Sustainability in library management in higher education institutions: a bibliometric analysis

Leonardo Ensslin
Department of Administration, University of Southern Santa Catarina, Palhoça, Brazil

Ademar Dutra
Department of Administration, Universidade do Sul de Santa Catarina – Campus da Grande Florianópolis, Palhoca, Brazil

Sandra Rolim Ensslin
Department of Production Engineering, Federal University of Santa Catarina – UFSC, Florianópolis, Brazil

Edinei Antonio Moreno
Department of Administration, UNISUL, Florianópolis, Brazil

Leonardo Corrêa Chaves
Department of Business Administration, Universidade do Contestado, Mafra, Brazil, and

André Andrade Longaray
Department of Administration, University of Rio Grande – FURG, Rio Grande, Brazil

Abstract

Purpose – This study aims to examine the characteristics of scientific publications that address the management of higher education institution (HEI) libraries from a sustainability perspective, through a bibliometric analysis, to contribute to the development of knowledge and to identify opportunities for further research.

Design/methodology/approach – The knowledge development process-constructivist instrument was used to select a portfolio of 24 articles that are scientifically acknowledged and aligned with the theme “Sustainable Management of Libraries in Higher Education Institutions” and delimited by the authors. This study, guided by a constructivist perspective, was carefully conducted to discern selections that differ from traditional definitions. The analysis followed a qualitative approach and used the following variables: fruitful authors, connection networks between authors and vision of sustainability (the degree of dimensional coverage).

Findings – The analysis of the literature highlighted the partnerships of authors from countries belonging to the American continent as the most involved in research on the subject and the evolution from a one-dimensional view – centred on the environment – to a multidimensional view.

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The understanding is that library management in HEIs, from a sustainability perspective, is an essential aspect of institutional legitimacy for the stakeholders. Therefore, sustainability should be treated in a multidimensional way and integrated with the institution’s values.

Keywords Libraries, Management, Sustainability, Higher education institution (HEI), Universities, ProKnow-C, Bibliometric analysis

Paper type Research paper

1. Introduction

Teaching and learning are separate but intertwined concepts. They are evident processes among people who comprise a successful organisation. These processes seem to be naturally performed in university environments – in classrooms, laboratories, informal meetings and libraries – as repositories of knowledge generation opportunities. To fulfil their institutional and social functions, libraries serve and welcome stakeholders with various demands: internal users, employees and society.

Users expect the library to meet their needs for data and information, as well as for socialisation, professional opportunities and reflection. Users expect the library to innovate to meet contemporary information needs. Employees require knowledge and functional skills to provide services and interact with the users. Society requires the library to welcome all individuals to whom it disseminates social, cultural and legal values. The library should preserve and make available documents, objects and culture and ensure that natural resources are used without hampering their availability in the future. Library sustainability requires that we remain responsive to the demands of stakeholders addressed in the literature, from a sustainability perspective.

The definition of the term sustainability is sometimes restricted to the dimension of natural resources when discussing the search for balance between meeting and satisfying the needs of the present, without impairing the existence of future generations (Barnes, 2012; Chowdhury, 2012; Drahein et al., 2019; Fedorowicz-Kruszewska, 2020). From this perspective, sustainability concerns how present attitudes influence the future, balancing economic, social and environmental aspects from the perspective of preserving the environment in the short, medium and long term (Aleixo et al., 2018; Chowdhury, 2012). The main discussions on sustainability in education were shaped by the Education for Sustainable Development Conference of 2002, the Nagoya Declaration in 2014, the adoption of the Sustainable Development Goals and the 2030 Agenda, presented in 2015 (United Nations Organization, 2015).

This understanding of sustainability, given its focus on catastrophic situations, has raised social awareness and favours the engagement of higher education institutions (HEIs) around the world, even in the context of library management (Aleixo et al., 2018; Alghamdi et al., 2017; Beringer, 2007; Chowdhury, 2012). HEIs, through their libraries, have a direct influence on the functions of education, socialisation, research and knowledge transfer. Their influence is indirect, through the daily activities of their management and their performance, which is committed to the tripod of stakeholders: user, employees and society (Alghamdi et al., 2017; Amaral et al., 2015; Asante and Ngulube, 2020; Aulisio, 2013; Beringer, 2007; Drahein et al., 2020; Kuzma et al., 2020; Purcell et al., 2019; Sheng and Sun, 2007).

Given the above perspectives, the research question is:

*RQ1. How has library management literature developed from a sustainability perspective?*
To answer this question, we performed a bibliometric analysis to examine the characteristics of scientific publications that address the management of HEIs’ libraries from a sustainability perspective, develop this knowledge and identify opportunities for further research. To select the bibliographic portfolio (BP) and guide our bibliometric analysis of these articles and their references, we chose the knowledge development process-constructivist (ProKnow-C) intervention instrument for its recognised ability in helping researchers to better understand the composition of the theme that they propose to research. Moreover, we use a structured process that allows rescuing procedures and choices made by the researcher and their results, which provides a scientific foundation for the process (Tasca et al., 2010; Ensslin et al., 2012).

Based on the study question, first, the ProKnow-C was used to select, via a structured process with traceability, a BP of scientific articles that represents the most relevant publications on this subject. Second, we highlighted the outstanding parameters of the BP: Featured Periodicals – Qualis-Capes and Scientific Journal Rankings (SJR) and Journal Citation Reports (JCR) Impact Factors; Authors and number of articles published in each portfolio; Co-authorship publications network – Analysis of the BP authors; Citation network – Analysis of BP references; Co-citation network – Analysis of BP references; Occurrence of partnerships between countries; and Occurrence of keywords in BP articles. Third, we present a macro analysis of the purposes of the articles, their results and their position regarding sustainability.

This article contributes to the development of the research area by compiling recognised studies in the English language in a BP and by mapping the objectives proposed by these articles, their results and the sustainability perspective used to identify the evolution and trends in understanding the topic and opportunities for further research. The feasibility of the study is reinforced by the collection of data from the Scopus and Web of Science databases.

2. Theoretical references
2.1 Higher education institutions and sustainability

In the literature, the theme of sustainability in library management is presented in a heterogeneous way. Some studies focus on the environmental dimension of sustainability (Barnes, 2012; Chowdhury, 2012; Drahein et al., 2019; Fedorowicz-Kruszewska, 2020), while other studies address sustainability more comprehensively, encompassing the dimensions of users, employees, society and the economy, in addition to the environmental dimension (Alghamdi et al., 2017; Amaral et al., 2015; Asante and Ngulube, 2020; Aulisio, 2013; Beringer, 2007; Drahein et al., 2020; Kuzma et al., 2020; Purcell et al., 2019; Sheng and Sun, 2007). Additionally, some studies warn about the need to focus efforts on the creation and implementation of strategic, tactical and operational processes aimed at their integration with the institution’s values, with the standardisation in a structured form of sustainability in the processes of this institution (Adams, 2013; Aleixo et al., 2018; Amaral et al., 2015; Asante and Ngulube, 2020; Asogwa, 2014; Barnard and Van Der Merwe, 2016; Berchin et al., 2017; Beringer, 2007; Chowdhury, 2014; Ekere et al., 2016; Fleacã et al., 2018; Jankowska and Marcum, 2010; Kapitulcínová et al., 2018).

Sustainability focuses on the responsibility of people and organisations regarding environmental, social and economic impacts, identifying harmful practices in these dimensions and proposing improvements for the well-being of communities and for the maintenance of ecosystems (Chowdhury, 2012, 2014). Thus, there is a need for sustainable actions to be integrated into the planning for people and organisations, focusing on
strategies that can achieve positive results in the short, medium and long term, especially in the awareness process.

In the context of worldwide events, HEIs are involved in creating and updating guidelines, goals and objectives for sustainable development, aiming to raise awareness among people, organisations and countries. HEIs have addressed the topic and collaborated to build an understanding of the sustainability concept and disseminate information and practices in different areas of society. HEIs have become essential in the task of seeking solutions for a sustainable future, prioritising the preservation of the environment and raising awareness (Aleixo et al., 2018; Amaral et al., 2015; Beringer, 2007).

HEIs are disseminators of knowledge and research, social development mentoring bodies and citizen training agencies. One of their roles is to raise awareness and qualifications of future opinion-makers regarding sustainable development (Adams, 2013; Amaral et al., 2015; Beringer, 2007). There are also many other ways in which HEIs promote sustainable development, including planning and control, management of people and processes, purchase of materials, construction and transport. The main objective of HEIs is to demonstrate to the society that it is possible to transform awareness into actions, by rationalising consumption, conserving resources, reducing waste and exercising efficient management. Additionally, they promote social equity, transparency and community values (Adams, 2013; Aleixo et al., 2018; Alghamdi et al., 2017).

To achieve sustainable institutional practices and policies, the agents involved – teachers, education workers, students and society – must have the commitment, training and involvement necessary to improve the institution’s sustainability performance (Aleixo et al., 2018; Alghamdi et al., 2017; Amaral et al., 2015). Managers of academic sectors or departments have the role of obtaining the results sought by the institution’s sustainable planning. The library is an important part of the academic community and a noteworthy example of this purpose, that is, carrying out activities that involve the entire student group. Managers must strive to include sustainable practices in their management so that their efforts are perceived by all.

2.2 Sustainable library management

Libraries play an indisputable role in the context of formal education and in practising and teaching sustainability. The importance of research concerning green and sustainable libraries is emphasised in the literature. Fedorowicz-Kruszewska (2020) argues that there is a difference between the concepts of green and sustainable libraries, as each has its peculiarities. Some authors associate a green library exclusively with the physical construction of the library building and sustainable architectural characteristics (Aulisio, 2013; Fedorowicz-Kruszewska, 2020; Jankowska and Marcum, 2010). The principles of a green library are based on reduced power, water, paper and material consumption and the use of renewable energy. The principles include building location strategies, efficiency in terms of lighting and thermal adequacy, avoiding the use of toxic products, such as paints, using recyclable materials when buying furniture and paying attention to waste disposal. Thus, the focus is on the use of renewable and non-renewable resources to achieve pleasant and sustainable conditions for library users (Aulisio, 2013; Chowdhury, 2014; Fedorowicz-Kruszewska, 2020; Jankowska and Marcum, 2010). With advances in research regarding sustainable libraries, the concept has evolved to include daily operations, the library’s routines and concerns regarding the training of users (Fedorowicz-Kruszewska, 2020; Jankowska and Marcum, 2010).

Sustainable management encompasses the environmental, social and economic domains. Aulisio (2013) and Fedorowicz-Kruszewska (2020) point out that libraries' environmental
Sustainability goals should include: strategic, operational and green planning actions; training programmes; bibliographic collections; buildings; services; projects focused on environmental preservation; and processes to continuously identify and meet the needs of users, employees and society. The process libraries becoming sustainable requires time, awareness of those involved and knowledge of the natural world (Fedorowicz-Kruszewska, 2020; Jankowska and Marcum, 2010).

Among the sustainable planning actions that can be included in management and which add value to libraries, the following stand out:

- assessment of the construction environmental impact, followed by strategies to define sustainable objectives;
- promotion of recycling in the environment and sharing actions with the community;
- assurance of open access to environmental information;
- organisation of research and discussion groups on the sustainability theme;
- assurance of funding sources and their long-term continuity;
- optimisation of materials purchased and used by the sector;
- generation and issuance of metric reports of the sustainable actions carried out;
- training of sector employees, students, teachers and the community in general;
- preservation and restoration of available printed bibliographic collections; and
- prioritisation in the acquisition of bibliographic collections in digital form (Aulisio, 2013; Asogwa, 2014; Chowdhury, 2014; Ekere et al., 2016; Fedorowicz-Kruszewska, 2020; Jankowska and Marcum, 2010).

Congruent with these actions, libraries must have available assessment tools with indicators that monitor economic, environmental and social impacts. Performance should be measured and resources provided to make the necessary improvements for sustainable management. In general, as stated by Jankowska and Marcum (2010), Asogwa (2014), Ekere et al. (2016), Fedorowicz-Kruszewska (2020) and Asante and Ngulube (2020), for developing sustainability indicators, libraries should consider some evaluation categories: strategies and plans; buildings and their administration; equipment and products; collection gathering; programmes, services and projects; qualification, training of employees; cooperation with the external environment; and user satisfaction. However, there is no minimum number of categories or indicators to be met that would characterise a library as sustainable. This will depend on financial, organisational, infrastructure and personnel conditions. It is noteworthy that the sustainability of libraries requires more than establishing an environmental goal to be achieved. It is possible to measure the indicators established in the categories and provide the manager with progress reports. According to forecasts, these evaluation categories should expand to include the concept of a competitive library that is regarded by users and employees as beneficial and by society as an aggregate of values. Only in this way will it be sustainable.

As explained by Aulisio (2013), Asogwa (2014) and Sheng and Sun (2007), librarians must take the lead in carrying out these actions and promoting sustainability. In this role, the professionals in charge of the library should carry out sustainable management activities to engage people in sustainability, manage available resources, meet demands of users and employees, disseminate successful practices and identify those in need of improvement (Asogwa, 2014; Ekere et al., 2016; Jankowska and Marcum, 2010). In short, librarians must apply sustainable management in libraries while practising their skills,
competencies and motivation as disseminators of information to facilitate user training. They should also raise awareness of the importance of the environment with internal and external users and institutionalise sustainability. Many strategies can be adopted to develop sustainable management in libraries, so that librarians can be agents that radiate knowledge and culture and provide pleasant places to be and work.

3. Methodological procedures
In this section, we present ProKnow-C as an intervention instrument and explain the selection of the BP in the context of literature on library management in HEI from the sustainability perspective.

3.1 Intervention instrument – knowledge development process-constructivist and procedure for data collection
Academic knowledge, in addition to being vast, is dispersed in a variety of publications, editions, databases and other research sources. This dispersion of knowledge creates a challenge for those investigating the topic. A structured process for literature review to expand, create focus and delimit the researcher’s knowledge on the investigation topic is necessary. For this unique theme, it is necessary to select a representative academic BP of articles.

In this study, the library management theme is expanded, and the focus for the researcher’s knowledge is established from the sustainability perspective. This is carried out concurrently with the selection of a BP aligned with the theme and is scientific in approach. This BP, delimited by the researchers, represents a fragment of the literature on the subject. Once the bibliographic reference is established, the next step is determining the parameters of the research. This step is known as bibliometric analysis. The instrument that meets all these demands is the ProKnow-C, which is selected for this research.

ProKnow-C is a structured process that enables investigators to understand and establish the frontiers of knowledge for their topic, create conditions for reflection on what has already been published, highlight the “gaps”, action alternatives for future research and generate support for the relevance and originality of the study (Ensslin et al., 2012; Tasca et al., 2010). ProKnow-C consists of the following main steps:

- selection of the BP;
- bibliometrics or bibliometric analysis;
- systemic analysis; and
- formulation of research questions and objectives.

In this study, Steps 1 and 2 were operationalised. The BP formation process is illustrated in Figure 1.

The operationalisation of ProKnow-C using the delimitations selected by the researchers resulted in a BP of 24 articles, which were used as data for bibliometric analysis. The BP data are presented in Table 1.

Once the BP is defined for the topic sustainability management in HEI libraries, the second stage of ProKnow-C addresses the bibliometric analysis of publications. This analysis highlights the parameters considered relevant to the topic, in the expectation that the information will be useful for researchers, the scientific community and society in general. The source of the information is the BP, which represents the theme as perceived by the researchers. Therefore, the BP adherence to the theme is essential for the legitimacy of the bibliometric review. For this study, ProKnow-C was used for its recognised ability to
help researchers to consolidate their understanding of the subject and identify a BP that reflects their understanding of the subject. Thus, the BP is the primary source of data for bibliometric analyses.

In the bibliometric analysis stage, the following variables were examined:

- journals, to verify their level of scientific relevance;
- articles and authors, to identify their scientific relevance;
- connection networks between authors, to determine the degree of interaction and collaboration;
- countries, to understand where the topic is being researched;
- most frequently used keywords to know the terminology used; and
- sustainability vision in terms of scope (one-dimensional or multidimensional) to understand how sustainability is being investigated in this literature sample.

Using the BP of 24 selected articles as a reference and its bibliographic references (only those aligned with the theme that was included in the same boundaries as BP), which amounted to another 19 studies, the variables were examined by counting the number of times they were found in the BP. The analysis of collaboration networks between BP authors, citations and keywords was the result of data feeding into the VOSviewer software that identified the association of occurrences of the publication variables. The scope variable is verified by the classification in:
<table>
<thead>
<tr>
<th>No. of article</th>
<th>Author/Title/Journal/Year of article</th>
<th>No. of citations (03/2021)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article 1</td>
<td>Aleixo, A. M.; Leal, S.; Azeiteiro, U. M./Conceptualization of sustainable higher education institutions, roles, barriers and challenges for sustainability: an exploratory study in Portugal/Journal of Cleaner Production/2018</td>
<td>167</td>
</tr>
<tr>
<td>Article 2</td>
<td>Amaral, L. P.; Martins, N.; Gouveia, J. B./Quest for a sustainable university: a review/International Journal Sustainability in Higher Education/2015</td>
<td>159</td>
</tr>
<tr>
<td>Article 6</td>
<td>Chowdhury, G./Building environmentally sustainable information services: a green is research agenda/Journal of the American Society for Information Science and Technology/2012</td>
<td>80</td>
</tr>
<tr>
<td>Article 7</td>
<td>Alghamdi, N.; Heijer, A. D.; Jonge, H. de./Assessment tools’ indicators for sustainability in universities: an analytical overview/International Journal Sustainability in Higher Education/2017</td>
<td>64</td>
</tr>
<tr>
<td>Article 8</td>
<td>Sheng, X.; Sun, L./Developing knowledge innovation culture of libraries/Library Management/2007</td>
<td>61</td>
</tr>
<tr>
<td>Article 9</td>
<td>Aulisio, G. J./Green libraries are more than just buildings/Electronic Green Journal/2013</td>
<td>61</td>
</tr>
<tr>
<td>Article 10</td>
<td>Kapitulčinová, D.; Atkinson, A.; Perdue, J.; Will, M./Towards integrated sustainability in higher education: mapping the use of the accelerator toolset in all dimensions of university practice/Journal of Cleaner Production/2018</td>
<td>52</td>
</tr>
<tr>
<td>Article 11</td>
<td>Barnes, L. L./Green buildings as sustainability education tools/Library Hi Tech/2012</td>
<td>37</td>
</tr>
<tr>
<td>Article 12</td>
<td>Fleacă, E.; Fleacă, B.; Maiduc, S./Aligning strategy with sustainable development goals (SDGs): process mapping diagram for entrepreneurial higher education institutions (HEIs)/Sustainability/2018</td>
<td>37</td>
</tr>
<tr>
<td>Article 14</td>
<td>Barnard, Z.; Van Der Merwe, D./Innovative management for organizational sustainability in higher education/International Journal of Sustainability in Higher Education/2016</td>
<td>34</td>
</tr>
<tr>
<td>Article 15</td>
<td>Purcell, W. M.; Henriksen, H.; Spengler, J. D./Universities as the engine of transformational sustainability toward delivering the sustainable development goals “Living labs” for sustainability/International Journal of Sustainability in Higher Education/2019</td>
<td>34</td>
</tr>
<tr>
<td>Article 16</td>
<td>Berchin, I. I.; Grando, V. D.; Marcon, G. A.; Corseuil, L.; Guerra, J./Strategies to promote sustainability in higher education institutions: a case study of a federal institute of higher education in Brazil/International Journal of Sustainability in Higher Education/2017</td>
<td>29</td>
</tr>
<tr>
<td>Article 17</td>
<td>Drahein, A. D.; Lima, E. P. de; Costa, S. E. G. da/Sustainability assessment of the service operations at seven higher education institutions in Brazil/Journal of Cleaner Production/2019</td>
<td>18</td>
</tr>
</tbody>
</table>

**Table 1.**

Bibliographic portfolio article bank (continued)
4. Presentation and discussion of results
This section presents a discussion of the results of the analysis on the following variables: bibliometric results – (4.1) Journals that are more receptive to the topic; (4.2) Articles and authors; (4.3) Authors and citations network; (4.4) Partnerships between countries; and (4.5) Keywords; and systematic results – (4.6) Sustainability dimensional scope in BP.

4.1 Journals that are more receptive to the topic
Regarding scientific journals, it was found that articles in the BP and references aligned with the theme were published in 27 different journals. In the BP, several periodicals are prominent: *International Journal of Sustainability in Higher Education*, with seven publications (17.5%), *Journal of Cleaner Production*, with four publications (10%) and *library management*, with two publications (5%). In the references, three journals stood out: *Libri, Library Hi-Tech and Electronic Green Journal*, with two (5%) articles published by each. The results show that there were no prominent journals that published articles in both portfolios. To add information about the journals, Qualis-Capes, SJR and JCR impact factors are presented (Table 2).

Note that the prominent journals are the *International Journal of Sustainability in Higher Education* and the *Journal of Cleaner Production*, for having Qualis-Capes A1 and Impact Factors superior to the others. In this sense, it can be said that these two journals have...
scientific recognition and visibility, because, as shown in the previous analysis, they are the journals that together published 11 articles, or 27%, of the total number of articles in the two portfolios.

4.2 Articles and authors
The BP consisted of 24 articles written by 53 authors. Of these, 50 (94%) were authors who published only one article (Figure 3). Highlights include AD Drahein, SEG da Costa and EP de Lima, who, in co-authorship, published two articles in 2019 and 2020. In the references, it is observed that 27 authors (96.5%) published only one article, with Chowdhury publishing three articles, in 2012, 2013 and 2014. Of the 81 authors, three prominent authors were identified in the BP and one author was highlighted in the references. In this analysis, it was also demonstrated that, although the authors G. Chowdhury and M. Fedorowicz-Kruszewksa presented articles in the BP and the references, there were no prominent authors in the sum of the two portfolios (BP and BP references) because they did not meet the criteria of having two publications in each portfolio per author.

Regarding the scientific recognition of the articles, it was found that, of the 1,057 citations, 245 (23%) were concentrated in 2013, showing greater representation in the scope of citations with three published articles: BP: “Sustainability reporting and performance management in universities”; and BP References: “Green libraries are more than just buildings”/“Sustainability of digital information services”. Also noteworthy from the BP are the articles from 2015 (“Quest for a sustainable university”) and 2018 (“Conceptualisation of sustainable HEIs, roles, barriers and challenges for sustainability”) and, from the BP references, the 2010 article (“Sustainability challenge for academic libraries”); together, they represent 42.5% (449) of the total citations, demonstrating that they are scientifically representative publications (Figure 2).

4.3 Authors and citations network
Figure 3 shows the 22 clusters of authors’ networks, formed by 56 nodes (authors) that make up the portfolio. What can be seen in the positioning of the clusters is the predominance of isolated study groups, with no co-authorship among the authors of the portfolio. However, Clusters 1, 2 and 3 are prominent because of the formation of research groups composed of five or more authors and Cluster 4, in which three authors have already published two co-authorship documents.

<table>
<thead>
<tr>
<th>Name of the Periodical</th>
<th>Qualis-Capes</th>
<th>Impact factor</th>
<th>Impact factor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SJR</td>
<td>JCR</td>
</tr>
<tr>
<td>International Journal of Sustainability in Higher Education</td>
<td>A1</td>
<td>0.635</td>
<td>2.000</td>
</tr>
<tr>
<td>Journal of Cleaner Production</td>
<td>A1</td>
<td>1.886</td>
<td>7.246</td>
</tr>
<tr>
<td>Library Management</td>
<td>B2</td>
<td>0.581</td>
<td>No information</td>
</tr>
<tr>
<td>Library Hi-Tech</td>
<td>A1</td>
<td>0.301</td>
<td>0.583</td>
</tr>
<tr>
<td>No information</td>
<td>No information</td>
<td>0.427</td>
<td>1.218</td>
</tr>
<tr>
<td>Electronic Green Journal</td>
<td>No information</td>
<td>0.120</td>
<td>No information</td>
</tr>
</tbody>
</table>

Table 2. Featured periodicals – Qualis-Capes and SJR and JCR impact factors

According to this analysis, the presence of co-authorship among the authors of the portfolio was not identified; however, Figure 4 reveals a connection among the authors through the references used in the construction of the articles, citing documents belonging to 16 authors of the BP.

Source: Authors (2021)

Figure 2. Authors and number of articles published in each portfolio

Figure 3. Co-authorship publications network – analysis of the bibliographic portfolio authors

Source: Authors (2021)
The result, as shown in Figure 4, indicates a certain relevance of the portfolio authors regarding the topic addressed, being included as references in the articles in the BP. An analysis of the authors’ co-citations was performed along with an analysis of the references, to assess which authors were most cited in the BP. For this analysis, a minimum of seven citations per author was considered.

Figure 5 shows the organisation of the authors most cited into four clusters; the most prominent cluster is the red one, headed by R. Lozano, with 46 citations. The established relationship is that, when an author from this highlighted group is cited, other authors from the same group are usually cited simultaneously, revealing the existence of some lines of thought and ascending research, determining that the group of authors is relevant to the theme. The same situation occurred in the other clusters but with less intensity. The objective was to demonstrate which authors are more relevant and influential on the subject and which supported the construction of the BP articles, giving the researcher the opportunity to analyse the highlighted authors and include them in their portfolios.

4.4 Partnerships between countries
Another analysis involved the countries in which the most partnerships for research and studies on the topic discussed were performed. The results of this analysis are presented in Figure 6.
There were 17 countries distributed across three main clusters. The USA, in partnership with 11 countries, and Brazil, in partnership with 10 countries, stand out in the red cluster. These results indicate that the highlighted countries, both from the American continent, are involved in research on the subject and seek the exchange of knowledge and the development of new research in partnership with authors from other countries.

4.5 Keywords
There were 144 keywords used in the articles. As shown in Figure 7, the keywords that stood out were sustainability and sustainable development, with nine occurrences each, and higher education, with seven occurrences. Other relevant keywords were libraries, green libraries, academic libraries and digital libraries, together comprising nine occurrences. These data – containing the keywords initially elaborated for this study in the research axes – ensure that the retrieved articles belonging to the BP are aligned with the topic focus selected by the researchers.
4.6 Sustainability dimensional scope in bibliographic portfolio

Table 3 presents the framework of each article in the BP regarding the scope of the form of sustainability management in libraries.

The results presented in Table 3 show different approaches toward studying sustainability in the BP publications. The authors of the BP articles argue that understanding the Sustainability Management of Libraries in HEIs is a problem that, when modelled, must consider their uniqueness in terms of the environment and actors, as well as their multidimensionality; these convictions are essential to ensure their legitimacy in the eyes of stakeholders. This understanding of the evolution of the sustainability theme as a multidimensional and singular theme enhances its importance, highlighting that sustainability is present in HEIs’ strategic objectives. Thus, their participation and contribution can be observed, measured and managed in the objectives, strategies, values and mission of the HEIs. This theme is not addressed in this study, and the gap presents itself as an opportunity for future researchers.

The BP highlights studies on sustainability, with recommendations for:

- the use of more flexible organisational forms with a broader mission and a more personalised educational approach (Aleixo et al., 2018);
universities to focus on economic and environmental dimensions in their sustainability reports (Amaral et al., 2015);

making university practices related to sustainability management part of the university’s management process (Adams, 2013);

sustainable policies that are integrated with the strategic objectives of universities (Jankowska and Marcum, 2010);

universities’ sustainability policies being committed to a climate-oriented strategy (Beringer, 2007);

using green information services to show greenhouse gas emissions (Chowdhury, 2012);

HEI libraries using the five essential benchmarks for sustainability management: management, academy, environment, engagement and innovation (Alghamdi et al., 2017);

sustainability management focusing its functions on knowledge innovation culture (Sheng and Sun, 2007);

implementing sustainable practices, together with students, staff, teachers and the local community, to establish a commitment to sustainability (Aulisio, 2013); and

promoting the integration of sustainability into all dimensions of higher education practice (Kapitulcinová et al., 2018).

The results also show that first, the general understanding of sustainability is associated with a one-dimensional view corresponding to the environment and that this view gained...
prominence in the academic community, given its appeal to catastrophic situations (Barnes, 2012; Chowdhury, 2012; Drahein et al., 2019; Fedorowicz-Kruszewska, 2020). From a different perspective, there is a recognition that sustainability is a broader, multidimensional concept that incorporates economic, social and environmental dimensions in the daily activities of its management (Alghamdi et al., 2017; Amaral et al., 2015; Aulisio, 2013; Kapitulčinová et al., 2018; Sheng and Sun, 2007). From a third perspective, sustainability, particularly in the libraries of HEIs, is thought of as an evolution of the latter, with knowledge emerging to achieve the multidimensionality associated with the integration of models that aid the management of sustainability in HEIs (Adams, 2013; Aleixo et al., 2018; Asante and Ngulube, 2020; Asogwa, 2014; Ávila et al., 2019; Barnard and Van Der Merwe, 2016; Berchin et al., 2017; Beringer, 2007; Chowdhury, 2014; Drahein et al., 2019; Ekere et al., 2016; Fleacă et al., 2018; Jankowska and Marcum, 2010; Kuzma et al., 2020; Purcell et al., 2019).

The analysis of the BP articles highlights that research in the area of library management in HEIs from the perspective of sustainability – even those with high scientific recognition – need to consider the environmental, economic and social dimensions of sustainability. Further, we note that some studies confirm the need to integrate sustainability variables into the strategic objectives of the context in which they are located; however, none of them clarifies how to do it, in terms of its operationalisation. Identifying the criteria of the context, building scales to monitor its performance, setting goals for each

**Source:** Authors (2021)
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<th>Article citation form</th>
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<tr>
<td>Aleixo et al. (2018)</td>
<td>To analyse how HEIs promote sustainability, the main concepts underlying this discipline and how higher education for sustainable development is understood and can be improved in Portuguese HEIs</td>
<td>They highlight the importance of change in HEIs, through using more flexible organisational forms, a broader mission, a more personalised educational offer and commitment to the international</td>
<td>Multidimensional with management model</td>
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<tr>
<td>Amaral et al. (2015)</td>
<td>To provide an overview of the different approaches used by universities to implement, assess and report on sustainability</td>
<td>Results show that universities tend to focus on the economic and environmental dimensions in their sustainability reporting, either because of the strong environmental connotation of sustainability or because environmental issues are easier to measure</td>
<td>Multidimensional (sufficient)</td>
</tr>
<tr>
<td>Adams (2013)</td>
<td>To provide a perspective on sustainability reporting and performance management in the university sector, advocating for increased accountability, improved (management of) performance and greater innovation in approach</td>
<td>The study concludes that university practice in sustainability reporting and performance management lags significantly behind other sectors and is far from optimising the sector’s potential</td>
<td>Multidimensional with management model</td>
</tr>
<tr>
<td>Jankowska and Marcum (2010)</td>
<td>To discuss multidimensional sustainability issues in academic libraries and identify the need to design an integrated framework for sustainable strategies in academic libraries</td>
<td>Indicators are the foundation for developing a comprehensive framework helping to assess the impacts of library operations and future projects on library sustainability Sustainable strategies need to be integrated into a platform to guide future decisions about the collection, library buildings and the scale of library preservation, digitisation, equipment, products and service network efforts</td>
<td>Multidimensional with management model</td>
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<tr>
<td>Beringer (2007)</td>
<td>To assess the Luneburg Sustainable University Project in an international non-European context; relating the project’s academic approach to selected methods of practice-oriented North American academic sustainability in higher education (SHE)</td>
<td>The University of Luneburg is encouraged to commit to a climate-neutral campus strategy and to implement a sustainability management system, among other initiatives</td>
<td>Multidimensional with management model</td>
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<tr>
<td>Chowdhury (2012)</td>
<td>To examine sectors that develop information-intensive activities, such as higher education and research, it is possible to reduce GHG emissions by making adequate use of IT in the creation, management and use of information</td>
<td>It shows that information systems and services for the higher education and research sector currently generate massive greenhouse gas (GHG) emissions and it is argued that there is an urgent need to develop a green information service</td>
<td>One dimension (Environment)</td>
</tr>
<tr>
<td>Alghamdi et al. (2017)</td>
<td>To analyse 12 sustainability assessment tools in universities and develop the structure and content of these tools to be more intelligible</td>
<td>Five benchmarks are essential for a holistic framework: management; academia; environment; engagement and innovation</td>
<td>Multidimensional (sufficient)</td>
</tr>
<tr>
<td>Sheng and Sun (2007)</td>
<td>To define the meaning and functions of the knowledge innovation culture (KIC) of libraries, its influencing factors and some strategies to develop it</td>
<td>The KIC of libraries is an institutional system of value and behaviour, which gains competitive advantages and enables the sustainable development of libraries through the creation of knowledge</td>
<td>Multidimensional (sufficient)</td>
</tr>
<tr>
<td>Aulisio (2013)</td>
<td>To discuss the role of academic libraries in supporting the university’s mission</td>
<td>Even if librarians do not have LEED-certified buildings and classroom time, it does not mean that the library cannot be a leader in campus</td>
<td>Multidimensional (sufficient)</td>
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<tr>
<td>The study argues that they must, therefore, also play their part in education and sustainability operations</td>
<td>sustainability</td>
<td>The implementation of sustainable practices, together with students, employees, teachers and the local community, is enough to establish a commitment to sustainability</td>
<td>Multidimensional (sufficient)</td>
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<td>To provide an overview of the terminology used to integrate sustainability principles into higher education, as well as the tools, methods, frameworks or models and approaches (TMFAs) available to change agents</td>
<td>The Accelerator is a versatile toolkit to promote the integration of sustainability into all dimensions of higher education practice</td>
<td>However, very few institutions are using the toolkit in an integrated way across all dimensions of institutional practice</td>
<td>One dimension (Environment)</td>
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<tr>
<td>To provide an overview of green building technologies and practices and to illustrate how public libraries can use them as tools to teach their communities about sustainability and promote behaviour change</td>
<td>Library directors, staff and board members need to explain how sustainability applies across the community and show them how these technologies and practices can be used to improve the environmental quality of their homes, work and society</td>
<td>Multidimensional with management model</td>
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<td>To analyse advances in sustainable development combined with business models and educational processes; application of the process scope diagram to conceptualise the educational model needed to guide the HEI to include sustainability in the organisational culture and operations</td>
<td>Highlights the lack of capacity of HEIs to integrate the principles and practices of sustainable development into all aspects of education and learning, to act as an entrepreneurial university</td>
<td>Multidimensional with management model</td>
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<tr>
<td>To develop a conceptual model and research framework for studying the economic, social and environmental sustainability of digital libraries</td>
<td>Sustainable business models that support digital libraries must also promote equitable access using specific design and usability guidelines that facilitate easier, better and cheaper access; provide support for the personal, institutional and social culture of users; and at the same time, comply with the policies and regulatory frameworks of the respective regions, countries and institutions</td>
<td>Multidimensional with management model</td>
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<td>To provide an overview of the innovative management strategies of the University of Johannesburg (UJ) during the volatile post-merger years in its quest for a sustainable future</td>
<td>A set of necessary and sufficient conditions for innovation in sustainable development in higher education include decisive leadership in strategic direction; regular, flexible and inclusive planning; regular climate and culture surveys; constant monitoring of progress; and strategic agility, essential to driving innovation across the entire workforce</td>
<td>Multidimensional with management model</td>
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<td>To explore different ways to create sustainability strategies for delivering the SDGs that are explored in a university setting with an example from the UK, Bulgaria (Europe) and the USA</td>
<td>Partnerships within and among universities can help to accelerate the delivery of the SDGs, enabling higher education to make a fuller contribution to sustaining the economic, environmental, cultural and intellectual well-being of our global communities</td>
<td>Multidimensional with management model</td>
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<tr>
<td>16 Berchin <em>et al.</em> (2017)</td>
<td>To analyse strategies that promote sustainability in HEIs, focusing on the case study of a federal HEI in Brazil</td>
<td>Each institution must develop its objectives based specifically on its institutional demands, a solid plan to measure and report on program performance to assess its success and identify weaknesses that can be considered and improved</td>
<td>Multidimensional with management model</td>
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<tr>
<td>17 Drahein <em>et al.</em> (2019)</td>
<td>To test a procedure to assess the adoption of sustainable practices in the services of technological institutions of higher education, known as institutes of technology and polytechnic universities</td>
<td>There are no external incentives that contribute to the adoption of good practices such as green offices. There are isolated initiatives that are mostly related to solid waste management. Educational programs do not adequately address sustainability issues.</td>
<td>One dimension – Environment</td>
</tr>
<tr>
<td>18 Asogwa (2014)</td>
<td>To measure the competencies of libraries in Nigerian universities, identify constraints on their performance and recommend the infrastructure and competencies needed to ensure their sustainability</td>
<td>Academic libraries and librarians in Nigeria are competent in three main areas – educational functions, professional development and research. They are not very effective in providing and using library resources in cyberspace, adequate funding, collection development and information technology skills.</td>
<td>Multidimensional with management model</td>
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<tr>
<td>19 Ekere <em>et al.</em> (2016)</td>
<td>To examine the users’ perception of the MTN digital library facilities, resources and services at the University of Nigeria, Nsukka, regarding the effectiveness and efficiency of the library system</td>
<td>The general perception of users regarding the facilities, resources and services of the MTN, UNN digital library is satisfactory. Online internet search services, email services and online referral services were provided in the MTN library at higher levels compared to other services.</td>
<td>Multidimensional with management model</td>
</tr>
<tr>
<td>20 Kuzma <em>et al.</em> (2020)</td>
<td>To analyse the effects of innovation on the performance of organisational sustainability, as well as on the environmental, economic and social dimensions</td>
<td>a) Existence of a positive relationship between innovation and sustainability performance; b) evidence of the size of the effect of innovation on sustainability performance; and c) the identification of gaps in the scientific literature that assesses the effect of innovation on the sustainability of organisations.</td>
<td>Multidimensional with management model</td>
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<tr>
<td>21 Ávila <em>et al.</em> (2019)</td>
<td>To conduct a comparative analysis by innovation continents and sustainability barriers in universities</td>
<td>There is a lack of knowledge management to connect science, technology, innovation and sustainability, to improve management conditions, innovate, make decisions, support initiatives, create incentives and control mechanisms. The main barriers are the lack of planning and focus, the lack of environmental committees, the lack of applicability and continuity of actions and resistance to change.</td>
<td>Multidimensional with management model</td>
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<tr>
<td>22 Drabie, et al. (2020)</td>
<td>To create a conceptual framework that allows the assessment of sustainability practices in HEIs</td>
<td>Provides a table composed of ten thematic axes that describe sustainable operations in HEIs. They are governance and politics, laws, ethics and integrity, education, purchasing, transportation, energy, water, food, innovation and hazardous waste.</td>
<td>Multidimensional with management model</td>
</tr>
<tr>
<td>23 Asante and Ngulube (2020)</td>
<td>To investigate the critical success factors for implementing total quality management and the implications for sustainable academic libraries in Ghana</td>
<td>The critical success factors for the implementation of total quality management were employees (EI) must be involved in decision-making about quality management; employees exposed to related skills training (ET) for team members; innovation training (IE) of team members; the work ethic in the workplace; having CO to regulate the team’s professional life; teamwork among employees to facilitate coordination of activities; having clear lines of authority and having clear results.</td>
<td>Multidimensional with management model</td>
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<tr>
<td>24 Fedorowicz-Kruszewska (2020)</td>
<td>(1) To clarify the term “green library”, (2) to conceptualise the term “green library” and (3) to determine areas of “green library”</td>
<td>The number of green library indicators was expanded, which allowed the definition of this term to be clarified. The definition of “green librarianship” was then formulated and the areas of green librarianship were indicated.</td>
<td>One dimension (Environment)</td>
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**Source:** Authors (2021)
scale and – based on this knowledge – generating science-based actions to improve the context of managing a library from the perspective of sustainability is knowledge that is absent from the portion of literature represented in our BP.

The results presented show that researchers have expanded their knowledge about the subject based on the researched bases and the BP generated.

The knowledge generated allows us to identify the characteristics essential for understanding how the topic has been addressed in the international literature, generating support for the continuity of the research.

4.7 Theoretical and applied contributions

Analysing a scientific work on its bibliometrics is a pedagogical process: the evaluator for the topic under study proposes to select such a portfolio from a fragment of international literature that will represent his theme and expects that the considerations, carried out from this sample, are useful to authors, scientific community and society. Following common errors are conspicuous in the BP selection processes to accomplish bibliometrics studies:

- searching for the portfolio based on an unclear or even incomplete or distorted understanding of the theme;
- disregarding the stage of identification and recognition of the main areas of knowledge that make up the theme;
- belittling the importance of connection, representativeness and alignment of keywords that reflect each area of knowledge that, according to the researcher, are part of their theme;
- disregarding the research phase of the most useful search bases for the topic or restricting the search to the most familiar bases;
- disregarding the opportunity to expand and consolidate the understanding of the theme that the BP selection process offers; and
- disregarding that the BP search and selection process need to be scientifically based, therefore, need to be documented and traceable.

For topics involving sustainability management, these challenges are intensified in view of the multiple understandings with which the topic is perceived by scientific communities given the absence of a recognised definition that compiles the views of researchers; the politicisation of the term; and the miscellany of understandings with which the term management is perceived in the literature when used in association with sustainability.

The present research proposes, as a theoretical and practical contribution, a constructivist methodological process that writes off the errors most found in bibliometric works. During the BP selection process, it presents a scientific and traceable procedure to facilitate reflection and identification of areas of knowledge and keywords that for the researcher which, in their perception, best represent the theme as perceived by them. It also provides a procedure to recursively verify content and promote adjustments so that they better represent the understanding that the researcher wants to convey. It creates a BP where it is explained why each of the researcher’s articles belongs to this selected group. It uses a process that documents its evolution and can be replicated, imparting it a better scientific foundation. These contributions help to avoid the emergence of skewed knowledge during the formation of BP and, thus, restrict the possibility of generating false beliefs, during its bibliometric analysis.
5. Conclusion
This study aimed to examine and understand the characteristics of scientific publications that address the sustainable management of libraries in HEIs. A bibliometric analysis enabled us to collaborate in the development of knowledge and to identify research gaps. The ProKnow-C intervention instrument was used to select 24 articles, guide the bibliometric analysis, generate knowledge regarding the context and discuss the results.

The findings from the bibliometric analysis showed that:

- Publications on sustainability in HEI libraries do not have a network of authors who work in co-authorship. This leads to isolated publications and research, without a consensual definition of the theme.
- The article with the greatest scientific recognition was *Conceptualization of sustainable HEIs, roles, barriers and challenges for sustainability: an exploratory study in Portugal*, by Aleixo, Leal and Azeiteiro, published in the *Journal of Cleaner Production*, in 2018. This article analyses how HEIs promote sustainability, the main concepts underlying this discipline and how higher education for sustainable development is understood and can be improved among Portuguese HEIs (neither the article nor the authors are cited by BP articles, supporting the conclusion that topic understanding is heterogeneous).
- Sustainability is a recent topic and consensus has not yet been reached on its concept or the most appropriate way to incorporate it into the institutions' management.
- The keywords sustainability, higher education and libraries are the most frequently mentioned, showing the alignment with the research axes used to explain the areas of knowledge considered by the investigators as shapers of the theme.
- The heterogeneity of understanding regarding the definition of Management of Library Sustainability in HEIs was evidenced in the discrepancies of the dimensions that support its understanding among the BP investigations.
- The absence of scientific leadership for the topic Sustainability Management of Libraries in HEIs indicates the need for new research with theoretical and practical approaches to be discussed by the scientific community in the search for new consensual views.
- The evolution of the dimensional understanding of sustainability indicates a trend towards multidimensionality; and the concern with the integration of sustainability with the institution's strategic objectives is a requirement for sustainability management.

As a theoretical contribution to the research, the bibliographical retrospective on the theme *Sustainability Management of Libraries in HEIs* stands out. The analysis showed that the first studies addressed the theme of sustainability in HEIs and were related to the issue of sustainable architecture, called green libraries, that is, focusing on the understanding of environmental one-dimensionality for sustainability. Subsequently, the recognition that sustainability is a multidimensional concept burgeoned. With the evolution of this concept, a new understanding emerges, considering that achieving the multidimensionality of sustainability requires its integration with the institution's values and standardisation. This view prevails in most current studies.

The analysis of the most prominent publications suggests that the BP publications address the theme *Sustainability Management of HEI Libraries* focusing on the technical aspects of sustainability in isolation, without clarifying how each property is measured, how it affects the strategic objectives and which actions can be taken that are fundamentally the
most suitable for the overall improvement of the institution. This finding emerges as an opportunity for research on the topic, *Sustainability Management of HEI Libraries*, working to align with the trend and account for the multidimensionality and integration of sustainability with the organisation’s strategic objectives to build a support model for Sustainability Management of Libraries in HEIs.

Regarding limitations, the use of only two databases and articles written in English for the development of the BP should be mentioned. This limitation has no appreciable impact on the composition of the BP, as ProKnow-C has a final step called the “Representativeness Test”, which aims to verify in the references of each BP article for outstanding scientifically recognised research aligned with the theme and when found, if they are not yet in the portfolio, then it incorporates them, regardless of their origin.

The limitations of the work are associated with the use of the ProKnow-C protocol. When using this protocol, it is the researcher who establishes the areas of knowledge that explain their topic in an exhaustive way; the keywords that represent each area of knowledge and, thus, define the search equation; the search bases; among the search results, by reading the title, abstract, full article whether the article is aligned or not; and by the number of citations, they establish whether the article has scientific recognition or not. By following this protocol, the researcher admits that their BP does not represent the literature for the universal understanding of the topic; on the contrary, their BP represents a portion of the literature that represents the topic, as perceived by the researcher. For some, using this protocol is a limitation, while for researchers who wish to research a topic with an understanding delimited by them, the use of the ProKnow-C protocol is the indicated choice.

As a suggestion for further research on the topic “Sustainability in Library Management in Higher Education Institutions”, we propose the construction of multi-criteria models in a context that recognises sustainability as part of HEIs’ strategic objectives. Where the variables have scales that meet the scientific foundations and explain and measure at operational, tactical and strategic levels, the performance of sustainability in the context of the library and, thus, graphically and numerically explain the contribution of sustainability to the HEI’s strategies, vision and mission.

**References**


**About the authors**

Leonardo Ensslin is a Mechanical Engineer, with a Doctorate in Industrial and Systems Engineering at the University of Southern California. Ensslin is a Senior Researcher at the Postgraduate Program in Administration at the University of Southern Santa Catarina – UNISUL. It has several high-impact international publications related to the theme of organisational performance evaluation.

Ademar Dutra is the Administrator, with a Doctorate in Production Engineering from the Federal University of Santa Catarina. Dutra is also the Professor and a Researcher at the Postgraduate Program in Administration at the University of Southern Santa Catarina – UNISUL. Ademar Dutra is the corresponding author and can be contacted at: ademar.unisul@gmail.com

Sandra Rolim Ensslin is an Accountant, with a PhD in Production Engineering from the Federal University of Santa Catarina – UFSC. Ensslin is the Professor and a Researcher at the Postgraduate Programs in Accounting and Production Engineering at the Federal University of Santa Catarina – UFSC.

Edinei Antonio Moreno is a Librarian, with a Master’s Degree in Management of Information Units. Doctoral Student of the Postgraduate Program in Administration at the University of Southern Santa Catarina – UNISUL.

Leonardo Corrêa Chaves is the Administrator, with a Doctorate in Administration from the Federal University of Santa Catarina – UFSC. Chaves is the Professor and a Researcher at the Professional Program in Administration at the University of Contestado (UnC).

André Andrade Longaray is a Mathematician, with a Doctorate in Administration from the Federal University of Santa Catarina – UFSC. Longaray is the Professor and a Researcher at the Postgraduate Program in Administration at the University of Rio Grande – FURG.