Development of a multicriteria analysis model to justify investments in information technology

Desenvolvimento de um modelo de análise multicriterial para justificativa de investimentos em tecnologia da informação

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1 INTRODUCTION

Decision-making related to investments in Information Technology (IT) in the public sector presents unique challenges, considering the specificities and complexities of this sphere. In this context, the development of a multi-criteria analysis model becomes essential to substantiate and justify IT investments in the public sector, taking into account the various criteria and aspects relevant to this area.

Through this review, we seek to identify the main approaches, methodologies, and contributions of existing studies in order to understand the current state of knowledge in this field.

The review also aims to identify research gaps and opportunities in order to provide direction for future studies in this area. It will consider the limitations and challenges encountered in implementing these models in the public sector, as well as possible adaptations needed to meet the particularities of this environment.

At the end of this review, it is expected to provide a comprehensive and updated overview on the subject, allowing a clearer understanding of the authors' contributions in the development of models of multicriteria analysis to justify IT investments in the public sector. Furthermore, it is intended to identify opportunities for future advances in this area of research, contributing to the improvement of IT investment decisions in the public sector and promoting the efficient and strategic technological development in this sphere.

2 OBJECTIVE

Perform a systematic literature review on IT investment evaluation methodology, with a justification based on a multi-criteria approach.

3 METHODOLOGY

This is a literature review, based on the Proknow-C method by Elsslin and Lacerda (2010), based on articles published from 2001 to 2023 in the electronic databases *Scopus*, *Scielo* and the Digital Library of the USP. This method consists of selecting the portfolio of articles, bibliometric analysis and systemic analysis. The theme used as the basis for the research was: development of a multicriteria analysis model to justify investments in information technology.

The following keywords were adopted: "*multicriteria*", "*information technology*" and "*investment*". Adaptations were made, with variations of the keywords according to their acronyms and differentiated spellings, namely: *MCDA*, Multi-criteria.

The Scopus base used as criteria '*Article title, Abstract, Keywords*' and the three keywords in English were inserted. The first search used the keywords: *investment, information technology* and *MCDA*. The filters: open access, article and English language were applied and 3 documents were obtained. Next, the search was redone with the words: *investment, information technology* and *multicriteria* and the filters: open access, article, English language and Portuguese language. A total of 18 documents were obtained. A new search with the words: *investmet, information technology* and *multi-criteria* and with the filters: open access, article, English language and Portuguese language, returned 34 documents. The documents were then imported into *EndNote*, a command was executed to exclude duplicates and to analyze the articles. Only 4 documents that were aligned with the theme remained in the portfolio. Aiming at a greater accuracy of the results, two more searches were carried out as described in the sequence. Keywords: *MCDA* and *investment*, with the filters: open access, article, English language and Portuguese language.

Returning results, of which, after reading within the base, 2 were exported to *EndNote* as documents aligned to the theme. The second search used the words: *MCDA* and *information technology*, with the filters: open access, article, English language and Portuguese language. Returning new results and again, after reading the base, 2 were exported to *EndNote*. Finally, a last search used the words: *information technology* and *investment*, with the filters: open access, article, English language, Portuguese language, area of knowledge computer science, in the last 10 years, sorted by number of citations

from highest to lowest and 3 documents aligned to the theme were selected. In the end, 12 articles related to the theme remained.

In *Scielo, the* criterion used was "all indexes" and the three key words in Portuguese were entered (investment, information technology and multicriteria). The result obtained was 1 document, but not related to the theme. An adjustment was made in the search by changing the writing of one of them to "multi-criteria" and then *MCDA*, and 0 results were found. New searches were performed, returning results according to the table below:

Table 1 - Keyword results

KEYWORDS			**RESULTS**
Investment	IT	*MCDA*	1
Investment	ICT	*MCDA*	0
Investment	IT	Multicriteria	8
Investment	IT	Multi-criteria	1
Investment	TIC	Multi-criteria	0
Investment	TIC	Multicriteria	0
Investment	Multicriteria		8
Investment	Multi-criteria		1
Information Technology	Multicriteria		7
Information Technology	Investment		43

In the digital library of the USP, the criterion used was "Dissertations" and the keywords multi-criteria, information technology and investment were entered. Five documents were found, of which one was selected as aligned to the theme. A new search was made with the words investment and information technology. The result obtained was 3 documents, 1 of which was related to the theme. In the third search the words investment and multicriteria were used and 2 documents were found, 1 of which was related to the theme. After changing the search to "Doctoral Theses" and using the keywords: investment, multi-criteria and information technology, the result obtained was 3 documents, 2 of which were aligned with the theme. Totaling in the end 3 dissertations and 2 theses aligned to the theme.

At the end of the searches in the three databases, 34 documents aligned to the theme remained to compose the bibliographic portfolio.

A bibliometric analysis was carried out with the objective of quantitatively measuring the scientific publications of the authors in academic journals. The characteristics analyzed were: relevance of the authors in the portfolio of articles; number of publications per year; degree of relevance of the journals; most relevant keywords.

4 DEVELOPMENT

From the methodology described, articles were found that serve as a bibliographic base for the bibliometric analysis. Figure 1 shows the relevance of the authors, based on the number of times they appear in the portfolio, after all the research and relational adjustments to the theme.

Figure 1- Relevance of authors in the article portfolio

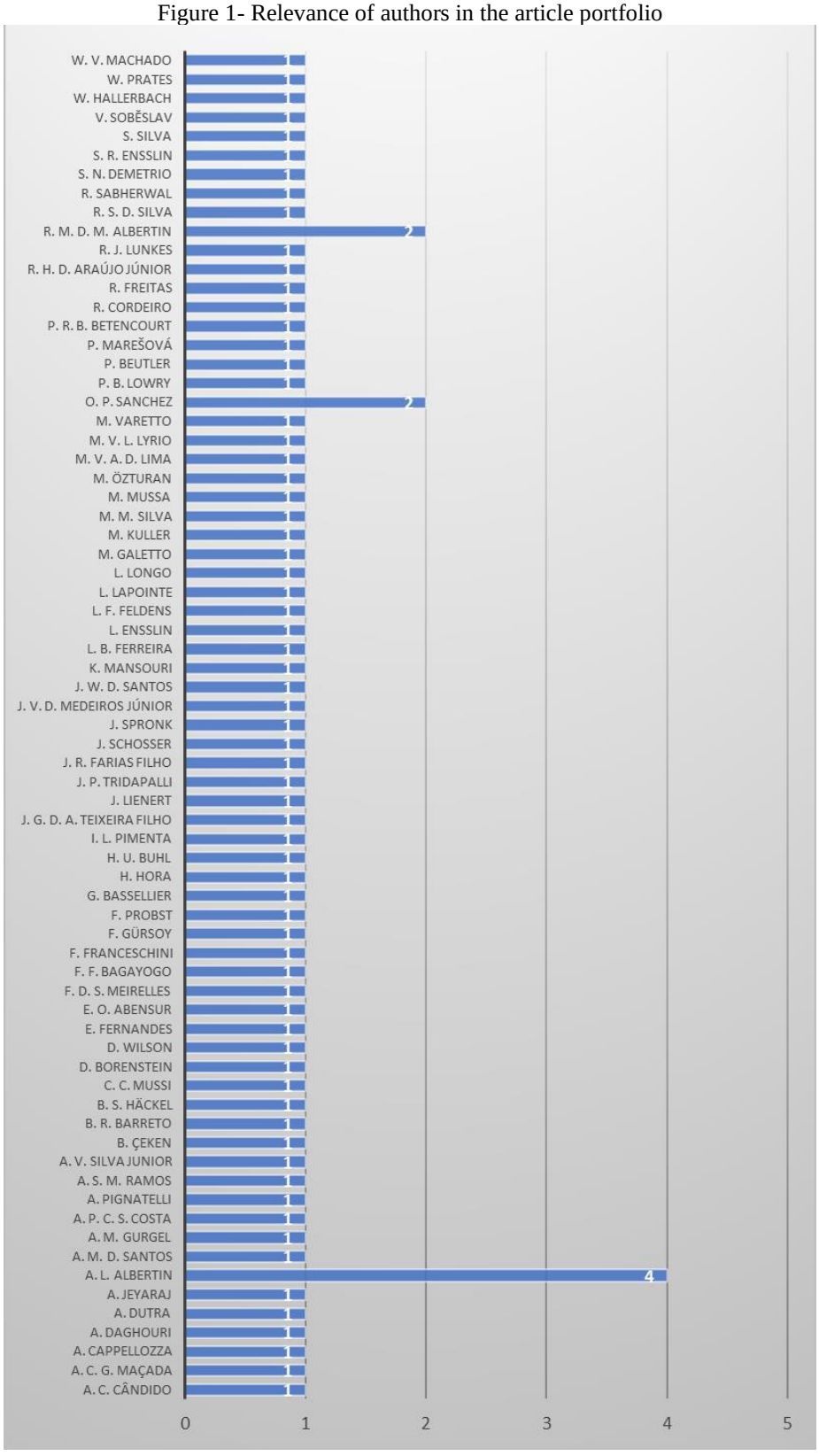
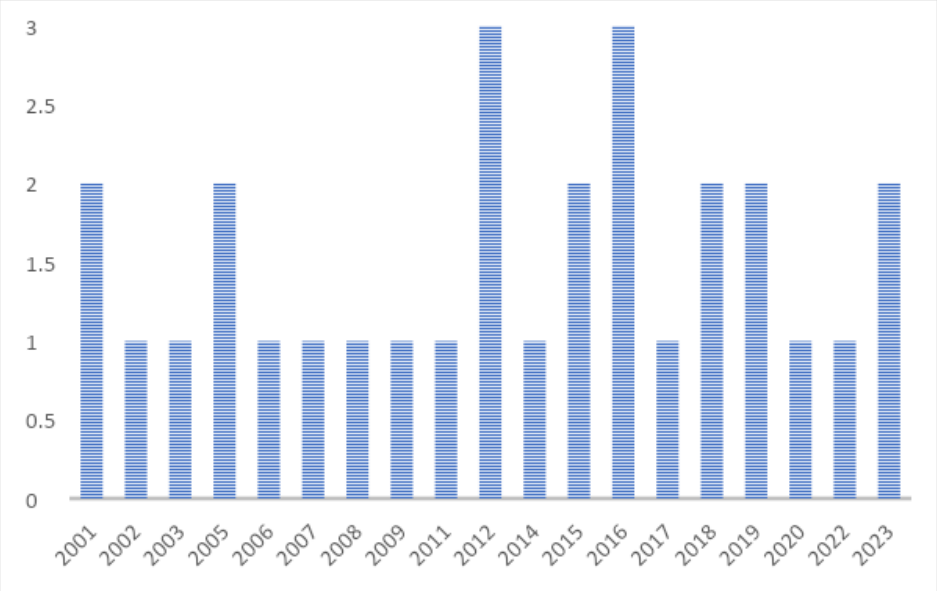


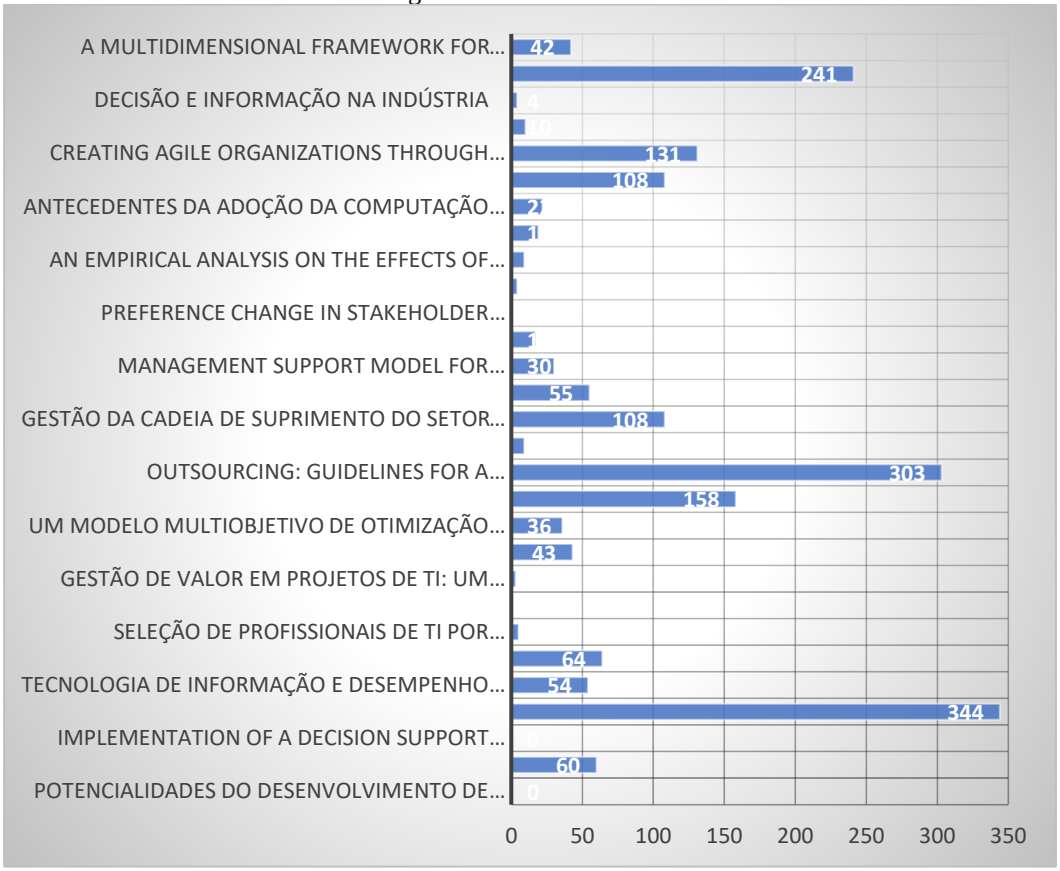
Figure 2 shows the number of articles published per year. Evidencing a slight increase in the last decade.

Figure 2 - Number of publications per year



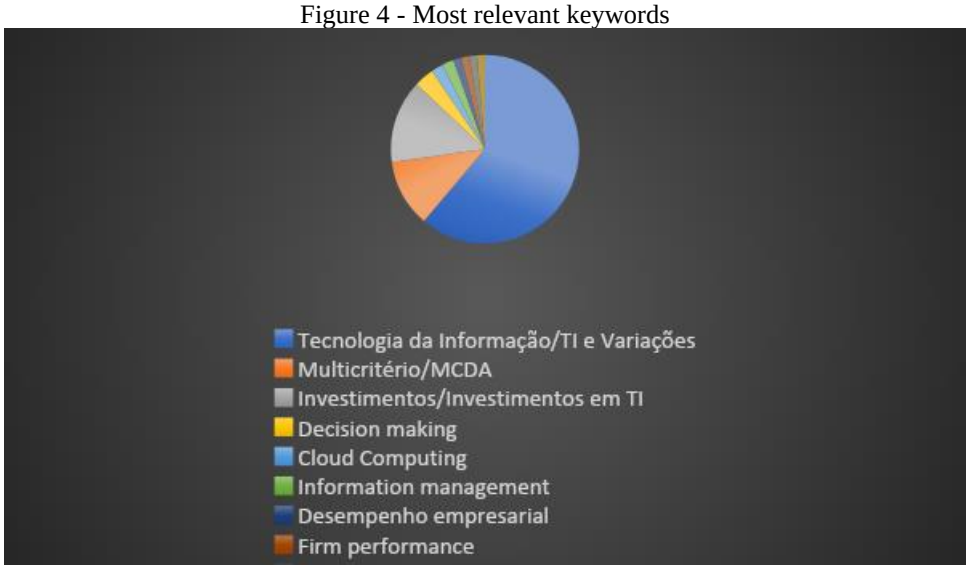
In chart 3, the relevance of the journals can be seen, based on the number of citations each had.

Figure 3 - Level of Journal Relevance



In graphic 4, the keywords were previously grouped, uniting for example, the variations of acronyms and translations of the same word, or even similar and related terms, leaving the 10 most relevant for the generation of the graphic.

Figure 4 - Most relevant keywords



5 CONCLUDING REMARKS

It is concluded then, that the theme has relevance based on previous research and the constant need of managers to justify IT investments in their organizations, adding value to the end activities, because the justification of investment is a key step in the process of adopting new technologies.

The systemic literature review about the development of a multi-criteria analysis model for justifying Information Technology (IT) investments in the public sector, based on the articles, provided an in-depth look at the existing approaches, methodologies, and contributions in this research area.

When analyzing the selected studies, it was possible to observe that the development of multicriteria analysis models to justify IT investments in the public sector is a relevant and challenging theme. The mentioned authors brought significant contributions, exploring different criteria, methods and techniques to assist in decision making.

One of the main conclusions is the importance of considering the complexity of the public sector environment when developing a multi-criteria analysis model. The specific nature of governmental organizations and the particularities of decision-making

processes in this context require the adaptation and incorporation of appropriate criteria to reflect the demands and objectives of the public sector.

Furthermore, it was possible to identify the need for further studies on the practical application of these models in the public sector, in order to assess their effectiveness and identify possible challenges and limitations. Obtaining concrete results and measuring the impacts of IT investments in the public sector are fundamental aspects to support decision making and ensure the efficient allocation of resources.

Finally, the systemic literature review pointed out gaps and research opportunities, suggesting directions for future studies. It is essential that further research explore aspects such as the financial sustainability of IT projects in the public sector, the integration of multi-criteria models with governance *frameworks,* and the adoption of participatory and collaborative approaches to involve relevant *stakeholders* in decisions.

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