements made up of five components that allow the execution of the company's business processes, the implementation of the strategic sustainability communication plan for customers, the use of Big Data to obtain different insights about customers, the automation of the Sustainable CRM performance measurement system, and the calculation of the value of the customer.

Therefore, this paper will make significant progress towards Sustainability-oriented CRM research and implementation. This will have important consequences for society because it will lead to an increase in the number of customers who are aware of sustainability, while also transforming business processes, products and services, by making them more sustainable. This

will imply, among other benefits, fairer treatment of customers and employees, and a reduction in the environmental impact of the business activity.

5.6. Conclusion

Consumers' and companies' growing interest in sustainability has transformed Customer Relationship Management into Sustainable Customer Relationship Management, with the aim of offering more socially and environmentally sustainable products and services while attracting and retaining sustainability-conscious customers.

This work proposes a useful methodology to implement sustainable CRM in a company. The methodology makes it possible to gain a view of the needs, scope, consequences and opportunities of the SCRM project, as well as allowing for greater control over the whole project life-cycle of the SCRM project, because all the activities to be performed in each phase of the implementation are clearly defined. The methodology is organized in nine phases: Project planning, Sustainable Organizational Framework, Customer strategy, Sustainable CRM performance measurement system, Business Process Re-engineering, Human Resources, Computer system, Construction of the information system, and Monitoring.

Future research could consist in generating case studies of good practices that contemplate different industries and different contexts, which would facilitate the application of the methodology in specific companies. Moreover, the methodology has been developed for companies manufacturing final products. It would be interesting to research if any changes are needed in the methodology when the customer is a company. Other future research could be to define indicators to measure successful development and implementation of the different phases of the project. Finally, it would also be interesting to extend the methodology to consider not only the customers, but also all the company's stakeholders.

5.7. Statements and declarations

5.8. References

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Chapter 6. Conclusions

In the quest for sustainability, our journey began with the stark realization of planetary boundaries and the relentless exploitation of Earth's finite resources. Sustainability, rooted in environmental preservation, has become a key concept for addressing contemporary societal challenges. While the Brundtland Report of 1987 defined sustainable development as meeting present needs without compromising the future, the diversity of sustainability definitions reveals its complexity.

This study zooms in on organizational sustainability, recognizing organizations' pivotal role in driving sustainability across various scales. However, defining sustainable organizations and articulating their roles remains challenging. Transitioning from profit-centric perspectives to holistic approaches is fundamental for sustainable development, necessitating a balanced triple bottom line approach.

Sustainability often remains theoretical, lacking practical application and clear implementation guidance. This study aims to bridge the research-practice gap by proposing practical tools for organizations, empowering them to transition from abstract sustainability concepts to actionable strategies. These tools serve to guide organizations toward a sustainable future that harmonizes economic, environmental, and social aspects while preserving resources for future generations.

6.1. Contributions and limitations

This section presents a summary of the main contributions of this thesis, as well as the limitations to be considered.

This thesis comprises four research articles, each with the general purpose of exploring the concept of sustainability and its applicability and implementation in organizations. Each of these four articles provides specific contributions related to the proposed objectives, which are outlined below.

The primary contributions of Chapter 2, which are linked to the achievement of Objective 1 "examine the state of the art and propose a useful framework for designing and implementing sustainability strategies linked to the SDGs in educational institutions", include:

- A systematic literature review and bibliometric analysis that not only extend existing bibliographical reviews on Education and SDGs by covering the period from 2015 to 2020 and utilizing the Scopus and Web of Science databases to broaden the information source but also identify top authors, countries, and institutions contributing to the field through statistical and bibliometric analyses.
- Six research categories and future research needs that facilitate future work and highlight research gaps in the field.
- A framework to guide academic institutions in the process of generating a global strategy for continuous improvement with a measurable and evaluable action plan based on the SDGs, incorporating the vision of various stakeholders in the education community.

Chapter 3 provides the following main contribution, which allows the fulfillment of Objective 2 "develop a business intelligence tool for sustainability management in higher education institutions":

- A comprehensive and holistic Sustainable Balanced Scorecard (SBSC) methodology addressing the integration of environmental, social, and economic dimensions throughout the entire Project Life-Cycle Guidance. This methodology has been rigorously tested and refined through the analysis of three real-life cases, ensuring its practical applicability and effectiveness.
- Examples of application of the methodology to the three case studies. These examples can guide practitioners (university managers, computer engineers, sustainability managers) to develop SBSCs in other universities.

The main contribution provided by Chapter 4 and Chapter 5, which manages to fulfill Objective 3 "investigate the current state of the art and propose a methodology for sustainable customer relationship management", includes:

- A systematic literature review in the field, addressing a notable research gap in Sustainable CRM, along with rigorous bibliometric statistical analysis offering insights

into the top contributing countries, authors, institutions, and sources, enhancing the understanding of the Sustainable CRM domain.

- A comprehensive classification framework with seven research categories, promoting a deeper understanding of the field and its major research streams.
- Future research challenges, providing valuable guidance for future research endeavors.
- A useful nine phases methodology to implement sustainable CRM in a company, making it possible to gain a view of the needs, scope, consequences and opportunities of the SCRM project, as well as allowing for greater control over the whole project life-cycle of the SCRM project, because all the activities to be performed in each phase of the implementation are clearly defined.

Overall, the research presented in this study has several limitations. In Chapters 2 and 4, there is potential bias stemming from the study's reliance on only two databases, Web of Science and Scopus, which primarily feature English-language articles. The omission of alternative databases and keywords may have influenced the results. Additionally, the bibliometric analysis approach used could be complemented by other methods like network analysis to provide a more comprehensive perspective. The classification of literature into research clusters may also be influenced by the chosen methodology.

On the other hand, Chapter 3, based on three specific cases within a particular sector, faces limitations in terms of generalizability due to its small sample size and reliance on a case study methodology. The findings may not be readily transferable to different industries or settings. However, it's important to note that the study utilizes both primary and secondary data sources, offering a rich understanding of the cases examined. While the sample size may limit broader generalizations, the comprehensive case studies provide valuable insights into companies of the time. Additionally, it should be highlighted that no quantitative financial impacts were observed during the research.

6.2. Future work

This section identifies some opportunities for future lines of research, giving continuity to the work presented in this thesis and proposing improvements related to it.

The work could be extended by applying the framework and methodology presented in different sectors and types of organizations, with the aim of improving and generalizing them and enabling a broader cross-sectional application. Furthermore, some quantitative validation method may be introduced in the case studies for more robust validation.

In particular, the future work related to Chapter 2 include assessing the framework's suitability for non-academic institutions to promote SDG awareness and participatory business strategy development and conducting a more in-depth analysis of qualitative findings within each category. In Chapter 3, future research should aim to overcome the limitation of generalizability by examining more cases with diverse contexts, enabling a broader cross-

sectional application of the proposed methodology, while also considering the possibility of conducting quantitative analyses to assess the financial impact of implementing a Sustainable Balanced Scorecard. Based on the result of Chapter 4 and Chapter 5, further research on the implementation of the concept in practical cases could be explored, contemplating different industries and different contexts. Future research could improve Chapter 5 by defining indicators to measure the successful development and implementation of the different phases of the project and extending the methodology not only for customer but to all the company's stakeholders.