SUSTAINABLE PUBLIC PROCUREMENT: A BIBLIOGRAPHIC SURVEY

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ABSTRACT

Purpose: This article aims to present the scientific production inherent to the subject of sustainable public procurement from documents surveyed in the Web of Science (WoS) database.

Theoretical framework: the work was based on understanding how the public procurement theme is correlated with sustainability and how, in quantitative levels, the scientific production addresses this issue.

Method/design/approach: The research was exploratory with a qualitative approach in which a structured mapping was performed, by means of the bibliometric method, on the scientific articles in WoS in the last five years.

Results and conclusion: as a result of the research, it was analyzed that the authors with the highest production on the subject are not necessarily the most cited, with only one occurrence. Other results were a great diversity of theories/models used by the selected authors. And they were obtained with the help of the R Program - Bibliometrix.

Research implications: the research makes explicit, through its results, both the relevance of the authors and the scientific production that these researchers are producing on sustainable public procurement. Another implication is the survey of the theories used for the studies on the theme.

Originality/value: as this is an unprecedented study, the research sought to present to the scientific community the importance of what is currently being produced on the subject of sustainable public procurement, providing managers and researchers with the most current sources and main authors on the subject.

Keywords: Bibliometric Survey, Program R, Sustainable Procurement, Organizational Theories.

COMPRAS PÚBLICAS SUSTENTÁVEIS: UM LEVANTAMENTO BIBLIOMÉTRICO

RESUMO

Objetivo: este artigo tem por objetivo apresentar a produção científica inerente ao assunto de compras públicas sustentáveis a partir de documentos levantados na base de dados da Web of Science (WoS).

Referencial teórico: o trabalho se fundamentou em compreender de que forma o tema compras públicas está correlacionado com a sustentabilidade e como, em níveis quantitativos, a produção científica aborda essa questão.

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Método: a pesquisa foi exploratória com uma abordagem qualitativa no qual foi realizado um mapeamento estruturado, por meio do método bibliométrico, nos artigos científicos da WoS nos últimos cinco anos.

Resultados e conclusão: Como resultado da pesquisa, analisou-se que os autores com maior produção sobre o assunto não necessariamente são os mais citados, havendo apenas uma ocorrência. Outros resultados foram uma grande diversidade de teorias/modelos utilizadas pelos autores selecionados. E foram obtidos com o auxílio do Programa R – Bibliometrix.

Implicações da pesquisa: a pesquisa explicita, por meio de seus resultados, tanto a relevância dos autores como da produção científica que estes pesquisadores estão produzindo sobre compras públicas sustentáveis. Outra implicação é do levantamento das teorias utilizadas para os estudos sobre o tema.

Originalidade/valor: por ser um estudo inédito, a pesquisa buscou apresentar à comunidade científica a importância do que se está sendo produzido atualmente sobre o tema compras públicas sustentáveis proporcionando aos gestores e pesquisadores fontes mais atuais e principais autores sobre o assunto.


1 INTRODUCTION

Public organizations through sustainable public procurement promote social and environmental policies, producing direct results in the economy. These purchases are promoted by means of tenders in which environmental criteria are inserted, integrated into the public bids, in the search for contracting goods and services, with the objective of minimizing environmental impacts.

Sustainable public procurement has been advancing in the search for green practices where the importance of purchasing goods and services with lower environmental impacts has become a national and global concern. And in this sense, Araújo and Teixeira (2018) state that sustainable purchasing aims, in a rational way, to use resources more efficiently, bringing with it economicity and preservation to the environment.

Sustainable public purchasing can be defined as a process in which organizations, through bidding and contracting, seek to value effective long-term considering costs, environmental, social and economic benefits throughout the entire production chain.

After these discussions on sustainable development, companies became more attentive to their management model, which typically focused only on the economy, giving no necessary attention to the environment. As a result, in the course of the historical trajectory, indices were created in order to ascertain how closely companies would be aligned with the "sustainability proposal" (Duda et al., 2022, p. 3).

In this sense, a sustainable purchase can be understood as the "rational use of natural resources, efficiency and economicity in the use of such resources, which contributes to the environment" (Araújo & Teixeira, 2018, p. 23).

Sustainability in public procurement and sustainable bidding are considered by Bim (2011) as synonymous and, taking as a principle the term sustainable bidding can be understood as a mechanism that directs, from a "green" purchase, to promote sustainable development through government acquisitions. Corroborating, Rosset and Finger (2017) state that sustainable purchasing is based on sustainability in the procedures reserved for obtaining goods and contracting services, as well as being a favorable act for society.
Bibliometric methods have therefore been used to generate data on sustainable public purchasing. As a concept, bibliometry, supported by a set of laws and principles applied to statistical methods, aims to carry out a mapping of the scientific production of certain authors, magazines, among others. Previously, Araújo (2006) indicated that bibliometrics was focused on quantifying editions, of the keywords existing in the physical books that were on the bookshelves of libraries, progressing little by little to the studies of scientific articles and their authors.

Silva (2013) demonstrates the value of conducting an orderly search of databases in order to find information in order to satisfy research needs. In scientific study, the researcher in the act of constructing his work, seeks theoretical support for the carrying out of his investigation. From this search for foundation is presented to the researcher on which theoretical/methodological line(s) he/she will be able to follow. Another point to be observed is the possibility of the reader, on beginning a reading of a given article, being able to identify the groups of scientists that were used in that study.

In view of this lack of understanding of the dynamics of production on the topic of sustainable public procurement, one notices a gap in the verification of which references the authors support their theories. Situation in which this research is dedicated, at least in minimizing this gap, seeking to present, the authors highlighted in scientific production with regard to sustainable purchases from the verification of the evolution of the number of document publications made available by the Web of Science (WoS). Thus, this work sought to answer questions such as: how many and which authors published on the topic of sustainable public procurement?

In this way, the research aimed to present the scientific production inherent to the subject of sustainable public procurement from documents collected in the WoS database, in the last five years, aiming to point out the authors who have excelled in scientific production as well, to verify if these were the most cited and; present from these surveys, which organizational theories were used by these authors. With the handling of the Lotka's Law, it was possible to carry out a verification of the researchers who most published them and to relate them to the quantity of publication in the area.

The research is justified in terms of having knowledge about what is being produced about sustainable purchases, given the direction of the public authorities, and is of fundamental importance, in the same way as the verification of which authors are being taken as a basis for studies in this area and for their theoretical grounding.

Therefore, this work intends to present in its following sections a brief contextualization on sustainable public procurement in Brazil and on bibliometric studies; the methodology used to obtain the results; carrying out the analyzes from the results obtained and, finally, the final considerations.

2 THEORETICAL FRAME

In view of the large amount of money spent by the federal, state, federal and municipal governments, sustainable purchasing can be used as a method of promoting sustainable development, with the aim of promoting new technologies, social welfare and the environment.

Both the government and the private sector have sought the adoption of sustainable practices, following the global trend proposed by the Commd. And the State, as a great consumer, also under pressure from international bodies, has realized the need to purchase goods and services in order to promote sustainable development as well. (Paes et al., 2019, p. 22).

For Majernik et al. (2017) the procurement process in public procurement aiming at sustainability as a criterion, aims at targeting the efficient use of public resources through the selection of less polluting products ensuring that the exploitation of child labor does not occur. In this way, the author presents characteristics of sustainability in purchases and in the same way that shows us the strength that the government has in creating disposition for the private market, making it recognize the state power and adapt to the current and future requests for products and services desired by the public administration. Hence the importance of public management considering sustainable purchases as a premise in its bidding processes for the acquisition of products and services.

With the concern for the acquisition of a good/service in the rules of Law 8.666/1993 in which it advocates the lowest value, Alencastro et al. (2014) shows that sustainable public procurement does not only carry the lowest value, but also quality factors, rights assurance, respect for labor laws and protection of the environment. In 2010, the bidding law itself received an amendment that provided for the promotion of sustainable development. This change occurred in the third article:

Art. 3. Bidding is intended to ensure compliance with the constitutional principle of isonomy, the selection of the most advantageous tender for the administration and the promotion of sustainable national development and will be processed and judged in strict accordance with the basic principles of legality, impersonality, morality, equality, publicity, administrative probity, binding to the convening instrument, objective judgment and those related to it. (Brazil, 1993).

In the same sense, the Ministry of the Environment has an Environmental Agenda in Public Administration (A3P) Program, which aims to join public institutions in order to make sustainable purchases by these bodies. In this Program, we can observe six axes that stand out with concern to the type of acquisition, are: rational use of natural resources and public goods; management of generated waste; quality of life in the work environment; awareness and empowerment of servers; sustainable public purchases; sustainable constructions.

Thus, the importance in sustainability practices related to public procurement is highlighted, even though studies are modest and their applicability in government institutions with the need for further research.

According to the aforementioned on the importance of the use of bibliometric methods for mapping scientific productivity; the method seeks, according to Guedes and Borschiver (2005), to investigate and quantify the processes of communication of writing through: publications, keywords, authors and periodicals. In this way, the bibliometric study makes it possible to identify the authors who are researching about sustainability in public purchases, as well as the existence of collaboration between researchers, opportunizing the verification of how scientific production is doing, in the light of a current theme in which they are dealing with solutions with a lower environmental impact.

Using bibliometric indicators, the research can be carried out using production indicators - counting the number of publications by types of documents, by institution, area of knowledge, etc. There are also citation indicators that Maia and Tsunoda (2019) point out that, based on the citations received by a given publication and link indicators, in which are verified in the occurrences of authorship, keywords, citations, can be verified the existence of networks of relationship between researchers.
In all scientific production, the researcher needs direction for the construction of his research, based on the registration of his list of references, in which there is the occurrence of communication between the researcher and his peers, making possible the development of his research. This process of identifying the references of a research study evidences a thought-out relationship between the researcher and authors that converge on the same theoretical path. Macias-Chapula (1998) treats the citation of a given author as a social process in which it reflects the characteristics of the researcher before its authors referenced in his research.

Studies of citation analyzes make it possible to verify "the proximity and interlocution of two documents are not determined by the authors of the documents, but defined by the scientific community that appropriates their content and establishes connections during the process of generating new knowledge". (Graccio, 2016, p. (88)

Kessler (1963) points out that the relations between authors are presented by means of bibliometric methods and, in the case of this research, the Lotka's Law was used, which seeks to estimate the degree of relevance of the authors raised in the light of the citations received by these and their scientific production.

3 METHOD

The research was carried out by means of a bibliometric survey in which there was a structured mapping in the scientific articles deposited in the database of the Web of Science (WoS), being this one, a congregator of articles from renowned scientific magazines as well as having various periodicals, books, reports and conferences.

The study was exploratory with a qualitative approach seeking to identify the production of which authors most produced on the theme and if these are the most cited, that is, to verify if there is a relationship between the quantitative of production and the quantitative of citations occurring by author. The delimitation of the subject was "sustainable purchases in the public sector". For a better refinement in the search, the Boolean operator "OR" was used, whose function is to present a true value if at least one of the five terms (keywords) used in this search is true, that is, retrieved by the database.

The data obtained were collected on June 21, 2022, in the WoS database, from the access through the platform of the Capes periodical. The keywords chosen to start the data collection were: sustainable bidding [sustainable bidding]; sustainable procurement in the public sector; sustainable public procurement [sustainable public procurement]; sustainability in public procurement [sustainability in public procurement]; government green procurement. It is worth noting the use of the English terms to increase data recoverability.

The research started, and from the results with the use of the advanced search and the Boolean operator "OR", refinement criteria were established in the own base of the WoS the period of the last five years.

After the results were obtained, the download was carried out and the next stage started; the processing of the data by the R Program, a software that has a language and environment for computing statistical data and graphs. There is a GNU project that is similar to the R language and environment that was developed at Bell Laboratories (formerly AT&T, now Lucent Technologies) by John Chambers and colleagues [...] provides a wide variety of statistical techniques (linear and nonlinear modeling, classical statistical tests, time series analysis, classification, grouping, [...] ), and is highly extensible.5 (The R Foundation, 2022).
Table 1 - Steps for planning a bibliometric research.

<table>
<thead>
<tr>
<th>Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine o(s) objetivo(s)</td>
</tr>
<tr>
<td>Definir o software a ser utilizado(s)</td>
</tr>
<tr>
<td>Expor o(s) indicador(es) bibliométrico(s) utilizado(s)</td>
</tr>
<tr>
<td>Determine um descritor de busca</td>
</tr>
<tr>
<td>Remover o(s) artigo(s) duplicado(s)</td>
</tr>
<tr>
<td>Elabore o(s) gráficos(s) para apresentar o(s) resultados</td>
</tr>
<tr>
<td>Escolha as bases de dados pertinentes</td>
</tr>
<tr>
<td>Importar o(s) resultados da(s) base(s)</td>
</tr>
<tr>
<td>Escreva o relatório (resultado final)</td>
</tr>
<tr>
<td>Realizar a pesquisa nas bases pelo descritor pré-selecionado</td>
</tr>
<tr>
<td>Estabelecer filtro para bases</td>
</tr>
</tbody>
</table>

Source: Adapted from Maia and Tsunoda (2019)

In order to attribute credibility to the knowledge produced, it is necessary to align the research with the stages to be carried out, obtaining the results aligned with the proposal initially made.

4 RESULTS AND DISCUSSIONS

The documents retrieved, after the initial selection made in the WoS database itself, were 79; accounting for 223 authors in 42 sources; in the period 2018 to 2022 (last five years).

As a result of the 223 authors found in this research, no author has produced more than three documents in the last five years. Thus, the graph calculation refers to Table 1.

Table 1 - List of authors recovered by production

<table>
<thead>
<tr>
<th>Written documents</th>
<th>N. of authors</th>
<th>Proportion of authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>206</td>
<td>0.924</td>
</tr>
<tr>
<td>2.</td>
<td>16</td>
<td>0.072</td>
</tr>
<tr>
<td>3.</td>
<td>1</td>
<td>0.004</td>
</tr>
</tbody>
</table>

Source: Authors themselves (2022)

According to Table 1, only one author produced three articles in the five-year period, however, 206 authors produced only one article each, without taking into consideration the co-authorship. This demonstrates the low productivity of documents published by author. Alvarado (2002) describes in his work Lotka’s law in which the number of authors who make n collaboration in a given field of knowledge is close to 1/n^2 of those who make only one collaboration, the proportion of those who contribute only once is more or less 60%. It can be noted, the vast majority of authors only contributed once, around 92% of the total authors listed in this survey.

Another survey carried out through the R Program were the most relevant authors, adopting the criterion of the amount of publication extracted by the program, obtained the ten (10) most relevant authors, being: Betzschneider, Adju-Bamfo; Bucea-Manea-Tonis;
Dzhabrailov; Dzupka; Gelderman; Jose Gamboa-Castro; Knebel; Kubak and Ligegard, as Graphic 1.

**Graph 1 - Relevance by authors**

![Graph 1 - Relevance by authors](image)

*Source: Authors themselves (2022)*

In Graph 2, it represents the calculation of the authors' production (in terms of number of publications and total citations per year) over time, it is noted the occurrence of publication of two articles in the year 2018, one by Gelderman and another by Jose Gamboa-Castro. In 2019 there was a 100% increase in publication, that is, four works were published, with Gelderman in particular. Starting for the year 2020, there were five works being two productions of Bretschneider and, finally, in the year 2021 with ten productions on sustainable shopping with highlight to Bacea-Manea-Tonis, Kenebel and Lingergard, all with two productions each, it should be noted that until the date of the research, no publications were found for the year 2022.

**Graph 2 - Production by authors**

![Graph 2 - Production by authors](image)

*Source: Authors themselves (2022)*
Graph 3 - Scientific production by authors

![Graph 3 - Scientific production by authors](image)

**Source:** Authors themselves (2022)

Graph 3 with regard to the most cited documents, we can see, according to data processed by Biblioshiny of the R Program, that the top ten are productions of authors that differ from those listed that most produced in the area, except for Adju-Bamfo (2019), which is in the fourth position as most cited in the world with the work "The role of e-government in sustainable public procurement in developing countries: A systematic literature review", published in 2019 by Resvista Resources, Conservation and Recycling . As a highlight, the work "Policies for transitioning towards a circular economy: Expectations from the European Union (EU)." , published in 2020 in the journal of Elsevier's journal, entitled, Resources, Conservation and Recycling, by author Hartley K (2020) received 94 citations. Second, with slightly more than half of the quotes received by the first author (57), Sonnichsen S. D. (2019) with the publication in the Journal of Cleaner Production in 2020 with the work entitled ‘Review of green and sustainable public procurement: Towards circular public procurement’, followed by the other authors.

Graph 4 - Documents most cited in the world.

![Graph 4 - Documents most cited in the world](image)

**Source:** Authors themselves (2022)

In the light of the data gathered in Graph 4, one can verify the low or even non-existence of a relationship between the author's productivity and the importance of the document, given that the authors who produced most in recent years, only Adju-Banfo appears both in the list of
those who produced most (in second place) and in the list of the most cited in the world (in fourth place).

### Table 2 - Relationship of most relevant authors with the most cited authors.

<table>
<thead>
<tr>
<th>Most relevant authors</th>
<th>Most cited documents globally (most cited authors)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bretschneider S.</td>
<td>Hartley K.</td>
</tr>
<tr>
<td><strong>Adju-Bamfo P.</strong></td>
<td>Sonnichsen S.D.</td>
</tr>
<tr>
<td>Bucea Manea Tonis R.</td>
<td>Delmonico D.</td>
</tr>
<tr>
<td>Dzhabrailov R</td>
<td><strong>Adju-Bamfo P.</strong></td>
</tr>
<tr>
<td>Dzupka P.</td>
<td>Bernal R.</td>
</tr>
<tr>
<td>Gelderman C.J.</td>
<td>Grandia J.</td>
</tr>
<tr>
<td>Jose Gamboa-Castro J</td>
<td>Zaidi S.</td>
</tr>
<tr>
<td>Knebel S.</td>
<td>Balzaretti, C. M.</td>
</tr>
<tr>
<td>Kubak M.</td>
<td>Loyal Son W.</td>
</tr>
<tr>
<td>Lingegard S.</td>
<td>Braulio-Gonzalo M.</td>
</tr>
</tbody>
</table>

Source: Authors themselves (2022)

Hartley (2020), in his work published in 2020, used the **Circular Economy Model** (CE) as a support. This model, addressed by Kirchherr et al. (2017) treats environmental sustainability, economic prosperity and social equity as goals to be achieved. A definition given by Hartley (2020) of a circular economy "is a system that replaces the economic concept of ‘end of life’ with the reduction, alternative reuse, recycling and recovery of materials in production/distribution and consumption processes." To ensure efficiency, product stages are mapped so that a policy mix can occur based on the entire product lifecycle.

Adju-Bamfo (2019), the only author who appears both in the number of published scientific productions (second place) and in the number of citations received (fourth place), was not found in the research the theory used, it is worth noting that the work in question was a systematic review of the literature. Another author who used a literature review was Sonnichsen (item 2), not presenting either, at least explicitly, the theory used as the basis of his research.

Delmonico (2018), the third most cited author, according to a survey, used as a support the **Theory of Ecological Modernization** in an attempt to present the government's initiatives in promoting green management practices in developing countries. Sarkis et al. (2011) points out that the theory is supported by the A3P Program, whose objective is to stimulate the adhesion of public institutions of all spheres in the implementation of sustainability practices in their management, being structured in six thematic axes "Rational use of natural resources and public goods; Management of generated waste; Quality of life in the work environment; Awareness and empowerment of servers; Sustainable public purchasing; Sustainable constructions." (Brazil, 2022).
Table 3 - Theories most used by the most cited authors.

<table>
<thead>
<tr>
<th>Most cited authors</th>
<th>Documents</th>
<th>Theory/model</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Zaidi, S.</td>
<td>Addressing the sustainable development through sustainable procurement: What factors resist the implementation of sustainable procurement in Pakistan? (DOI: 10.1016/j.seps.2018.11.008)</td>
<td>Interpretative Structural Template</td>
</tr>
<tr>
<td>8. Balzaretti, C. M.</td>
<td>Improving the overall sustainability of the school meal chain: the role of portion sizes. (DOI: 10.1007/s40519-018-0524-z)</td>
<td></td>
</tr>
<tr>
<td>9. Loyal Son, W.</td>
<td>Sustainability and procurement practices in higher education institutions: Barriers and drivers. (DOI: 10.1016/j.jclepro.2019.05.020)</td>
<td>Barrier and facilitator</td>
</tr>
</tbody>
</table>

Source: Authors themselves (2022)

The Delphi model, used by Bernal (2019), is a process that allows a group of people to develop work related to complex issues by providing a joint answer, but, Bernal, without the closeness that can bring about the influence of both the strongest and most influential people on the outcome of the work.

The conceptual model whose function is to present a set of hypotheses of reality, Grandia (2019), in his research used this method to present the relationship between skill, motivation and opportunity in the implementation of sustainability types.

The methodology used by Zaidi (2018) was that of the Interpretative Structural Model - it deals with an interactive learning process, being an interpretative method in which from the identification of the elements of the problem can be solved in a group (decision through the team).

After reading the full text of Balzaretti (2019), it was realized that the text, even after the completion of the cited filters, had no connection with what was raised by this research. The article addresses the discrepancies in the portions of the school food in Italy, and with this, it was chosen not to identify the methodology or model used by Balzaretti.

Barriers and facilitators or drivers was how Leal Filho (2019) used as a model to answer questions about sustainable shopping in universities. This model shows that barriers can be usefully taken into account, and are often little used as drivers from the right conditions.

Braulio-Gonzalo (2020) used the Building Sustainability Assessment (BSA) tool. The objective of the sustainability assessment is to gather information to assist in decision making, in which the potential of the site is evaluated, the preservation and registration of the cultural and national identity of the building, energy consumption economy, protection and conservation of water resources, among others.
Finally, it was not possible to identify, by way of reading the articles, the theoretical models that the authors Sonnichsen and Adju-Bamfo took as a basis for carrying out the researches.

5 FINAL CONSIDERATIONS

This study aimed to present the scientific production inherent in the subject of sustainable public procurement from documents collected in the WoS database over the last five years, confirming Kessler (1963) by Lotka's theory that many authors produce few works and few produce much.

Another factor was the verification that these authors who most produced were not necessarily the ones most cited by the other researchers. It should be noted that productivity is not necessarily tied to the importance of the article, or that is to say, high productivity for a given author may not lead to a high index of quoting his work. That said, only Adju-Bamfo (2019) with his work "The role of e-government in sustainable public procurement in developing countries: A systematic literature review" presented itself both in the range of productivity (author) and in the high quantitative of citations (41), the others not achieving this highlight.

Finally, the theories and/or models applied as support for their research were the most diverse, not finding a closeness, or even tendencies among the authors.

As a limitation of research, there was a difficulty in finding more studies related to comparisons of productivity versus quantitative citations linked to researchers, a situation aggravated when referring to studies produced by Brazilians. In this way, it is expected to contribute to the expansion of study in this area as well as in the development of techniques and procedures for better visualization of future research. In the light of the above, as a research proposal, it is suggested to expand the survey in other databases as well as to verify how Brazilian researchers are engaged in this area.

REFERENCES


Leal Filho, W., Skouloudis, A., Brandli, LL, Salvia, AL, Avila, LV, & Rayman-Bacchus, L. (2019). Sustentabilidade e práticas de compras em instituições de ensino superior: Barreiras e impulsionadores. Sustainability and procurement practices in higher education institutions:


