**ORIGINAL ARTICLE**

# Identification of Positioning Factors in Academic SEO (ASEO) through a Scoping Review

*Identificació de factors de posicionament al SEO acadèmic (ASEO) mitjançant una revisió exploratòria*

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## Abstract

Academic SEO (ASEO) refers to a set of practices aimed at improving the visibility and impact of an author's or institution's academic output. Authors, publishers, and librarians all play important roles leveraging their respective expertise in optimizing academic content. The main objective of this paper is to identify the ranking factors that influence the algorithms of search engines and academic literature databases, as well as to uncover other factors or strategies that, while not directly impacting ranking, can be useful for increasing the visibility of an author's academic production. A scoping review was conducted following the SALSA framework, which identified a total of 23 publications. From these, the factors under study were identified and synthesized. 40 factors were identified, described, and grouped by type (direct / indirect), time (pre-publication / post-publication), and according to the actor(s) involved (author, publisher or librarian). Finally, a series of recommendations are also provided for each of the actors involved.

## Keywords

academic search engine optimization; ASEO; academic search engines; ranking factors; algorithms

## Resum

El SEO acadèmic (ASEO) es refereix a un conjunt de pràctiques orientades a millorar la visibilitat i l'impacte de la producció acadèmica d'un autor o institució. Autors, editors i bibliotecaris tenen un paper clau dins el marc de la seva expertesa per optimitzar el contingut acadèmic. L'objectiu principal d'aquest treball és identificar els factors de posicionament que influeixen en els algoritmes dels motors de cerca i les bases de dades de literatura acadèmica, així com descobrir altres factors o estratègies que, tot i no tenir un impacte directe, poden ser útils per augmentar la visibilitat de la producció acadèmica d'un autor. S'ha dut a terme una revisió exploratòria seguint el model SALSA, que ha permès identificar un total de 23 publicacions. A partir d'aquestes, s'han identificat i sintetitzat els factors estudiats. S'han identificat, descrit i classificat 40 factors segons el tipus (directe/indirecte), el moment (prepublicació / postpublicació) i segons l'actor o actors implicats (autor, editor o bibliotecari). Finalment, també es proporcionen una sèrie de recomanacions per a cada un dels actors implicats.

# 1. Introduction

Beel *et al.* (2010a) define Academic Search Engine Optimization (ASEO) as the "creation, publication, and modification of scholarly literature in a way that makes it easier for academic search engines to both crawl it and index it." Similarly, Codina (2019a) defines it as "the set of practices aimed at increasing the visibility and accessibility of academic outputs." Gonzalez *et al.* (2019) consider it an application branch or sub-specialty of SEO that "encompasses all existing optimization techniques for websites linked to the academic environment (universities, repositories, online scientific journals, online academic profiles, etc.)," thereby establishing its scope across various types of websites (institutional, digital repositories, platforms for managing and publishing scientific journals, and academic social networks) and directly linking it to disciplines such as webometrics or altmetrics. According to Codina (2019b), the direct objective of ASEO is to increase the visibility of academic work, which leads to the indirect goal of increasing the likelihood of being cited.

Beel *et al.* (2010a) identify three key differences between SEO and ASEO. Firstly, in most regions, SEO professionals primarily focus on optimizing content visibility within a single search engine (Google), whereas academic SEO encompasses a broader range of databases and academic search engines where an author or institution aim to enhance their visibility. Secondly, whereas SEO deals exclusively with open access pages, academic SEO often involves content "locked" within publishers' databases, making them "invisible" to search engines. Finally, while SEO professionals have significant control over the aspects of the pages they aim to optimize, academic SEO authors have much more limited maneuverability, usually limited to optimizing the text of their documents. However, the institutions employing these authors or the journals publishing their research can optimize the websites hosting these materials.

Academic SEO involves not only authors and research groups but also journal publishers and librarians at institutions with academic repositories (Codina, 2019b). In this sense, Google Scholar (GS) provides a comprehensive set of recommendations in its official documentation to facilitate the crawling and indexing of academic publications. These recommendations target all three groups and encompass aspects related to document crawling, indexing, formatting, and technical and presentation characteristics (Google, 2024).

Regarding the implementation stages, Codina (2019b) identifies two distinct phases: pre-publication, during which the article is written and developed, and post-publication, encompassing all actions carried out after the paper is published.

Furthermore, we can distinguish between two types of factors: direct and indirect. Direct factors (also termed on-page factors in traditional SEO) have a direct impact on the algorithm and, consequently, the document's ability to rank for a given keyword. Indirect factors (analogous to off-page factors in SEO) play a subtler role as they do not directly affect the algorithm but contribute to the document's visibility by influencing its crawling and indexing or indirectly improving metrics that can enhance ranking, such as the number of citations received.

The main objective of this study is to identify and consolidate, within a single document, the ranking factors that influence the algorithms of academic search engines and databases, as well as to identify other factors or strategies that, while not having a direct impact, may still be useful in increasing the visibility of an author's academic output. Secondary objectives include identifying the methodologies and approaches most used in the studies under review, beyond the broad areas of interest. As a result of this analysis, a set of practical recommendations tailored to each of the profiles involved is also provided.

## 2. Methodology

To identify the studies for analysis, the SALSA framework was applied (Booth *et al.* 2012). The results of applying this working method are summarized in Table 1 and Figure 1, while the narrative summary is included in the Results section and on Figshare.[1]

Table 1. Result of the bibliographic review. Source: own elaboration

| Phase | Application |
| --- | --- |
| Search | Databases: *Scopus* and *Web of Science* (WoS) <br> Search equation: <br> *Scopus*: "academic seo" OR "academic search engine optimization" OR "scientific search engine optimization" OR aseo (Topic) = title, abstract and indexing <br> WoS: TITLE-ABS-KEY ("academic seo" OR "academic search engine optimization" OR "scientific search engine optimization" OR aseo) <br> The initial search, limited to the title field, and failing to retrieve some texts known by the author to be relevant, was expanded to include the abstract and keyword fields. The reformulation returns some noise, especially in WoS for the term "aseo" which is subsequently resolved in the next phase by excluding all false positives as shown in Figure 1. <br> While the two databases were selected based on quality and academic rigor criteria, the limited number of results suggests that some relevant documents may have been missed. To supplement the initial search, the review was expanded by examining the citations within the identified publications (snowballing). <br> Search language: English. <br> Search date: July 12, 2024. |
| Appraisal | Initial number of documents: *Scopus* 64, WoS 210 <br> Documents after applying inclusion / exclusion criteria: 23 <br> Inclusion / exclusion criteria: duplicate entries; false positives; articles not written in English or Spanish; the work does not address ASEO or the visibility of academic production as a central theme; and documents published in journal sections other than "Articles" (e.g., editorials, reviews). |
| Synthesis | Through narrative synthesis (see the Results section) and summary table (available on *Fighsare*). |

| Phase | Application |
|---|---|
| Analysis | The object of study, the objectives, the hypotheses raised, the methodology used, and the results obtained are analyzed. |

Figure 1. Graphic representation of the process of searching and selecting the corpus of articles.
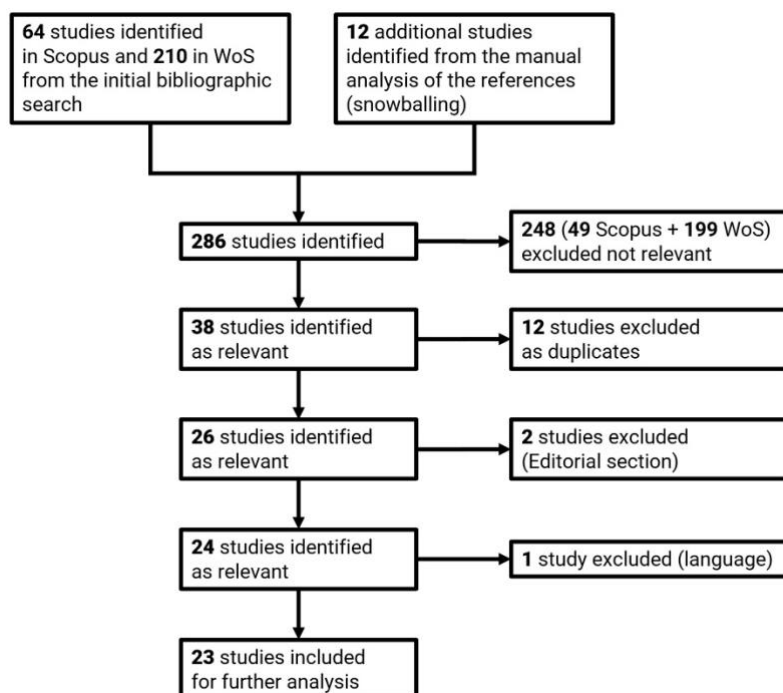
## 3. Results

This section presents the narrative synthesis derived from the analysis of the texts deemed relevant in the preceding phase. The data available on *Figshare* summarizes the results obtained using a table that includes the identified factors, among which the technical recommendations published by GS (Google, 2024) have also been considered. In total, 40 factors have been identified, distributed as follows: 12 direct factors and 28 indirect factors; 28 factors that are worked on before publication and 12 post-publication. On the other hand, the author is involved in 28 factors, editors participate in 18 and librarians can contribute in 13 factors.[2]

Based on the analysis of the corpus of documents resulting from the review, three major areas or themes have been identified: a) technical optimization factors, b) dissemination and visibility strategies in repositories and social media, and c) impact of citations, co-authorship, and language of publication. The first of these themes covers technical aspects directly related to search engine crawling and indexing, as well as strategic issues related to content optimization. It includes technical issues such as the selection of journal or repository software, practices such as the analysis and use of keywords in strategic sections (titles, abstracts, and keywords), the metadata optimization, or the implementation of standards such as DOI or Schema.org. Regarding social media dissemination strategies, the theme covers the active promotion of the profile and publications of researchers on academic social networks with the aim of improving the reach of these contents and indirectly increase citation potential. Finally, regarding the impact of certain contextual factors, studies within this theme explore how variables such as the citation count, publication language, open access status, or certain editorial practices influence the content visibility. The methodological approaches employed in

the analyzed works included non-systematic literature reviews, empirical methods based on quantitative analysis of data obtained through automated searches and case studies.

The first studies identified date back to 2009. Beel and his colleagues are pioneers in the field (Beel *et al.* 2009a; 2009b; 2009c; 2010a; 2010b). Their research focused on improving visibility specifically within GS. Following these initial works, other authors focus on more specific aspects, such as the impact of citations on the visibility of academic works, a topic on which publications have continued until 2024 (Ebrahim *et al.* 2013; Martín *et al.* 2014, 2016, 2017; Ebrahimy *et al.* 2016; Rovira *et al.* 2018, 2019; Tavosi 2024). Literature reviews offering recommendations to authors, editors and librarians derive from the first published works (Beel and Gipp 2010a) and continue until 2022 (Portuguez *et al.* 2019; Schilhan *et al.* 2021, Corrin *et al.* 2022). Other topics focused on specific factors such as the impact article length, publication language or co-authorship cover the period 2015-2021 (Letchford *et al.* 2015; Rovira *et al.* 2021). Case studies are focused on experiments in academic repositories in which various improvements are addressed aimed at increasing the visibility of the institution's publications (Macgregor 2019), or focused on experimenting with more specific technologies such as Schema.org (Pekala 2018; Nevado *et al.* 2021). Finally, works related to social interaction as a strategy to improve the visibility of publications date back to the period 2016-2021 (Ebrahimy *et al.* 2016; Serrano *et al.* 2016; Pastor and Páez 2021).

Beel *et al.* (2010a) introduce the concept of ASEO and provide guidelines for optimizing the visibility of scientific literature in GS based on the three previous studies carried out by the same research team (Beel and Gipp 2009a; 2009b; 2009c). According to these authors, the relevance of a document is reflected in the number of times the search term appears within the document, along with the position (title, keyword, abstract...) at which it appears. The fields that could potentially impact relevance include (in no particular order): title, authors' names, abstract, section headings, authors' keywords, body of the article, tables and figures, name of the publication, social keywords, social annotations, description, file name and URI.

These authors also highlight the importance of metadata within PDF files, as well as using real text, rather than images of text for figures titles and captions. Specifically for GS, they highlight that its algorithm is based on the following factors: relevance, citation count, author names, and publication name. The title plays an important role in determining relevance. While the publication date itself may not directly impact ranking, the search engine does allow filtering by recent date ranges, which can benefit more recent publications. As for guidelines for authors, they recommend: planning the selection of keywords and incorporating them in the title, abstract and body of the article; integrating synonyms for these terms; being consistent in how the name of the authors is transcribed to avoid losing citations; publishing documents with a structure or template typical of a scientific paper (introduction, previous works, results...); obtaining citations; including real text in all figures and tables instead of images in bitmap format; adding metadata to the final PDF file; publish in open access; once the article is published, it should also be included in the author's website and other repositories, and it is important that the pages containing the PDF of these works also include the most important fields (title, abstract and keywords).

On the other hand, Corrin *et al.* (2022) focus on the value of keywords to improve the visibility of academic publications. The correct selection of these terms is of greater importance as their maximum number is limited in some publications. In this work, it is recommended to review the thematic suitability of the selected keywords before publishing the article by performing exploratory searches in academic search engines. It is also recommended to use tools such as Google Trends to determine the interest or not in that keyword and estimate its traffic volume. However, they caution against keyword stuffing in titles and abstracts. Unlike other authors, in this case, it is recommended to be consistent with the terminology used throughout the text.

For their part, Serrano *et al.* (2016) propose a methodology for identifying emerging search terms that can help researchers enhance their visibility and citation counts. The method focuses on the analysis of keywords and obtaining terms with a search volume with potential demand to subsequently include these terms in the title and abstract fields, as well as in the text of the article. To assess competition, they recommend searching for the target keyword by limiting searches to article titles, as this is one of the most important fields for assessing relevance.

Nevado *et al.* (2021) analyzed the impact of implementing the Schema.org ontology in the University of Valencia's RODERIC academic repository on *Google* and GS rankings. Their results, like those of previous researchers (Pekala 2018; Macgregor 2019), did not definitively demonstrate a positive or negative impact, despite observing a slight increase in traffic. However, their literature review included additional relevant texts not identified in the databases used for this study.

Among them, the research by Beel and Gipp (2009a) determines that there is a correlation between the number of citations received and ranking position. This result goes in the same direction as that of Rovira *et al.* (2018) in which it is concluded that the number of citations received by an article is the most important external SEO factor, far above other factors also mentioned such as the presence of the keyword in the title of the document, the publication date —the most recent ones being able to be better positioned—, or the density or frequency with which the keyword appears in the text of the document, the latter being a factor of little or no relevance.

Beel and Gipp (2009b) also analyze and discuss the impact of the age of a text as a ranking factor. However, since older texts generally have a greater number of accumulated citations, it is difficult to assess the real impact of this factor. This conclusion corresponds with the one in the work of Martín *et al.* (2016), who, in addition to suggesting that the impact of the citations received positively favors these articles, add as a complementary factor the so-called "first page of results syndrome", by which users tend to preferentially access the first results obtained, which, on the other hand, in the case of GS, appear ordered by relevance and, therefore, influenced by the number of citations received.

In other work, these authors (Martín *et al.* 2014) analyze the correlation between the number of versions of a document in GS and the citations received, and how this can affect the ranking. While they do not find a direct correspondence between the number of versions and the ranking position, a small positive effect does emerge in a subsequent study by the same authors (Martín *et al.* 2017). In the same work (Martín *et al.* 2014) they do find a relationship between citations received and ranking position; they determine that the most cited works in GS are in English, far ahead of the rest of

the languages; that 60% of the most cited documents are not available in open access; that 51% are also indexed in WoS ; and that, on average, these works have 70% more citations in GS than in WoS .

In a later study, Rovira *et al.* (2019) analyze and compare the algorithms used to determine relevance in academic search engines: GS and *Microsoft Academic* (discontinued), and in two bibliographic databases: WoS and *Scopus*, using reverse engineering techniques based on the statistical analysis of Spearman's rank correlation coefficients. Their results indicate that the algorithms of GS and *Microsoft Academic* are strongly conditioned by the volume of citations received by the indexed works, this being the main ranking factor —a criterion that they also detect in WoS, although this database claims not to use it—, and that seems to have no influence on Scopus.

Tavosi *et al.* (2024) seek to delve deeper into the relationship between the visibility of an academic document and the number of citations it receives. Their results do not show a significant correlation, which leads them to believe that a significant part of the citations are based on the authors' deep knowledge of the subject area or the habit of citing the "celebrities" in each field, and not so much on the fact that these articles appear at the top of the ranking.

In order to determine whether the language in which a document is published is a ranking factor in GS, Rovira *et al.* (2021) studied the results of 45 searches. The analysis of the first thousand results of each one points to a bias in multilingual searches (i.e., when results are obtained in different languages) carried out in GS, in which documents published in languages other than English are systematically relegated to much lower positions in the ranking.

Drawing on existing literature and their professional experience as academic librarians, Schilhan *et al.* (2021) highlight the importance of file metadata and the inclusion of keywords in specific article sections such as the title or the publication date. Regarding the title, they recommend being brief, but always including the keyword at the beginning, and avoiding ambiguous or misleading formulas. This recommendation aligns with the findings of Letchford *et al.* (2015) who found a correlation between journals that publish articles with shorter titles and a greater number of citations per article. Alternatively, they recommend being cautious with the use of subtitles since some databases do not index them, and also with the use of words with special characters. Regarding keywords, they recommend consulting controlled languages, including both generic terms and more specific ones, using singulars and focusing on terms that represent the content and not the results. For abstracts, they recommend repeating the keyword several times and including synonyms to broaden the scope of the terms used thereby increasing visibility; using short and precise sentences, avoiding overly ornate language and including all the usual sections. In relation to the final file, they focus on the use of metadata, as well as avoiding images of text or any other text that cannot be processed by search engines. Finally, they highlight the greater relevance of the most recent texts, which are typically more prominent in search results.

While the number of citations received is an important factor for the visibility of scientific production, Ebrahim *et al.* (2013) collected a set of recommendations to improve this metric: use the same name consistently in all publications; be consistent also with the way of citing the affiliation; plan the selection of keywords appropriately;

include the main keyword several times in the abstract; publish in high-impact journals; self-archive articles in open access repositories; create, maintain, and optimize a professional website with the publications; publish in open access; publish with international authors; publish with multiple authors; include a greater number of references in articles; publish long articles; contribute to Wikipedia and include citations to one's own work; publish informative texts in blogs; have a presence in academic social networks; write review articles; include highlighted citations or "callouts" in articles; avoid question form titles, which are downloaded more, but cited less; make datasets used available in open access; publish in journals across various disciplines; and include recent publications in email signature.

Portuguez *et al.* (2019) carried out a systematic review of the strategies for visibility of scientific production in open access electronic journals. Most of the studies included in the review are bibliometric analyses with quantitative analysis that address a set of academic documents with the aim of identifying elements such as authorship and co-authorship in the most cited articles, the impact of the article through the citations count, the citation over time, the trend in citations with respect to a subfield in databases, the citations received by a journal or set of journals, visibility in specific databases, citation studies from the h-index or through altmetrics. Among the strategies detected we find publication in high-impact journals, the creation of megajournals, using DOIs, and publishing preprints. Social strategies are also mentioned, including presence in Mendeley[3] and ResearchGate, as well as in general social networks such as *Facebook* and *Twitter* (currently X), since in some works it was observed that articles mentioned in these media received a greater number of citations (Sanz-Casado *et al.* 2016). It is also noted that co-authorships favor the visibility of scientific production (Noorhidawati *et al.* 2017; Liao *et al.* 2018), that articles that use DOIs are more cited than those published in journals that use URLs (Arévalo *et al.* 2016; Peters *et al.* 2016), and that the strategy of preprints in institutional repositories also increases the number of citations (Maflahi and Thelwall 2018; Bornmann and Haunschild 2017).

GS is sensitive to fraudulent practices (black hat) as shown in the work of Beel and Gipp (2010b) in which they implemented an experiment with which they managed to improve the positioning of several articles by manipulating citations count, adding invisible text that was indexed, and incorporating irrelevant keywords. Articles randomly created with an automatic article generator (SciGen) were also indexed, some even containing advertisements for drugs such as Viagra.

Finally, Pastor and Páez (2021) present a case study focused on enhancing the dissemination of scientific output through social media platforms like Twitter and Facebook and, specifically, on the value of using hashtags in this strategy. The results suggest a potential increase in the number of citations received when articles are disseminated on social media. Continuing with the possible impact of social media, Ebrahimy *et al.* (2016) analyze the possible impact of three specific social media actions: saving, discussing, and recommending. The first, especially in Mendeley, seems to have a positive effect on the number of future citations. Conversely, discussion plays a negative role, while the effect of recommendation does not seem to have a significant effect.

Table 2. Top ten factors with the greatest coincidence among the works analyzed in the scoping review

| Factor | Description |
|---|---|
| Citations count | The article has received a substantial number of citations. |
| Keyword in the title | The article title includes the search keyword. Preferably, the keyword is included in the first half of the title. Avoid using special characters in titles and question form titles, while downloaded more frequently, are cited less often. |
| Keyword in the abstract | The article abstract includes the search keyword. |
| Keyword in the article *keywords* | The article's keywords include the search keyword. It is recommended to use controlled language, include both generic and specific terms, use singular forms, and focus on terms that represent the content, not the results. |
| Keyword in the body of the article | The article body includes the search keyword. |
| Using synonyms of the keyword | The text incorporates synonyms of the main keyword to ensure relevance in searches using alternative forms of the target keyword. |
| Metadata in HTML pages | Repositories and journals must include Highwire, Eprints, BE Press or PRISM meta tags. If not possible, Dublin Core metadata should be used. |
| Metadata in PDF files | PDF files contain metadata with the paper title and author names. |
| Keywords in article elements such as tables or figures | One or more article's tables legend or figure captions include the search keyword. |
| Academic social media profiles | Create profiles on academic social networks such as ResearchGate. This facilitates the tracking and indexing of publications, increases the number of sources where they are available, and indirectly encourages citations. |

# 4. Discussion and conclusions

The scientific literature published on ASEO is relatively scarce and mainly focused on GS. This paper presents a synthesis of knowledge published within this field over the last fifteen years. Analysis of the retrieved publications reveals the main direct positioning factors, as well as other factors that can indirectly enhance the visibility of scientific output production of researchers, research groups or institutions.

The analysis of the published literature also allows us to observe how, initially, the fundamental interest was in the positioning factors and the functioning of the algorithms, while, since the advent of altmetrics, works have appeared that focus on their possible impact on the visibility of scientific production, as well as on collecting good practices and strategies in this regard.

Below is a set of recommendations based on the findings of the review, structured according to the profile of the person responsible and the phases in which they take place.

| Actor | Phase | Recommendation |
|---|---|---|
| Authors | Pre-publication | Identify the keywords for which you want to gain visibility. This analysis involves assessing search volume and the competition level, both of which are important factors in determining your chances of ranking highly. For example, an emerging and novel topic with limited existing literature offers a better chance of achieving top rankings, although a very specific topic will likely generate fewer monthly searches. |
| Authors | Pre-publication | Publish strategically. Prioritize high-impact journals and longer articles in English, ideally in open access, while also considering preprints. |
| Authors | Pre-publication | Optimize the text. Include keywords and their variants in the title, abstract, keywords, article body, figure captions, and table legends. |
| Authors | Pre-publication | Maintain consistent author names and affiliations across all publications, ideally using identifiers such as ORCID. |
| Authors | Post-publication | Actively disseminate published works on academic social networks (e.g., *ResearchGate*, *Academia*...), general social networks (e.g., *X*, *Bluesky*...), as well as on personal websites, email signatures, and on university or research group websites. |
| Editors | Pre-publication | Provide author guides containing article optimization guidelines, from keyword selection and text writing to technical aspects such as using alternative text for images. |
| Editors | Pre-publication | Implement and correctly configure search engine-compatible technologies to ensure proper crawling and indexing of content. |
| Editors | Pre-publication | Encourage publication in search engine-friendly formats such as HTML or PDF (under 5MB). Templates should be syntactically and formally correct, clearly identifying elements such as the title, authorship, and references. |
| Editors | Pre-publication | Include relevant, machine-processable metadata in article PDFs and web pages. |
| Editors | Post-publication | Actively disseminate journal publications on social media, blogs, and other publisher communication channels. |
| Librarians | Pre-publication | Implement and correctly configure search engine-compatible technologies for proper content crawling and indexing. |
| Librarians | Pre-publication | Promote and organize workshops and create guides on strategies to improve the visibility of institutional authors' publications. |
| Librarians | Pre-publication | Promote open self-archiving of publications, ensuring correct metadata assignment and content quality in the repository. |
| Librarians | Post-publication | Actively disseminate on social media the works published by authors in institutional repositories. |

As we have seen, authors, editors, and librarians responsible for academic repositories all play an important role in the different phases of an ASEO strategy. In this sense, researchers must be trained in ASEO principles and apply all known optimization strategies. For their part, journal editors should provide clear guidelines to authors to guide their optimization work regarding the structure of articles, use of metadata, optimization of figures and tables, among other things. All these issues can be solved by means of well-optimized templates together with guidelines for authors that take into account all these elements. In addition, they must ensure that their websites are fully compatible with technologies used by search engine crawlers and academic databases. Finally, librarians managing academic repositories should promote the publication of documents that adhere to the technical and formal characteristics

outlined in this paper, as well as ensure that their websites are fully compatible with the search engine guidelines such as GS.

# Notes

1  https://doi.org/10.6084/m9.figshare.28304036

2  In this case, some factors have been attributed to more than one actor.

3  Following its acquisition by Elsevier, Mendeley experienced several changes, including differences in the visibility of public profiles and the option to create public groups. These changes have resulted in Mendeley now focusing primarily on bibliographic reference management, rather than its previously more prominent social functionalities, which have been largely discontinued.

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