Bibliometric study on SDG 6: analysing main content aspects by using Web of Science data from 2015 to 2021

Dibbern, Thais[a]; Rampasso, Izabela Simon[b,c]; Serafim, Milena Pavan[a]; Bertazzoli, Rodnei[c]; Leal Filho, Walter[d]; Anholon, Rosley[c]

[a]Laboratory of Public Sector Studies, School of Applied Sciences, University of Campinas, Limeira, Brazil.

[b] PNPD/CAPES Program, Doctoral Program in Sustainable Management Systems, Federal Fluminense University, Niterói, Brazil.

[c]School of Mechanical Engineering, University of Campinas, Campinas, Brazil.

[d]Faculty of Life Sciences, Hamburg University of Applied Sciences, Hamburg, Germany.

*corresponding author: izarampasso@gmail.com

Abstract

Purpose: The main objective of this article is to understand how the literature has been addressing the United Nations' Sixth Sustainable Development Goal to obtain an overview of the current scenario and future perspectives.

Design/methodology/approach: For this, a bibliometric analysis will be conducted with documents published between 2015 and 2021 and present in the Web of Science database. Initially, 328 documents were identified and after careful reading of titles and abstracts, 239 were analysed. These documents were analysed using tools available on the Web of Science database and the software Bibliometrix.

Findings: Among the results generated, it should be highlighted the identification of the motor themes "sustainable development" + "developing countries" and "water security", presenting a significant relevance to the field and a high development level. In addition, "human rights" was verified as an emerging theme in the context of SDG6 debates.

Originality/value: The information provided here offers good documentation of the extent to which SDG 6 is documented in the literature and can be helpful for researchers interested in the topic.

Keywords: SDG 6; Sustainability; Drinking water; Bibliometric Analysis.

1. Introduction

The last 30 years have marked a period of great advances in the scope of discussions related to sustainable development (Salvia *et al.*, 2019). This concept has been gaining attention in global debates mainly due to climate change and to a variety of environmental (O'Connor *et al.*, 2020) and social problems (Ikram *et al.*, 2020). A largely accepted definition of sustainable development (Donaires *et al.*, 2019; Martins *et al.*, 2019) was presented by the World Commission on Environment and Development (WCED): as the capacity to meet "the needs of the present without compromising the ability of future

generations to meet their own needs" (WCED, 1987). In essence, the mentioned concept integrates the economic, environmental, and social dimensions (Sachs *et al.*, 2019).

Among the main contemporary instruments that aim to contribute to sustainable development, Sustainable Development Goals (SDGs) should receive special attention (UN, 2015). Published in 2015 as a global policy to be implemented by all countries, the SDGs follow up on the Millennium Development Goals (MDGs) and present 169 integrated targets distributed in 17 goals. Among SDGs main topics, it is possible to highlight poverty eradication, to ensure people's health and well-being, to ensure gender equality, to reduce of inequalities, among others (UN, 2015).

SDG 6, in particular, focuses on the guarantee of drinking water and basic sanitation to the entire world population; this guarantee can be considered an essential requirement for reaching the other SDGs (UN, 2015). According to Horne et al. (2018), SDG 6 is necessary for economic growth, environmental sustainability, and the eradication of poverty and inequalities. Some targets of SDG 6 can be cited: universal access and fair distribution of drinking water, sanitation, and hygiene; water quality improvement, pollution reduction, dumping eradication, and reduction of the release of chemicals and hazardous materials; increase the efficiency of water use; water resource management integration implementation; protection and restoration of water-related ecosystems; increase international partnerships; support and strengthen partnerships with local communities, considering the improvement of water and sanitation management (Belmonte-Ureña *et al.*, 2021; Horne *et al.*, 2018; UN, 2015). As highlighted by Cook and Davíðsdóttir (2021), these targets related to SDG 6 are also relevant for assessing the economic well-being of a country.

Despite their visible importance, some challenges arise as obstacles in the achievement of these targets, especially the fact that the supply of water and sanitisation for many citizens is inadequate and improper. These challenges are among the causes of the death of millions of people, especially children, due to diseases related to the consumption of non-potable water and lack of basic sanitation. Still, regarding these challenges, it is estimated that 1 in 3 people do not have access to drinking water in the world; 2.2 billion people do not have treated water services worldwide; 4.2 billion do not have adequate basic sanitation services; and, 3 billion people do not have basic facilities to perform adequate hand hygiene (Biswas and Tortajada, 2019; United Nations Children's Fund (UNICEF) and World Health Organization, 2019). The COVID-19 pandemic increased the number of unemployed people, the poverty and reduced people quality of life (Biswas and Tortajada, 2019; Tortajada, 2021; Vialli, 2021). In this sense, challenging even more the achievement of the SDG 6 targets and

targets from other SDGs, such as SDG 8 ("Decent Work and Economic Growth"), for example (Anholon *et al.*, 2021).

It is possible to note that the targets of SDG 6 are critical for the survival and livelihood of the world population since its absence tends to harm the health and food security world population. In other words, the guarantee of a sustainable supply of drinking water and sanitation has a direct link with the other global objectives related to economic growth, industrialisation, sustainable consumption, and production, becoming essential to reach the other SDGs (Biswas, 2021).

Considering the presented context, this article aims to answer the following research question: "How has the academic literature been addressing the United Nations' SDG 6? The academic literature presents some studies with closely related themes, but these studies present relevant differences to the present research.

In this sense, it is interesting to present the differences of this research regarding the article entitled "Evolutionary overview of water resource management (1990–2019) based on a bibliometric analysis in Web of Science". In the mentioned article (Lv *et al.*, 2021), these terms were used in the search: (TI = water resource management and TI = water resource governance). It is possible to see that the search was restricted to the "articles" typology and limited to the titles. The software used for data analysis was Scimat. In our study, our terms were "SDG 6" and its derivations (using SDG 6, a document to be selected needed to mention this objective of sustainable development and it could not necessarily include the term "water" in the title). The period was from 2015 to 2021 and the search considering the terms in title, abstract, or keywords. Only in the years 2020 and 2021, 141 articles were retained, these years were not contemplated in the article "Evolutionary overview of water resource management (1990–2019) based on a bibliometric analysis in Web of Science". Our data analysis uses tools from the Web of Science database and Bibliometrix software. Thus, it is clear that there are significant differences of the present study and the paper of Lv et al. (2021) and the relevance of both. Other studies, in turn, have a more specific focus and carry out literature reviews on urban water management (Sochacka *et al.*, 2021), floating treatment of wetlands (Colares *et al.*, 2020), sustainable use of water in agriculture (Velasco-Muñoz *et al.*, 2018), water management accounting (Olusanmi *et al.*, 2021). They are, therefore, focused on specific areas.

In addition to this introduction, this article is composed of four more sections. Section two is dedicated to the presentation of methodological procedures, section three presents the results of bibliometric analysis, section four debates mainly result from thematic identified

within SDG 6 macro theme (clusters), and finally, section 5 presents conclusions and final considerations.

2. Methodological Procedures

Methodologically, in this article, it is performed a bibliometric analysis of documents published in the Web of Science from 2015 to 2021. As evidenced by Zupic and Čater (2015), bibliometric analysis is used in the literature to establish an overview of specific areas of knowledge. In this study, the documents were collected and analysed in May 2021. The objective of this research was exploratory and focused on identifying the core themes highlighted by these documents, instead of testing and confirming it. This is corroborated by Collis and Hussey (2013).

The research sample used in this study was obtained through the selection of documents from the Web of Science, an international database that offers scientific information to the academic community. This database is the largest referential source of technical and scientific literature reviewed by peers, thus allowing a broad view of the themes published with scientific rigour. Authors such as Norris and Oppenheim (2007), Castillo-Vergara et al. (2018), Santana and Cobo (2020) highlight the quality of the documents published in the Web of Science database.

The terms used for this search in the Web of Science platform were: "SDG6" or "SDG 6" or "sustainable development goal six" or "sustainable development goal 6 ". We decided to search these terms in "topics" (title, abstract, and keywords). The search was refined throughout the application of a filter by publication year from 2015 to 2021. Considering these sets, the first outcome generated 328 documents. The first sorting focused on document types. Only those documents classified as "articles" were considered in further analyses. After it, 256 documents were selected. In the sequence, titles, abstracts and keywords were carefully read and those documents that were not within the scope of this study were removed. Thus, the final sample was composed of 239 items that were considered in the analysis.

Another important step to perform this research was homogenising keywords and authors names in the database used. According to Mariani and Borghi (2019), it is necessary to homogenise differences in authors names and the use of synonyms for keywords or

keywords written differently. In this sense, homogenisation can provide a more robust scientific mapping.

Regarding the keywords, an example was the terms "2030 agenda for sustainable development" = "2030 agenda" = "agenda-2030" that were unified as "agenda 2030". Another example was the term "sdg 6" (used as the standard term), that was also presented in the keywords as "development goal 6"; "goal 6"; "(sdg 6)"; "sustainable development goals" (sdg6)"; sustainable development goal 6; "sustainable development goal (sdg) 6"; "sdg6". Several other words presented the same need of unification. A second analysis for homogenisation was the use of terms with the same meaning, such as "Humans rights (to water)" and "Humans rights", that were unified for "Humans rights". In relation to the keywords, a third issue was also addressed, since some articles did not present keywords; for them, initially, additional keywords from the database were used and, when it was not possible, the authors structured the keywords considering the abstract of the article. Regarding the authors analysed, few names required homogenisation, e.g., "BANDA S" and "BANDA ST", that were both for the authors "Sembeyawo T. Banda".

To conduct the mentioned homogenisation, the authors of this research converted the file bibitex obtained from Web of Science database into a xlsx file, through the R-Studio. After conducting the careful analysis mentioned, data was sent back to R-Studio. The bibliometric analysis was performed via Bibliometrix software. As argued by Aria and Cuccurullo (2017), Bibliometrix is a powerful software, with a user-friendly interface that uses R-Studio structure for data processing.

Considering the objectives of this study, the following analyses were developed: 1) summarising the primary information about the analysed sample; 2) analysis scientific production regarding publishing year; 3) more relevant sources, including analysis through Bradford's Law; 4) main affiliations present in the sample of documents; 5) main countries and analysis of the collaboration network; 6) most cited documents from the studied sample; 7) academic articles most cited as references in the sample of documents; 8) the most frequent words; 9) the dynamics of these words during the period from 2015 to 2021; 10) thematic map about clustered themes for SDG6. In this study, the thematic map was set with the following parameters: 800 as the limit for the number of words; 17 as the minimum cluster frequency per thousand documents; and maximum of 2 labels for each cluster.

In Bradford's Law, it is argued that: *"if the journals containing articles on a given subject are arranged in descending order of the number of articles they carried on the subject, then successive zones of periodicals containing the same number of articles on the*

subject form the simple geometric series 1: n :n²: n³ and Bradford called the first zone, the nucleus of periodicals particularly devoted to the given subject" (Alabi, 1979, p. 151).

For the thematic map, it is initially interesting to define the concepts of centrality density. According to Callon et al. (1991, pp. 164–165), centrality measures the importance of a theme for a scientific field and the density measures how developed this theme is. The structure of a thematic map, according to Cobo et al. (2012), is composed of four quadrants. In the upper right quadrant, there is the area for high-density and high-centrality themes, which are called motor themes. In the lower right quadrant, there are the high-density but less dense themes; they are defined as the basic or transversal themes. In the upper left quadrant, there are the themes of low centrality and high density, essentially defined as specific or isolated themes. Finally, in the lower-left quadrant, there are the themes of low density and low centrality, which are not completely clear yet; they are classified as "emerging or declining themes" (Cobo *et al.*, 2012). Figure 1 illustrates these quadrants.

Figure 1 position.

From the bibliographic findings obtained, it was possible to debate the results and establish the conclusions and final considerations. Figure 2 synthesises the procedures conducted in this research, enabling the replication of the procedures.

Figure 2 position.

3. Results and discussions

Initially, it is interesting to present general information on the sample analysed. In total, 239 articles published in 109 journals were analysed. They presented 6,423 citations until the moment of this research. After data homogenisation, 864 keywords were identified; other 619 words were considered as generated from the database. Regarding authors, 940 researchers were identified in the sample, presenting an average of four authors in each document. Additional details can be verified in Table 1.

Table 1 position.

Regarding the annual scientific production on the field, the number of articles published per year since 2015 is shown in Figure 3. It is noted that interest in the SDG6 theme has been growing strongly. It is noteworthy that, in 2021, the value shown in the graph corresponds to the total number of publications until the time this research was performed.

Figure 3 position.

Analysing the journals that contributed the most in terms of articles in the analysed sample, it is observed through Figure 4 that six journals present contributions greater than 3%. When performing a shared analysis using the BradFord's Law, via Bibliometrix software, it is observed that in Zone 1 there are six journals that published 85 of the documents (Sustainability; Science of The Total Environment; Water; Journal of Water Sanitation and Hygiene for Development; Journal of Environmental Management; International Journal of Environmental Research and Public Health). In Zone 2, there are 25 journals that published 76 documents and finally, in Zone 3, 78 journals are responsible for 78 documents. Analysing the number of documents by zones, they are close, but in relation to the progression 1: n: n^2: n^3; there is a greater deviation with a distance between the zones. Despite limitations of this study regarding sampling delimitation (only articles are considered), it is evident, as shown in Figure 5, that the six journals in Zone 1 are the "Core Sources" and this is a result to be highlighted.

Figure 4 position.

Figure 5 position.

In the sequence, the most relevant authors were analysed. Through Table 2, it is possible to identify those authors that stand out: Kalin RM (7 articles), Rivett MO (7 articles) and Bartram JK (6 articles). It is also evidenced the high number of authors that have 3 articles in the sample.

Table 2 position.

Figure 6 presents the main affiliations evidenced in the sample of documents studied. The University of Strathclyde stands out, being present in 24 documents, and the University of OXFORD is also highlighted, being involved in 14 articles. Other relevant affiliations are presented in Figure 6.

Figure 6 position.

Analysing the countries mentioned in the analysed documents, the United Kingdom is emphasised, participating of 154 documents and the United States with presence in 144 documents. It should be mentioned that more than one country can be present in each document according to the authors affiliations. Figure 7 shows the other countries that also stand out in this analysis and Figure 8 shows the cooperation network between countries. Through Figures 7 and 8, it is possible to verify that besides being the most frequent countries in the sample, the cooperation between the United States and the United Kingdom (UK) should be highlighted. Another interesting relationship is between the UK and Malawi.

Figure 7 position.

Figure 8 position.

Focusing on the citations received by the analysed documents, it is possible to verify that the article "The Relevance of Circular Economy Practices to the Sustainable Development Goals" (published in 2019) stands out, presenting 156 citations. Other two articles also received a large number of citations, they are "Evaluating Synergies and Trade-Offs among Sustainable Development Goals (SDGs): Explorative Analyses of Development Paths in South Asia and Sub-Saharan Africa" and "Trade-offs between social and environmental Sustainable Development Goals", with 58 and 51 citations, respectively. The data regarding the ten most cited documents are presented in Table 3.

Table 3 position.

Regarding the academic references cited by the analysed documents, three articles are highlighted, they are "Policy: Map the interactions between Sustainable Development Goals", "Fecal Contamination of Drinking-Water in Low- and Middle-Income Countries: A Systematic Review and Meta-Analysis", and "Towards Integration at Last? The Sustainable Development Goals as a Network of Targets", with 13, 12 and 11 citations, respectively. In Table 4, the most relevant references cited by the analysed sample are presented.

Table 4 position.

When analysed the frequency of the words, it is possible to observe that those directly related to sdg and water analysis are highlighted. In Table 5, the most frequent words and their occurrences are detailed.

Table 5 position.

Besides words occurrence, an interesting analysis to be conducted is the dynamic of words occurrences throughout the years. As it is shown in Figure 9, the frequencies of the words "SDGs" and "SDG6" largely increased in the analysed period and, in 2021, their frequencies were much higher than the other words, showing the increasing relevance of SDGs' related debates in the literature. In addition, it should be noted that all the words presented in Figure 9 increased their frequencies during the analysed period. Further details can be verified in the mentioned figure.

Figure 9 position.

As presented in the methods section, a thematic map (Figure 10) was structured to analyse the words regarding their density. In this analysis, an important finding was obtained: the themes "sustainable development" + "developing countries" and "water security" were identified as motor themes, that is, they are important and well-developed

themes in these debates and because of this, they work as motors for the debates. Another important finding is the presence of "human rights" as an "emerging or declining theme".

Figure 10 position.

Initially, it is important to mention that the descriptive bibliometric mapping about documents published per year and by typology, considered the main countries where institutions researching about the theme are placed, journals with the most significant number of documents analysed, number of citations and the most references cited by the documents analysed, among other condensed information. These are extremely valuable for researchers interested in SDG 6 themes. The synthesis presented in this paper can be considered a guide.

Considering all the contributions presented by the findings of this research, the analysis of the thematic map should be highlighted. Regarding "human rights" allocation in the map, it is possible to verify it is an emerging theme. Besides the relevance of water for fauna and flora survival, Bwire et al. (2020) also emphasise the dangers of waterborne diseases that people may be subject to when their access to safe water is scarce. Heller et al. (2020) highlight the relevance of the UN's establishment of water and sanitation as human rights in 2010. However, despite the advancements of this debate in recent years, some countries (such as Uruguay, Bolivia, and the Maldives) do not consider water and sanitation as human rights. In addition, the authors argue several challenges that still require attention, such as transboundary waters, analysis of drinking water quality, public services related to water and sanitation, among others.

Focusing on the identified motor themes, relevant issues can be considered from them. As highlighted by Wutich (2020), water security is among the most important goals for the maintenance of life on earth. Besides quantity, the water security is also related to the quality of water and for ensuring it, a combination of technologies and policies is required (Mycoo, 2018). Among the manners of seeking water security through technologies, improved irrigation systems can be mentioned (McCartney *et al.*, 2019; Mungsunti and Parton, 2019).

Regarding the combination of "sustainable development" and "developing countries" as motor themes, the focus of many articles on developing countries can be explained by the greater challenges that these nations present for achieving SDG 6. As argued by Udmale et al. (2016), population size and lack of adequate infrastructure and resources can be mentioned as reasons for the greater difficulty that these countries have to ensure people

assess to drinking water. Besides focusing on developing countries, some research addresses rural areas of these nations and highlight the greater difficulties that these regions present regarding sustainable management of water (Díaz-Alcaide *et al.*, 2021; Marshall and Kaminsky, 2016).

In summary, the main findings are presented in the Table 6.

Table 6 position.

4. Conclusions and Final Considerations.

Bibliometric analyses contribute to a better understanding of the profile of a theme, and of an academic knowledge area. The process of extraction of strategic information can support researchers interested in a theme, providing detailed guidelines. Over the past few years, bibliometric studies have become more frequent since the information and scientific bases have become more accessible in digital format. As a result, tools and software have emerged to assist this type of study.

In addition to the condensation of information that can be useful to researchers interested in the area, our study also identified that "human rights" is an emerging theme in the debates related to SDG 6, indicating that the connection of a sustainable management system as a human right is more recent and should be further addressed. While "water security", and "sustainable development" and "developing countries" were identified as motor themes in the field, showing the relevance of these topics and the great attention that they are receiving in the literature.

Besides evidencing the relevance of SDG 6 as a core theme in several studies in the literature, this research presented those issues most addressed and the emerging one. The findings presented here can be used in future research as a source of information to base other studies and by policy makers to establish support arguments regarding the establishment of sustainable water management systems and proposals of partnerships for it. Especially when the strategic map is defined, a clearer view is provided to researchers and policy makers about how each theme is characterised regarding their centrality and density, providing a relevant theoretical contribution. For teaching, the findings of this research drive professors and students to the most appropriate source of information and themes. We also

understand that supporting better training for the future professionals regarding SDG 6, this study presents contributions to enhance society well-being.

The study was developed with all scientific rigour to provide credibility to the information identified. However, some limitations can be mentioned. The main limitation is associated with the fact that the search was conducted only on the Web of Science database. It is one of the best scientific databases of the word. Nonetheless, there are others. Thus, searches on different bases can provide other results. As proposals for future studies, we recommend the conduction of research focused on the link between human rights and water security, especially in developing countries. Considering the relevance of this step in the search for sustainable development, further studies exploring manners to ensure the access of drinking water to everyone are urgent. Considering this, we suggest the following research questions for future studies: a) In the perspective of experts, how developing countries can conciliate economic development, and fundamental rights for water and sanitation for all? b) How to enable water security projects on a global scale? c) How the rights for water and sanitation impact the other SDGs?

References

Alabi, G. (1979), "Bradford's law and its application", *International Library Review*, Vol. 11 No. 1, pp. 151–158.

Anholon, R., Rampasso, I.S., Martins, V.W.B., Serafim, M.P., Leal Filho, W. and Quelhas, O.L.G. (2021), "COVID-19 and the targets of SDG 8: reflections on Brazilian scenario", *Kybernetes*, Vol. 50 No. 5, pp. 1679–1686.

Aria, M. and Cuccurullo, C. (2017), "bibliometrix : An R-tool for comprehensive science mapping analysis", *Journal of Informetrics*, Vol. 11 No. 4, pp. 959–975.

Belmonte-Ureña, L.J., Plaza-Úbeda, J.A., Vazquez-Brust, D. and Yakovleva, N. (2021), "Circular economy, degrowth and green growth as pathways for research on sustainable development goals: A global analysis and future agenda", *Ecological Economics*, Vol. 185, p. 107050.

Biswas, A.K. (2021), "Water as an engine for regional development", *International Journal of Water Resources Development*, Vol. 37 No. 3, pp. 359–361.

Biswas, A.K. and Tortajada, C. (2019), "Water crisis and water wars: myths and realities", *International Journal of Water Resources Development*, Vol. 35 No. 5, pp. 727–731.

Bwire, G., Sack, D.A., Kagirita, A., Obala, T., Debes, A.K., Ram, M., Komakech, H., *et al.* (2020), "The quality of drinking and domestic water from the surface water sources (lakes, rivers, irrigation canals and ponds) and springs in cholera prone communities of Uganda: an analysis of vital physicochemical parameters", *BMC Public Health*, Vol. 20 No. 1, p. 1128.

Callon, M., Courtial, J.P. and Laville, F. (1991), "Co-word analysis as a tool for describing the network of interactions between basic and technological research: The case of polymer chemsitry", *Scientometrics*, Vol. 22 No. 1, pp. 155–205.

Castillo-Vergara, M., Alvarez-Marin, A. and Placencio-Hidalgo, D. (2018), "A bibliometric analysis of creativity in the field of business economics", *Journal of Business Research*, Vol. 85, pp. 1–9.

Cobo, M.J., López-Herrera, A.G., Herrera-Viedma, E. and Herrera, F. (2012), "SciMAT: A new science mapping analysis software tool", *Journal of the American Society for Information Science and Technology*, Vol. 63 No. 8, pp. 1609–1630.

Colares, G.S., Dell'Osbel, N., Wiesel, P.G., Oliveira, G.A., Lemos, P.H.Z., da Silva, F.P., Lutterbeck, C.A., *et al.* (2020), "Floating treatment wetlands: A review and bibliometric analysis", *Science of The Total Environment*, Vol. 714, p. 136776.

Collis, J. and Hussey, R. (2013), *Business Research: A Practical Guide for Undergraduate and Postgraduate Students*, Palgrave Macmillan.

Cook, D. and Davíðsdóttir, B. (2021), "An appraisal of interlinkages between macro-economic indicators of economic well-being and the sustainable development goals", *Ecological Economics*, Vol. 184, p. 106996.

Díaz-Alcaide, S., Sandwidi, W.J., Martínez-Santos, P., Martín-Loeches, M., Cáceres, J.L. and Seijas, N. (2021), "Mapping Ground Water Access in Two Rural Communes of Burkina Faso", *Water*, Vol. 13 No. 10, p. 1356.

Donaires, O.S., Cezarino, L.O., Caldana, A.C.F. and Liboni, L. (2019), "Sustainable development goals – an analysis of outcomes", *Kybernetes*, Vol. 48 No. 1, pp. 183–207.

Heller, L., De Albuquerque, C., Roaf, V. and Jiménez, A. (2020), "Overview of 12 Years of Special Rapporteurs on the Human Rights to Water and Sanitation: Looking Forward

to Future Challenges", *Water*, Vol. 12 No. 9, p. 2598.

Horne, J., Tortajada, C. and Harrington, L. (2018), "Achieving the Sustainable Development Goals: improving water services in cities affected by extreme weather events", *International Journal of Water Resources Development*, Vol. 34 No. 4, pp. 475–489.

Ikram, M., Zhang, Q., Sroufe, R. and Ferasso, M. (2020), "The social dimensions of corporate sustainability: An integrative framework including COVID-19 insights", *Sustainability (Switzerland)*, Vol. 12 No. 20, pp. 1–29.

Lv, T., Wang, L., Xie, H., Zhang, X. and Zhang, Y. (2021), "Evolutionary overview of water resource management (1990–2019) based on a bibliometric analysis in Web of Science", *Ecological Informatics*, Vol. 61, p. 101218.

Mariani, M. and Borghi, M. (2019), "Industry 4.0: A bibliometric review of its managerial intellectual structure and potential evolution in the service industries", *Technological Forecasting and Social Change*, Vol. 149, p. 119752.

Marshall, L. and Kaminsky, J. (2016), "When behavior change fails: evidence for building WASH strategies on existing motivations", *Journal of Water, Sanitation and Hygiene for Development*, Vol. 6 No. 2, pp. 287–297.

Martins, V.W.B., Rampasso, I.S., Anholon, R., Quelhas, O.L.G. and Leal Filho, W. (2019), "Knowledge management in the context of sustainability: Literature review and opportunities for future research", *Journal of Cleaner Production*, Vol. 229, pp. 489–500.

McCartney, M.P., Whiting, L., Makin, I., Lankford, B.A. and Ringler, C. (2019), "Rethinking irrigation modernisation: realising multiple objectives through the integration of fisheries", *Marine and Freshwater Research*, Vol. 70 No. 9, p. 1201.

Mungsunti, A. and Parton, K.A. (2019), "The sustainability of the muang fai irrigation system of northern Thailand", *AIMS Environmental Science*, Vol. 6 No. 2, pp. 77–93.

Mycoo, M.A. (2018), "Achieving SDG 6: water resources sustainability in Caribbean Small Island Developing States through improved water governance", *Natural Resources Forum*, Vol. 42 No. 1, pp. 54–68.

Norris, M. and Oppenheim, C. (2007), "Comparing alternatives to the Web of Science for coverage of the social sciences' literature", *Journal of Informetrics*, Vol. 1 No. 2, pp.

161–169.

O'Connor, B., Bojinski, S., Röösli, C. and Schaepman, M.E. (2020), "Monitoring global changes in biodiversity and climate essential as ecological crisis intensifies", *Ecological Informatics*, Vol. 55, p. 101033.

Olusanmi, O.A., Emeni, F.K., Uwuigbe, U. and Oyedayo, O.S. (2021), "A bibliometric study on water management accounting research from 2000 to 2018 in Scopus database", edited by Amoo, E.O.*Cogent Social Sciences*, Vol. 7 No. 1, p. 1886645.

Sachs, J.D., Schmidt-Traub, G., Mazzucato, M., Messner, D., Nakicenovic, N. and Rockström, J. (2019), "Six Transformations to achieve the Sustainable Development Goals", *Nature Sustainability*, Vol. 2 No. 9, pp. 805–814.

Salvia, A.L., Leal Filho, W., Brandli, L.L. and Griebeler, J.S. (2019), "Assessing research trends related to Sustainable Development Goals: local and global issues", *Journal of Cleaner Production*, Elsevier Ltd, Vol. 208, pp. 841–849.

Santana, M. and Cobo, M.J. (2020), "What is the future of work? A science mapping analysis", *European Management Journal*, ELSEVIER SCI LTD, THE BOULEVARD, LANGFORD LANE, KIDLINGTON, OXFORD OX5 1GB, OXON, ENGLAND, Vol. 38 No. 6, pp. 846–862.

Sochacka, B.A., Kenway, S.J. and Renouf, M.A. (2021), "Liveability and its interpretation in urban water management: Systematic literature review", *Cities*, Vol. 113, p. 103154.

Tortajada, C. (2021), "COVID-19 and clean water, sanitation and wastewater management", *International Journal of Water Resources Development*, Vol. 37 No. 2, pp. 179–181.

Udmale, P., Ishidaira, H., Thapa, B. and Shakya, N. (2016), "The Status of Domestic Water Demand: Supply Deficit in the Kathmandu Valley, Nepal", *Water*, Vol. 8 No. 5, p. 196.

UN. (2015), "Transforming our world: the 2030 Agenda for Sustainable Development", available at: https://sdgs.un.org/2030agenda (accessed 6 January 2021).

United Nations Children's Fund (UNICEF) and World Health Organization. (2019), "Progress on household drinking water, sanitation and hygiene 2000-2017".

Velasco-Muñoz, J., Aznar-Sánchez, J., Belmonte-Ureña, L. and Román-Sánchez, I. (2018), "Sustainable Water Use in Agriculture: A Review of Worldwide Research",

Sustainability, Vol. 10 No. 4, p. 1084.

Vialli, A. (2021), "Pandemia torna a universalização do acesso mais difícil", *Valor Econômico*.

WCED. (1987), "Our Common Future: Report of the World Commission on Environment and Development", *United Nations Commission*, Vol. 4 No. 1, p. 300.

Wutich, A. (2020), "Water insecurity: An agenda for research and call to action for human biology", *American Journal of Human Biology*, Vol. 32 No. 1, available at:https://doi.org/10.1002/ajhb.23345.

Zupic, I. and Čater, T. (2015), "Bibliometric Methods in Management and Organization", *Organizational Research Methods*, Vol. 18 No. 3, pp. 429–472.

Table 1. Main information about data (Source: data from research generated by Bibliometrix)

Description	Results
Sources	109
Documents (Article)	239
Average citations per documents	6,423
Average citations per year per doc	2,246
References	10,980
Keywords Plus – from database (ID)	619
Author's Keywords (DE)	864
Authors	940
Authors of single-authored documents	20
Authors of multi-authored documents	920
Authors per Document	3.93

Table 2. Researcher most relevant regarding documents authorship (Source: Data from research generated by Bibliometrix)

Authors	Articles
Kalin RM	7
Rivett MO	7
Bartram JK	6
Addison MJ; Anthonj C; Bain R; Banda ST; Coulson AB; Cronk R; Fleming L; Giupponi C; Han M; Jimenez A; Lapworth Dj; Macdonald Am; Qadir M; Truslove Jp; Wanangwa Gj; Ward Jst; Willetts J	3

Table 3. Citation of the analysed documents. (Source: data from research generated by Bibliometrix)

Document	Total Citations
Schroeder, P., Anggraeni, K. and Weber, U. (2019), "The Relevance of Circular Economy Practices to the Sustainable Development Goals", *Journal of Industrial Ecology*, Vol. 23 No. 1, pp. 77–95.	**156**
Mainali, B., Luukkanen, J., Silveira, S. and Kaivo-oja, J. (2018), "Evaluating Synergies and Trade-Offs among Sustainable Development Goals (SDGs): Explorative Analyses of Development Paths in South Asia and Sub-Saharan Africa", *Sustainability*, Vol. 10 No. 3, p. 815.	**58**
Scherer, L., Behrens, P., de Koning, A., Heijungs, R., Sprecher, B. and Tukker, A. (2018), "Trade-offs between social and environmental Sustainable Development Goals", *Environmental Science & Policy*, Vol. 90, pp. 65–72.	**51**
van Puijenbroek, P.J.T.M., Beusen, A.H.W. and Bouwman, A.F. (2019), "Global nitrogen and phosphorus in urban waste water based on the Shared Socio-economic pathways", *Journal of Environmental Management*, Vol. 231, pp. 446–456.	**35**
Saladini, F., Betti, G., Ferragina, E., Bouraoui, F., Cupertino, S., Canitano, G., Gigliotti, M., et al. (2018), "Linking the water-energy-food nexus and sustainable development indicators for the Mediterranean region", *Ecological Indicators*, Vol. 91, pp. 689–697.	**33**
Udmale, P., Ishidaira, H., Thapa, B. and Shakya, N. (2016), "The Status of Domestic Water Demand: Supply Deficit in the Kathmandu Valley, Nepal", *Water*, Vol. 8 No. 5, p. 196.	**33**
Hussein, H., Menga, F. and Greco, F. (2018), "Monitoring Transboundary Water Cooperation in SDG 6.5.2: How a Critical Hydropolitics Approach Can Spot Inequitable Outcomes", *Sustainability*, Vol. 10 No. 10, p. 3640.	**32**
Fader, M., Cranmer, C., Lawford, R. and Engel-Cox, J. (2018), "Toward an Understanding of Synergies and Trade-Offs Between Water, Energy, and Food SDG Targets", *Frontiers in Environmental Science*, Vol. 6, available at:https://doi.org/10.3389/fenvs.2018.00112.	**29**
Alarcón, D.M. and Cole, S. (2019), "No sustainability for tourism without gender equality", *Journal of Sustainable Tourism*, Vol. 27 No. 7, pp. 903–919.	**24**
Nhemachena, C., Matchaya, G., Nhemachena, C., Karuaihe, S., Muchara, B. and Nhlengethwa, S. (2018), "Measuring Baseline Agriculture-Related Sustainable Development Goals Index for Southern Africa", *Sustainability*, Vol. 10 No. 3, p. 849.	**24**

Table 4. Academic references cited in the analysed documents. (Source: data from research generated by Bibliometrix)

Cited References	Citations
Nilsson, M., Griggs, D. and Visbeck, M. (2016), "Policy: Map the interactions between Sustainable Development Goals", *Nature*, Vol. 534 No. 7607, pp. 320–322.	13
Bain, R., Cronk, R., Wright, J., Yang, H., Slaymaker, T. and Bartram, J. (2014), "Fecal Contamination of Drinking-Water in Low- and Middle-Income Countries: A Systematic Review and Meta-Analysis", edited by Hunter, P.R.*PLoS Medicine*, Vol. 11 No. 5, p. e1001644.	12
Le Blanc, D. (2015), "Towards Integration at Last? The Sustainable Development Goals as a Network of Targets", *Sustainable Development*, Vol. 23 No. 3, pp. 176–187.	11
Bartram, J., Brocklehurst, C., Fisher, M., Luyendijk, R., Hossain, R., Wardlaw, T. and Gordon, B. (2014), "Global Monitoring of Water Supply and Sanitation: History, Methods and Future Challenges", *International Journal of Environmental Research and Public Health*, Vol. 11 No. 8, pp. 8137–8165.	9
Mekonnen, M.M. and Hoekstra, A.Y. (2016), "Four billion people facing severe water scarcity", *Science Advances*, Vol. 2 No. 2, p. e1500323.	9
Pradhan, P., Costa, L., Rybski, D., Lucht, W. and Kropp, J.P. (2017), "A Systematic Study of Sustainable Development Goal (SDG) Interactions", *Earth's Future*, Vol. 5 No. 11, pp. 1169–1179.	9
Fuso Nerini, F., Tomei, J., To, L.S., Bisaga, I., Parikh, P., Black, M., Borrion, A., et al. (2018), "Mapping synergies and trade-offs between energy and the Sustainable Development Goals", *Nature Energy*, Vol. 3 No. 1, pp. 10–15.	8
Vanham, D., Hoekstra, A.Y., Wada, Y., Bouraoui, F., de Roo, A., Mekonnen, M.M., van de Bund, W.J., et al. (2018), "Physical water scarcity metrics for monitoring progress towards SDG target 6.4: An evaluation of indicator 6.4.2 'Level of water stress'", *Science of The Total Environment*, Vol. 613–614, pp. 218–232.	8

Table 5. Most frequent keywords in the analysed documents. (Source: data from research generated by Bibliometrix)

Words	Occurrences
sdgs	87
sdg6	72
water	27
sanitation	23
water quality	22
water supply	22
drinking water	21
sustainability	14
groundwater	12
wash	11
agenda 2030	9
climate change	9
sustainable	9
sustainable development	8
water governance	8
africa	7
developing countries	7
malawi	7
water scarcity	7

Table 6. Summary of the main findings. (Source: data from research generated by Bibliometrix)

| Item analysed	Main finding
Researchers most relevant regarding documents authorship	Kalin RM; and Rivett MO
Most cited document of the sample	Schroeder, P., Anggraeni, K. and Weber, U. (2019), "The Relevance of Circular Economy Practices to the Sustainable Development Goals", Journal of Industrial Ecology, Vol. 23 No. 1, pp. 77–95.
Most cited academic reference	Nilsson, M., Griggs, D. and Visbeck, M. (2016), "Policy: Map the interactions between Sustainable Development Goals", Nature, Vol. 534 No. 7607, pp. 320–322.
Most frequent keywords	Sdg; and sdg6
Contribution of leading journals	Sustainability
Main affiliation	Univ. Strathclyde
Highlighted countries	UK; and USA
Motor themes	Water security; Sustainable development; Developing countries
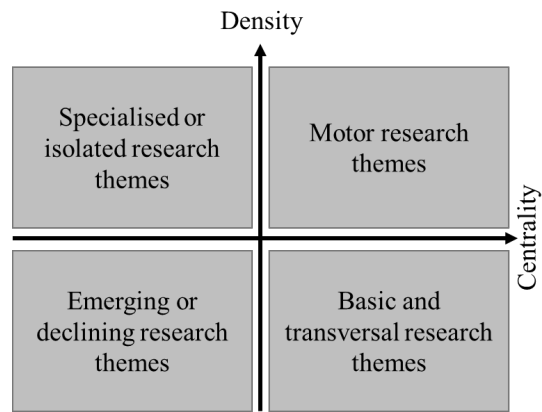
Figure 1. Strategic diagram (Source: Adapted from (Cobo *et al.*, 2012))