TRENDS AND EVOLUTION OF SCIENTOMETRIC AND BIBLIOMETRIC RESEARCH IN THE SCOPUS DATABASE

TENDENCIAS Y EVOLUCIÓN DE LA INVESTIGACIÓN CIENCIOMÉTRICA Y BIBLIOMÉTRICA EN LA BASE DE DATOS SCOPUS

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ABSTRACT

Objective. The study focused on the in-depth and mixed exploration of the main trends of scientometric and bibliometric research in the SCOPUS database. **Design/Methodology/Approach.** A mixed, sequential, and integrative approach was used, divided into two stages. In the first, a bibliometric study was conducted to answer two fundamental questions. In the second qualitative procedures from integrative syntheses were developed and the main results were integrated. **Results/Discussion.** The results demonstrate the increase in studies developed from both disciplines, their growing collaborative and interdisciplinary nature, as well as the importance of continuing the development of their methodologies. The qualitative analysis allowed us to identify two fundamental themes in which the relationship between 11 categories, one of them shared, and 23 codes are configured. In general, the functions and potential offered by both types of studies are examined.

Conclusions. The findings not only allowed us to characterize the main trends in bibliometric and scientometric studies, but also fundamental issues were discussed for a better understanding of these trends, specific recommendations were offered and various methodological aspects were assessed. It was concluded that there was a need to continue delving deeper into both disciplines, especially from the perspective of non-specialist users and the opening of future lines of research. **Originality/Value.** The research offers a solid and innovative methodology, consolidating a system of protocols implemented by transcendental authors and those generated by the academic networks to which the authors belong. Additionally, an expanded as well as in-depth review is offered, with a consistent foundation and qualitative analytical procedures for a better understanding of the data collected.

KEYWORDS: scientometrics; bibliometrics; trends; Scopus

RESUMEN

Objetivo. El estudio se centró en la exploración profunda y mixta de las principales tendencias de la investigación cienciométrica y bibliométrica en la base de datos SCOPUS. **Diseño/Metodología/Enfoque.** Se utilizó un enfoque mixto, secuencial e integrador, dividido en dos etapas. En el primero se realizó un estudio bibliométrico para responder a dos preguntas fundamentales. En el segundo se desarrollaron procedimientos cualitativos a partir de síntesis integrativas y se integraron los principales resultados. **Resultados/Discusión.** Los resultados demuestran el incremento de los estudios desarrollados desde ambas disciplinas, su creciente carácter colaborativo e interdisciplinario, así como la importancia de continuar el desarrollo de sus metodologías. El análisis cualitativo permitió identificar dos temas fundamentales en los que se configura la relación entre 11 categorías, una de ellas compartida, y 23 códigos. En general, se examinan las funciones y potencialidades que ofrecen ambos tipos de estudios. **Conclusiones.** Los hallazgos no sólo permitieron caracterizar las principales tendencias en los estudios bibliométricos y cienciométricos, sino que también se discutieron cuestiones fundamentales para una mejor comprensión de estas tendencias, se ofrecieron recomendaciones específicas y se evaluaron diversos aspectos metodológicos. Se concluyó que era necesario seguir profundizando en ambas disciplinas, especialmente desde la perspectiva de los usuarios no especialistas y la apertura de futuras líneas de investigación. **Originalidad/Valor.** La investigación ofrece una metodología sólida e innovadora, consolidando un sistema de protocolos implementados por autores trascendentales y los generados por las redes académicas a las que pertenecen los autores. Además, se ofrece una revisión ampliada y en profundidad, con una base consistente y procedimientos analíticos cualitativos para una mejor comprensión de los datos recopilados.

PALABRAS CLAVE: cienciometría; bibliometría; tendencias, Scopus

1. INTRODUCTION

The importance of scientific knowledge in today's society is indisputable, and its transfer has become popularized to the point that it has reached various non-academic platforms where disseminators (scientists and others not so much) seek to bring fundamental findings to the general public (Barrot, 2022; Horta et al., 2022). In the present, as it was in the past, background research constitutes a foundational block of any knowledge production process, to the point that it is axiomatic in most academic cultures to think first of all about the search for prior knowledge before beginning a study, even before outlining an idea.

This axiom, although current, has become considerably more complex due to the constant production and accelerated expiration of knowledge, technologies, cultural artifacts, and diverse forms of behavior (Barrera León et al., 2024; Da Silva Nascimento et al., 2021; Kipper et al., 2021; Liesa-Orús et al., 2020). These changing trends frequently make research work more difficult as they require scholars to have a clear awareness of the value of the theories followed, as well as of the validity of the data consulted and the methodologies used for their collection and processing. In other words, it is no longer enough to establish a minimum theoretical framework and explore the main results of a reduced pool of studies; the production of scientific knowledge demands mastery of the field in terms of authors, lines, gaps, multi- and interdisciplinary relationships, main institutions and projects, among other key aspects.

Without this information and its proper assessment, scientific research can incur serious errors such as inadequate expenditure of resources, backward theoretical and methodological foundations, poorly informed

decision-making, and loss of collaboration opportunities, among others (Smaldino, 2020). In addition, the results of a scientific study today acquire special relevance, especially in the Open Access domain, as they constitute a source of support for decisions for other social agents or natural persons who benefit from being able to rely on evidence when facing certain situations of daily life, making a purchase or designing a program.

In short, the need to quantify scientific production to establish trends, evaluate the state of a field, or predict it, as well as make decisions, can be cataloged as a central one in today's society (Mohadab et al., 2020). That is why two disciplines stand out in the fulfillment of these objectives since they have supported with evidence the rise of science, the transfer of knowledge, and informed decision-making: bibliometrics and scientometrics. Although some consider both to be a set of techniques for visualization, this paper defends the notion that both constitute well-structured fields in which different scientific disciplines converge, hence their increasingly solid categorization as transdisciplinary research spaces.

Therefore, given the arguments offered, this paper aims to examine the evolution of scientometric and bibliometric research in the SCOPUS database. In addition, the main development trends in both disciplines will be evaluated and analyzed thematically. Finally, the main reasons behind their rise, the fundamental strengths and an integrative synthesis for their use as a source of knowledge in decision-making will be presented.

2. BACKGROUND

2.1. Brief approach to the origin of the disciplines

Bibliometrics and scientometrics are two disciplines that, although they share the common goal of quantifying and analyzing scientific and scholarly output, have their own distinct histories and applications (Marginson, 2022). Bibliometrics emerged as a way of applying quantitative methods to the study of scholarly and scientific literature, with Paul Otlet, a Belgian visionary in the early 20th century, proposing innovative ideas on information storage and retrieval (Gan et al., 2023; Kim & Kang, 2021; Pessin et al., 2022). Although, in the beginning, the classification proposed by Otlet was especially linked to books, this position should be understood in terms of the forms of scientific communication of the decade and his position as a documentalist (Rousseau & Rousseau, 2021).

However, it was Alan Pritchard who in 1969 officially coined the term "bibliometrics", defining it as the application of mathematical and statistical methods to books and other media (Agostini et al., 2020; Ruiz-Pomeda et al., 2020). The importance of his contribution was such that for some he is the "true" father of the field and is recognized for the contribution of his ideas and work to the development of tools that today are indispensable for scientists in the analysis and evaluation of science (Chen et al., 2022; Sobral, 2021; Onchonga & Abdalla, 2023).

Since then, bibliometrics has evolved to encompass the evaluation of scientific and scholarly literature, helping to understand the dynamics of scientific communication and the distribution of knowledge in different fields. Tools such as citation analysis now make it possible to measure the impact of papers, journals, and authors, playing a crucial role in identifying research trends and emerging areas of study, especially those related to virtual environments and new technologies (Nicolas et al., 2020, pp. 1990–2017). Although some authors still define it as a method, bibliometrics has now developed as an organized system of procedures, but also as a line of methodological development in constant evolution, where authors use it while studying how to perfect it (Dharmani et al., 2021; Mulet-Forteza et al., 2022; Raudales-Garcia et al., 2024).

In parallel, scientometrics, which focuses on the broader measurement of science, technology, and innovation, was introduced in 1978 by Nalimov and Mulchenko. With roots in a book published in 1969, these authors proposed novel ideas for the time, presenting science as a self-regulating system whose dynamizing core was information (Rousseau, 2021). Subsequently, Gardfield advocated the importance of review papers and the need to strengthen the methods for producing and analyzing them (Blümel & Schniedermann, 2020; Serenko, 2021). These premises mark how science is conducted today, where the different ways of approaching

scientific literature have gained relevance and are no longer considered an inferior form of communication, nor are their data and findings considered inferior to those of empirical studies previously appreciated as the gold standard of science.

This discipline employs a variety of indicators and statistical methods to assess scientific and technological development, including research productivity and collaboration patterns, as well as the impact of research on society and science policy. In addition, its focus has moved from the parcellation of information to a broader search, in recognition of science's evolution from well-compartmentalized fields to multi- and interdisciplinary productions (Guo et al., 2021).

Both disciplines have experienced exponential growth thanks to the digitization of scholarly information and the development of online bibliographic and scientific databases (Mokhnacheva & Tsvetkova, 2020). This has facilitated more detailed and real-time analyses of scientific production. However, this boom has also posed challenges, such as ensuring the quality and relevance of scientific publications in the face of pressure to publish. In addition, this scenario has represented a call to adapt to new forms of scientific communication, such as open-access publications, preprints, and the use of academic social networks.

In the current academic context, bibliometrics and scientometrics play fundamental roles in the evaluation of research and in decision-making related to science policy and resource allocation. Both continue to adapt and refine their methodologies to capture better the complexity of modern science and its impact on society. As previously introduced, these trends reflect the ever-changing nature of research and scholarly communication, especially in the information and knowledge age (Martínez Castillo et al., 2024).

2.2. Brief description of its main utilities

Bibliometrics and scientometrics have revolutionized how the academic community evaluates, directs, and broadens the scope of its research. This is an idea of cardinal importance, fundamentally in a context where the definition of science has moved away from static precepts and embraces different ways of producing knowledge, which has meant a growing boom in research and publications. Therefore, one of the main contributions of both is the ability to evaluate and improve the quality of scientific research through the use of tools such as citation analysis and the impact indexes of the journals. This allows researchers and institutions to determine the influence of their work, orienting it towards areas that promise greater impact and recognition within the scientific community.

In addition, these disciplines have been indispensable in identifying trends and emerging areas within the vast landscape of research and technological development. By analyzing patterns in the publication and citation of scientific papers, they enable the discovery of expanding fields of research and novel technologies. This ability to anticipate future directions in science is invaluable for researchers, science policymakers, and funding agencies, facilitating the efficient allocation of resources to areas with the greatest potential for innovation and social benefit (Vázquez Vidal & Martínez Prats, 2023). However, these arguments find their main niche from the perspective of the overwhelming amount of texts produced, scientific publications in circulation, and increasingly complex academic evaluation mechanisms, which are strongly influenced by the aforementioned indicators.
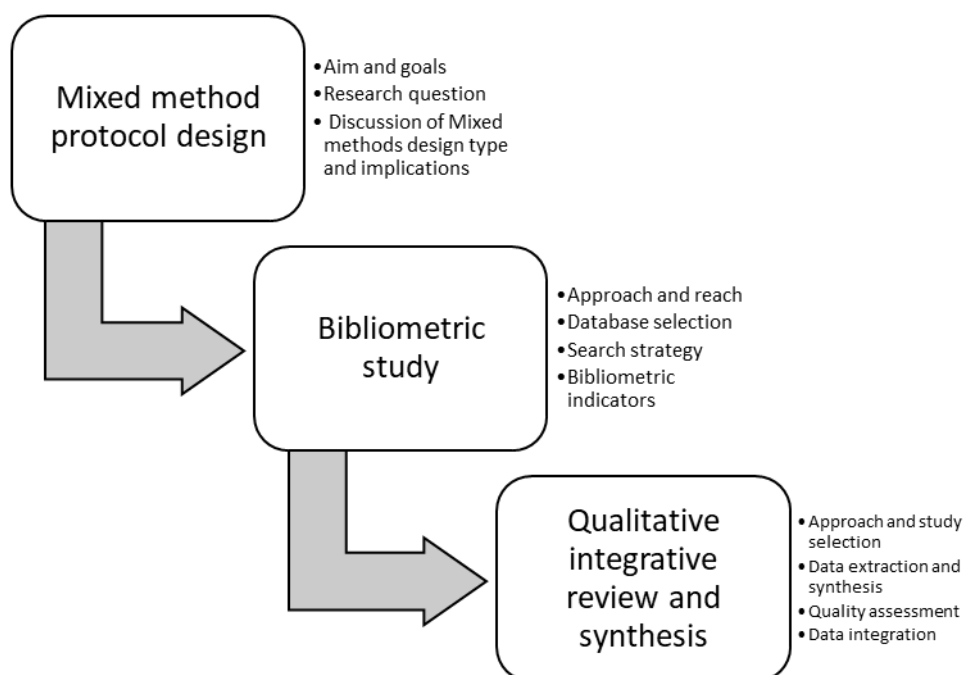
Finally, bibliometrics and scientometrics contribute significantly to the creation and strengthening of collaborative networks. By analyzing citation and collaboration networks, these disciplines help to identify potential collaborators and centers of excellence in different areas of knowledge, promoting interaction between disciplines and geographical boundaries. This interconnection not only accelerates scientific progress but also optimizes the distribution and access to knowledge, thus enhancing the global impact of research. Together, bibliometrics and scientometrics have transformed how academia understands and leverages its own output, as well as boosting quality, visibility, and collaboration in the scientific arena.

3. METHODOLOGY

The methodology was designed with a mixed, sequential, and integrative approach, whose rationale is anchored to the need to strengthen the methodological rigor of the research and achieve high levels of reliability, replicability, and depth (Harrison et al., 2020). Although the first two aspects are achievable through quantitative studies, depth, especially in terms of understanding trends, is one of their limitations, despite their widespread use outside the information sciences for these purposes (Cabeza-Ramírez et al., 2020; González-Alcaide, 2021; Pelit & Katircioglu, 2022). Furthermore, this decision favored an epistemological approach to the data, which contributes to a better answer to the research questions due to analyzing the data contextually and in terms of relevance concerning the research objectives as a measure to replace the superficial use of qualitative procedures such as coding and categorization (Cao & Shao, 2020; Linnenluecke et al., 2020; Velásquez Castro & Paredes-Águila, 2024)

Therefore, the team of authors decided on the implementation of a two-stage protocol, the first with a bibliometric design and the second aimed at an integrative synthesis of chosen texts to reach a deeper level of knowledge from the qualitative processing of the sources (Snyder, 2019). Finally, at the end of the second stage, data integration was performed, which was specifically aimed at the mixture of both lines (data strands) for a final unified presentation (Harrison et al., 2020; Ryan et al., 2022; Towe et al., 2020). This type of combinatorial protocol is part of the methodological adaptations employed by the research team to comply with the coding scheme proposed by Harrison et al. (2020) in the determination of the levels of methodological rigor (low, medium, high), and has been employed in different previous studies with satisfactory results.

Figure 1. Diagram of mixed method design and adaptations

3.1 Bibliometric study

The first stage was conducted using a bibliometric design of the most relevant literature in the fields of bibliometrics and scientometrics. Since one of the main challenges of bibliometric studies is the elaboration of the research question (Nyakurukwa & Seetharam, 2023), first the descriptive scope of the study and its indicators of interest were defined. Subsequently, they were delimited as research questions in this stage:
How has scientometric and bibliometric research evolved in the SCOPUS database?
What are the main trends in scientometric and bibliometric research in the SCOPUS database?

The scheme of work was organized in such a way that independent researchers 1 and 3 performed the search and analysis of scientific production between 2014 and 2024 without restrictions on language or type of sources. The search formula used was: TITLE-ABS-KEY ("scientometrics" OR "bibliometrics" OR "bibliometric studies" OR "scientometric studies") AND PUBYEAR > 2013 AND PUBYEAR < 2025 AND (LIMIT-TO (OA , "all")).

The review process was conducted on March 3, 2024, and a total of 14,197 investigations were collected (N = 14,197). For the analysis of the information, the file containing the metadata was downloaded in ".RIS" format, which was subsequently processed by researcher 3 using the EndNote X8 bibliographic manager. Finally, given the mixed and sequential nature of the protocol, researchers 1 and 2 selected papers of particular relevance and pertinence through the procedures that will be detailed in stage two.

3.1.2. Bibliometric indicators, data sources, and data representation

The bibliometric indicators analyzed were as follows:
- Trend and temporal evolution: The behavior of the research and its frequency over time was studied using a trend line adjusted to the highest R^2 value.

- Document typology: Documents were classified according to their type (papers, books, etc.).

- Areas of knowledge: The number of publications per country was identified.

- Production by country: The number of publications by country was identified. The map was generated with the Lens platform (https://lens.org/).

- Institutional affiliation: The number of publications by institution was analyzed.

Source of information: They were obtained from the SCOPUS database. The .XLSX files were downloaded in Excel format and further processed using Microsoft Excel software.

The following knowledge maps were produced:
- Analysis of keyword co-occurrence and its evolution over time. This analysis was complemented with the Lens word map and its density frequency.

- Correlation and collaboration between countries.

- Analysis of author collaboration and citations with the support of the Lens platform.

Representation of information: The VOSviewer software and the Lens platform (https://lens.org/) were used.

3.2. Integrative synthesis

This approach was chosen because it contributes especially to critically analyzing selected sources while allowing a qualitative evaluation of them in terms of the emergence of new ideas and perspectives (Deslandes et al., 2022; Gerup et al., 2020; Priego Morales, 2024). Since bibliometric and scientometric studies constitute a broad database in terms of editorial production, the use of integrative synthesis was because, according to Snyder (2019), in the case of mature and established fields, it favors the expansion of the theoretical or procedural bases according to the research questions. Thus, the following research question was elaborated:
What elements, crystallized and emerging, characterize the use of studies that bibliometric and scientometric studies?

Therefore, how the use of both types of studies is conceived was considered as a topic to be explored. This particular approach was chosen because, despite the large volume of papers and conference proceedings on the subject, the initial literature search revealed that the criteria for their selection and the advantages and disadvantages they offer are not frequently questioned, a methodological aspect that the integrative synthesis does consider (Schut et al., 2020). In the scientific literature specifically dedicated to integrative synthesis, it is common to find the affirmation of systematicity or the use of this classification (Debellis et al., 2021; López

Rodríguez Del Rey et al., 2024; Omerov et al., 2020; Røsvik & Rokstad, 2020), in the study presented we did not opt for this modality.

This was because the focus was on the emergence of new ideas, not on the systematization of the use of bibliometric and scientometric studies, an aspect largely resolved in the first stage. In this sense, the analysis of the data and their representation relied on the manual design of meaning networks generated from free coding, category synthesis, and the construction of main themes (Amsrud et al., 2019; Moreira & Reis Fonseca, 2024; Saunders et al., 2023).

3.2.1. Eligibility and quality assessment criteria

The selection of sources was carried out based on the search performed in the first stage. Researcher 3 was in charge of the independent selection of the sources (documents) from an initial reading, while researchers 1 and 2 were in charge of the in-depth and oriented reading to confirm the selection. This process was supported by a matrix in charge of certifying the relevance of the sources:

Figure 2. Matrix of eligibility criteria
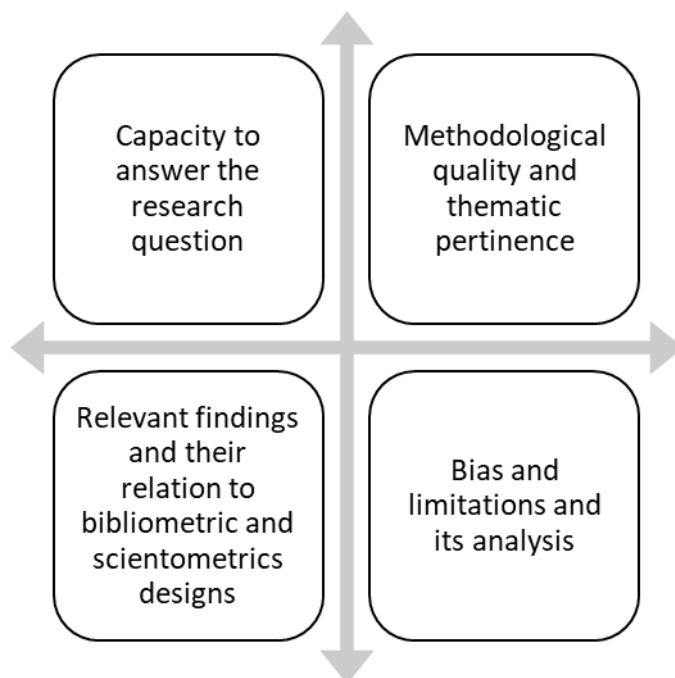
Once the database was created, a thematic team analysis was conducted according to the scheme of Saunders et al. (2023) for conducting this type of process. The first was aimed at superficial reading for initial and free coding, creating a list of codes and general ideas associated with them (memos), and discussing the results with the team. The second phase started with the evaluation of the baseline and indicators for the identification of data saturation, the merging of code lists, and the integration of memos for the generation of categories. The third phase began by checking that all textual data had been coded, an aspect that required the inclusion of a neutral code for segments that did not provide relevant information. Finally, codes (all lowercase), categories (initial capital letters), and themes (all capital letters) were represented in a manual network diagram for better exploration of the data and their final discussion.

4. RESULTS

4.1. First stage

A positive and growing trend in bibliometric research was identified in the SCOPUS database (Figure 1). The behavior was homogeneous and characterized by a polynomial function with a confidence level of 48.97 %; from the year 2020, the studies with this approach exceeded 1000 documents, with a maximum peak in 2023

of 3281 papers. The data indicate that in the year 2024, there are already 825 papers in the first four months of the year, which means that if this trend continues, a total of 3300 papers are expected, which would exceed those registered in 2023, although the descriptive scope of the research should be taken into account for the interpretation of these results. When comparing these findings, the literature showed similar trends and a marked inclination to growth, although warnings about the silent development of some fields also appeared (Nesari et al., 2022; Raban & Gordon, 2020; Sgambati & Gargiulo, 2022; Ülker et al., 2023; Wang et al., 2022).

Figura 3. Trend and temporal evolution of the investigations. Source: own elaboration
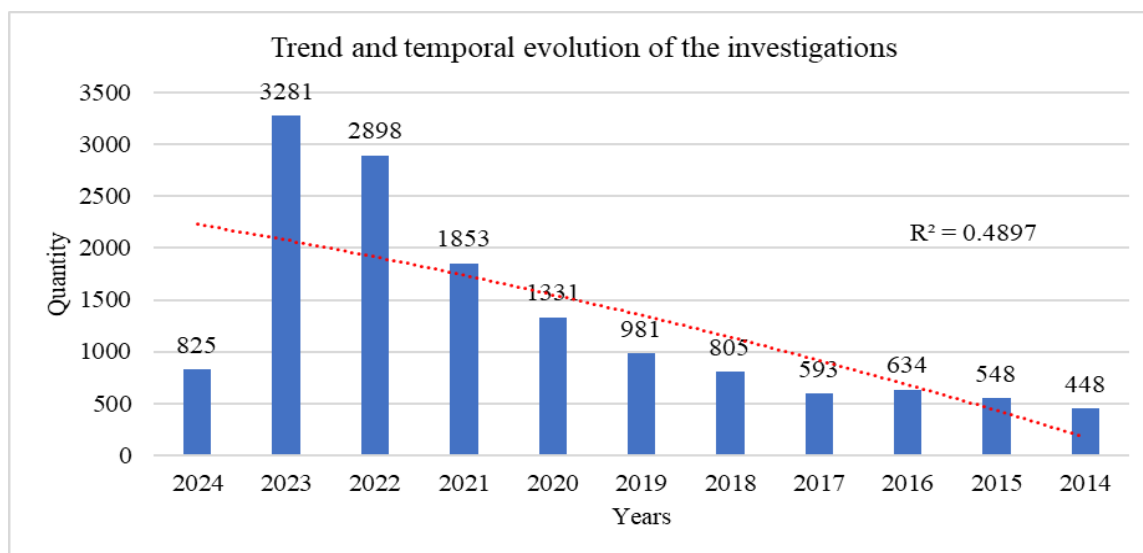

The research was distributed in 12 types of documents (Table 1). According to the data collected, research papers predominated with 9440, a type of source that represented 66.49 % of the total, where innovative methodologies with new approaches to the creation of lines of research, organization of knowledge, and exploration of new bibliometric indicators were also identified. Review papers, with 2968 documents, ranked second by combining this approach with systematic literature reviews (Moral-Muñoz et al., 2020; Umeokafor et al., 2022). With only 3.35 % of the total, letters to the editor were found that had a central theme in the bibliometric approach in scientific research and reflections for the future. In this case, it is also necessary to consider the type of objectives and analyses to be carried out in each study since different publications classify the papers in different ways, which may indicate a lag for outdated ways of understanding what bibliometric and scientometric studies are (Demir et al., 2020; Mirghaderi et al., 2022; Yan & Zhang, 2022).

Tabla 1. Number of investigations by type of document.

No.	Type of document	Quantity	%
1	Research paper	9440	66,49
2	Review paper	2968	20,91
3	Editorial	475	3,35
4	Event	464	3,27
5	Letter	327	2.30
6	Errata	263	1.85
7	Note	148	1.04
8	Book chapter	52	0.37
9	Short survey	28	0.20
10	Data document	18	0.13
11	Book	10	0.07
12	Retractions	4	0.03

Figure 4 shows an analysis of the amount of research by area of knowledge, where the most representative was medicine with 5965 documents, followed by social sciences with 3487 documents out of a total of 26 identified areas of knowledge.

Figure 4. Number of research projects by area of knowledge
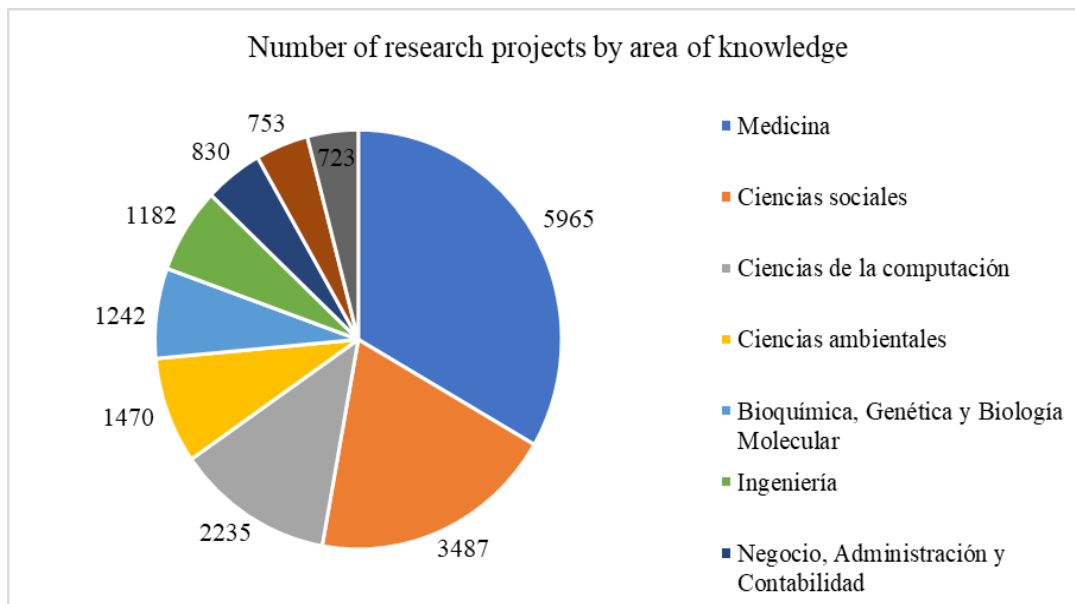
Research was identified in 157 countries, which demonstrates the geographic expansion of the field and the relevance of its institutional and decision-making relevance. An analysis of the countries with more than 500 published documents (Figure 5), showed that China with 3769 documents was the largest producer, followed by the United States, Spain, and the United Kingdom with 1939, 1152, and 1094 documents respectively. All of them produced more than 1000 bibliometrics in the period, which is consistent with the findings of multiple studies.

Figure 5. Scientific production by country. Source: Prepared by the authors
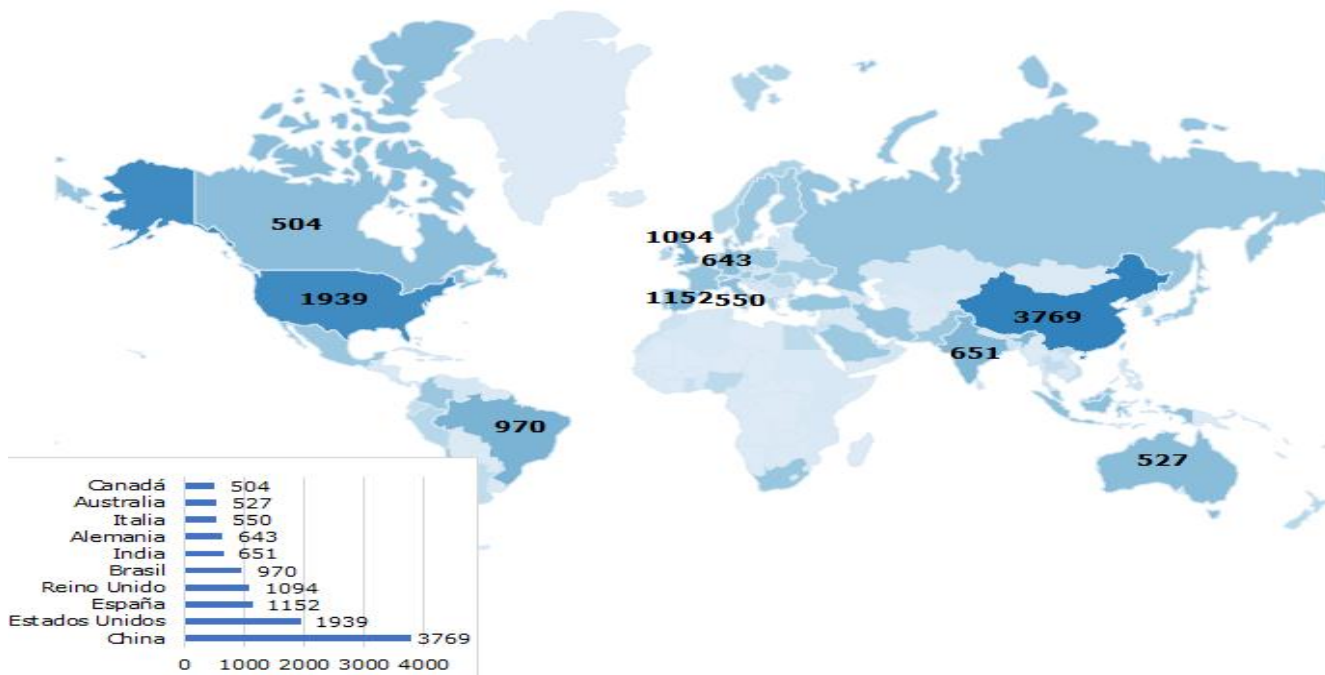
Figure 6 shows an analysis of the amount of research according to institutional affiliation. A total of 159 affiliations were identified among authors and research groups dedicated to both fields. In order to refine the results, the study focused on institutions with more than 100 published papers, which showed that the most representative affiliation was the Chinese Academy of Sciences, with 188 papers.

Figure 6. Scientific production by institutional affiliation
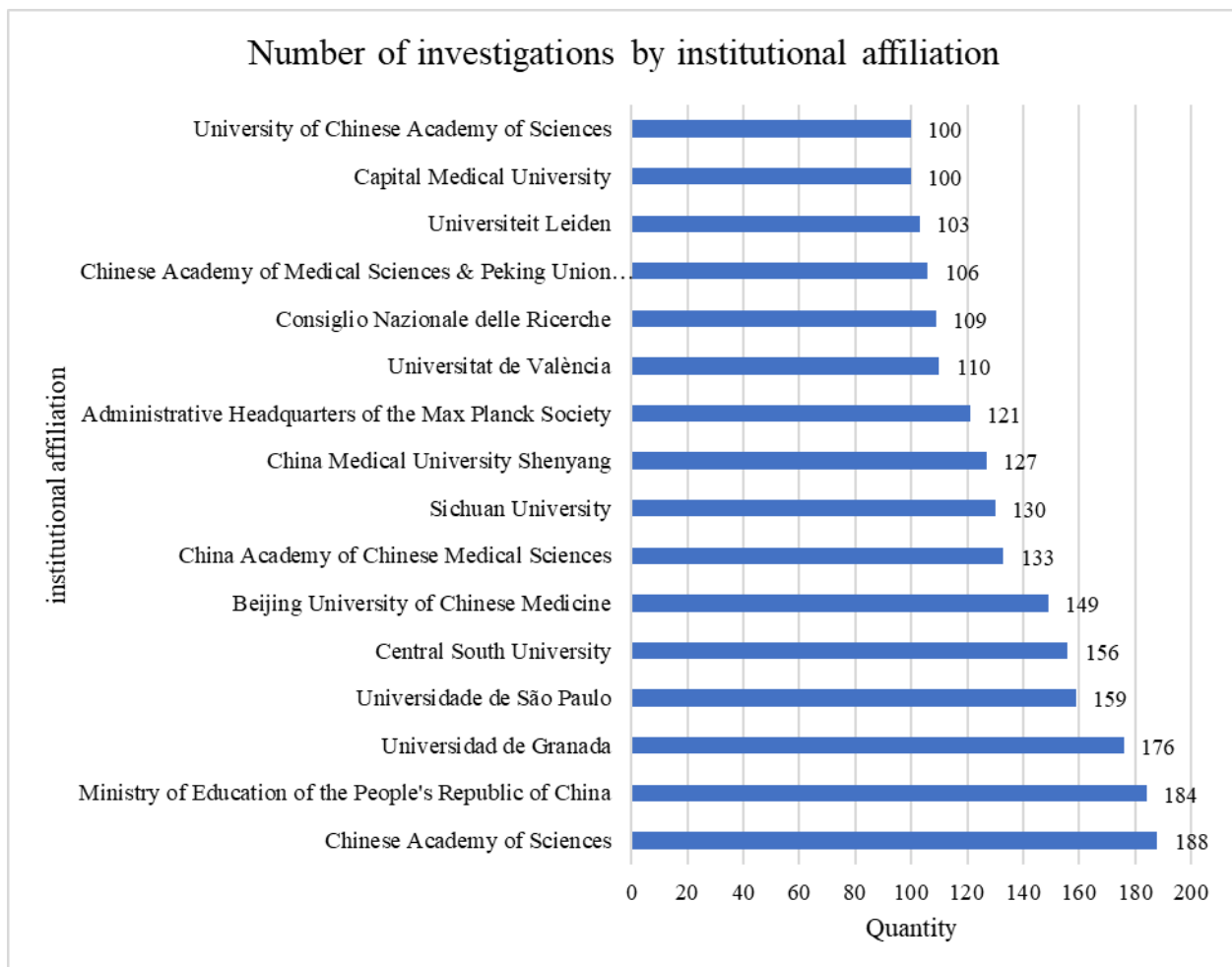
To clarify the main trends in terms of publication, an analysis of the relationship between keywords with a level of cooccurrence equal to or greater than 65 was carried out. As a result, 395 items were identified, grouped into seven clusters (Figure 7), to which the main lines of research were associated:

1. Evaluation of scientific productivity in biomedicine, comparative analysis of academies and institutions based on quantitative and qualitative indicators.
2. Evaluation of acupuncture in the treatment of cancer and heart disease, bibliometric analysis, and data visualization using Vosviewer software.
3. Optimization of academic research in the era of Industry 4.0, an approach based on bibliometric analysis and artificial intelligence.
4. Analysis of the scientific production of countries in the field of bibliometric research, comparative studies, and trends.
5. Bibliometric and comparative studies of the impact of the COVID-19 pandemic on the mental health of adolescents and health personnel.
6. Improvement of bibliometric research using advanced database technologies and techniques.
7. Impact of errata on bibliometric and scientometric analyses of pregnancy research.

Figure 7. Keyword co-occurrence analysis (n≥65). Source: own elaboration

On the other hand, an analysis was made of the frequency of keywords used in the research (Figure 8) using the keyword map (Figure 8 a) and the keyword density map (Figure 8 b). In this sense, it was identified that the most used keyword was computer science (n= 33685), followed by political science, bibliometrics, and medicine with n= 24668, n= 22705, and n= 18705 repetitions, respectively in the papers during the period.

Figure 8. Keyword knowledge map

(a)   (b)

Figure 9 (a) shows the authorial collaboration network, where the relationship between authors Liu, Y, Zhang, Y., Wang, Y. and Li, Y predominated with the highest frequency of collaboration. On the other hand, Figure 9 (b) shows the frequency in the number of papers of the main authors, where the highest producer was Bornmann, L., with 121 papers, followed by Abramo, G., and Sweileh, W.M., with 75 and 64 papers, respectively.

Figure 9. Map of authorial collaboration (n≥15) and frequency of publications

(a)   (b)
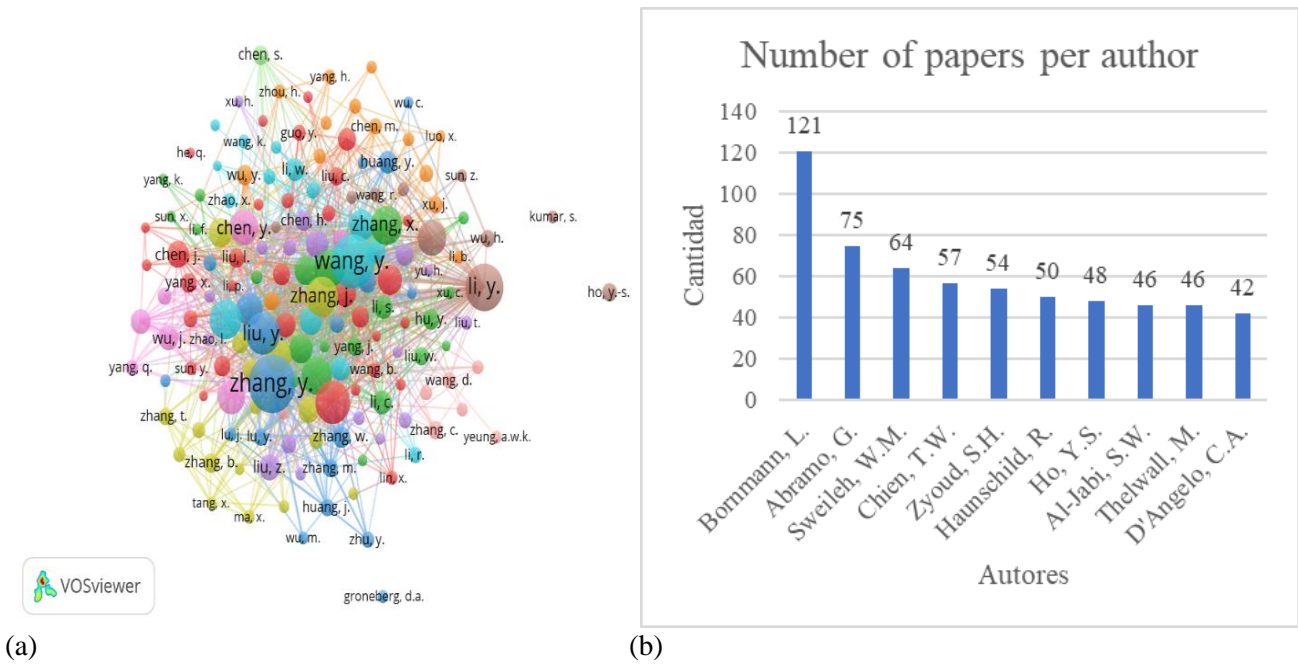
The highest number of citations was concentrated in the period 1995 - 2024 (Figure 10), an expected result according to multiple sources (Guo et al., 2023; Lipson et al., 2022; Xie et al., 2020). While citations of open access papers predominated, during the period 2006 – 2012, the highest number of citations was recorded with a total of approximately 9500 citations. However, a considerable number of papers were found to be concentrated in recent periods, highlighting the acceleration of studies and growth in terms of volume (Agbo et al., 2021; Bornmann et al., 2021; Coccia, 2020), although a greater number of years may correlate with a greater number of citations, an aspect that requires further studies (Norouzi et al., 2021; Rodríguez-Soler et al., 2020; Suwaileh et al., 2020).

Figure 10. Map of author co-citation in the Lens database
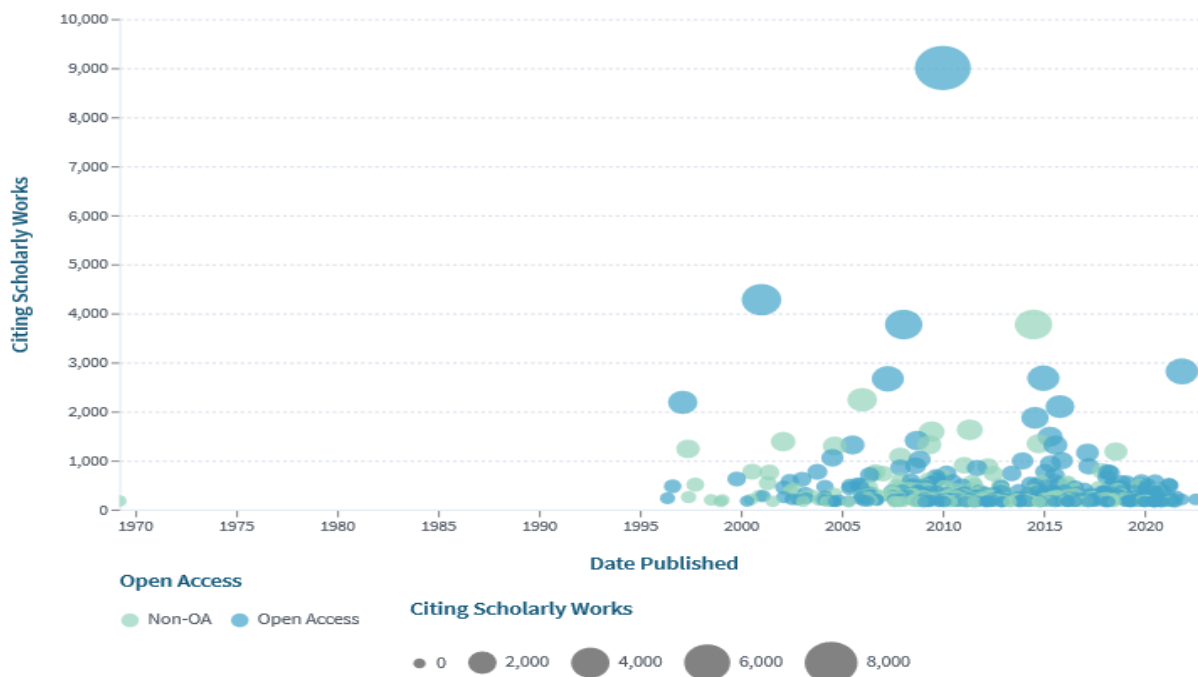
4.2. Integrative synthesis

The analysis of the texts collected required a progressive process of analysis, marked by the intertextual assessment of the arguments and rationale presented by the authors when choosing and operationalizing the bibliometric and scientometric studies. In general, there was a predominant use of a) presentation of sources for support, b) justification of the procedures implemented, and c) clarification or mention of limitations. These results were contrasted in the specific literature of both disciplines with similar indicators reported by specialists (González-Alcaide, 2021; Rousseau & Rousseau, 2021). In particular, González-Alcaide warns about the accelerated and uncontrolled growth of the discipline, which was evidenced in this study, but the team of researchers also attributes this increase to the relative ease of exploitation offered by specialized platforms and programs, which automate and simplify the most complex procedures in bibliometric terms.

Another key element gathered during the first phase was the emphasis on mapping science and presenting metrics. This position's limitations were related to the provision of a large volume of background information or comparisons without deep verbal analysis. These results should be interpreted in terms of the hypothetic and deductive approach and positivism as a fundamental root in terms of epistemology, which points to the need to advance methodologically and gnoseologically to include mixed approaches and new ways of producing qualitative data to help make sense of these complex metrics.

In total, 23 codes were identified and distributed in two major themes (Table 2). However, although the total number of codes transited through the stages and revisions of the research team from 21 to 25, the categorical relationship was maintained and recorded according to the original manual design (Figure 11). In this relationship, it could be seen that the tendency of centrality was referred to the detection of emerging areas, the optimization of the publication strategy, and the guidance of academic decision-making. The other main areas of emphasis were the promotion of direct access and the improvement of the evaluation of scientific research.

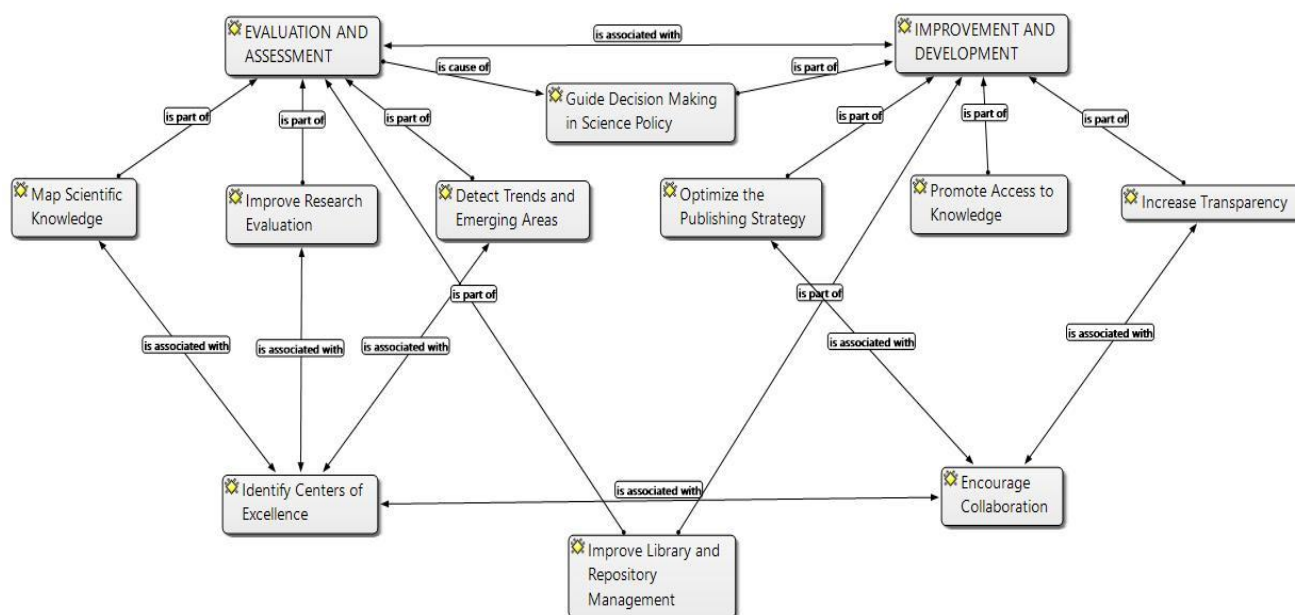**Figure 11.** Central themes and categorical relationship

Table 2. Main themes and codes distribution

EVALUATION AND ASSESSMENT	IMPROVEMENT AND DEVELOPMENT
1- objective and quantitative evaluation 2- impact and quality 3-identify influential works	1- provide valuable data 2- promotes informed decisions 3- aid to manage resources and promote strategic areas
1- identification of new research trends and emerging technologies 2- promotes adaptation to changes	1- selection of the most appropriate journals 2- maximize visibility and the impact of research findings.
panoramic view of the development of different fields of knowledge 2- better understanding of how different areas of research interrelate and evolve.	1- improve analysis of collaboration networks 2- facilitate the identification of potential collaborators 3-aid on building multidisciplinary and multinational research teams
1- identification of leading institutions and research groups 2- diagnosis of contribution to specific areas of knowledge 3- facilitates strategic alliances and academic mobility.	1- publication of metrics and analysis 2- promotes transparency in research evaluation 3- facilitates academic decision-making processes.
	1- development of open access policies and the dissemination of scientific research 2- facilitate access to a broader audience
Total: 10	**Total: 13**

These themes were divided into four (EVALUATION AND ASSESSMENT) and five categories (IMPROVEMENT AND DEVELOPMENT) respectively, while a shared category appeared whose determination was made by content analysis and code counting (Improve Library and Repository Management) (Table 3). The relationship between the topics can be presented through the analogy between diagnosis and treatment/intervention, especially in the health sciences disciplines. The first is that, as in the analogy, the data suggest that bibliometric and scientometric studies have as their primary function to gather the evidence necessary to identify the current state of a process and to seek a reasonable prediction of its behavior so that decisions can be made in an informed manner. The second reason is that, although each

theme showed specific functions, the interrelationship between the two was also appreciated, especially in the category in C1. Guide Decision Making in Science Policy.

Table 3. Main themes and categories

EVALUATION AND ASSESSMENT	IMPROVEMENT AND DEVELOPMENT
Improve Research Evaluation	Guide Decision Making in Science Policy
Detect Trends and Emerging Areas	Optimize the Publishing Strategy
Map Scientific Knowledge	Encourage Collaboration
Identify Centers of Excellence	Increase Transparency
Improve Library and Repository Management	Promote Access to Knowledge
	Improve Library and Repository Management

In the first case, the theme was marked by its diagnostic nature, which shows the orienting nature of both disciplines when undertaking processes of understanding a certain field or subject (Figure 12). In this theme, category 4 (Identify Centers of Excellence) stood out in terms of centrality, which demonstrates within the sample a key idea in the studies of both disciplines: modern science moves around institutions, projects, and programs. Other aspects highlighted in this category were the visualization and mapping of fields of knowledge, the detection of the configuration of disciplines and their relationships with others, the identification of emerging trends and crystallized trends (authors, lines, constructs), and the identification of the most relevant aspects of the research.

Figure 12. Main theme EVALUATION AND ASSESSMENT
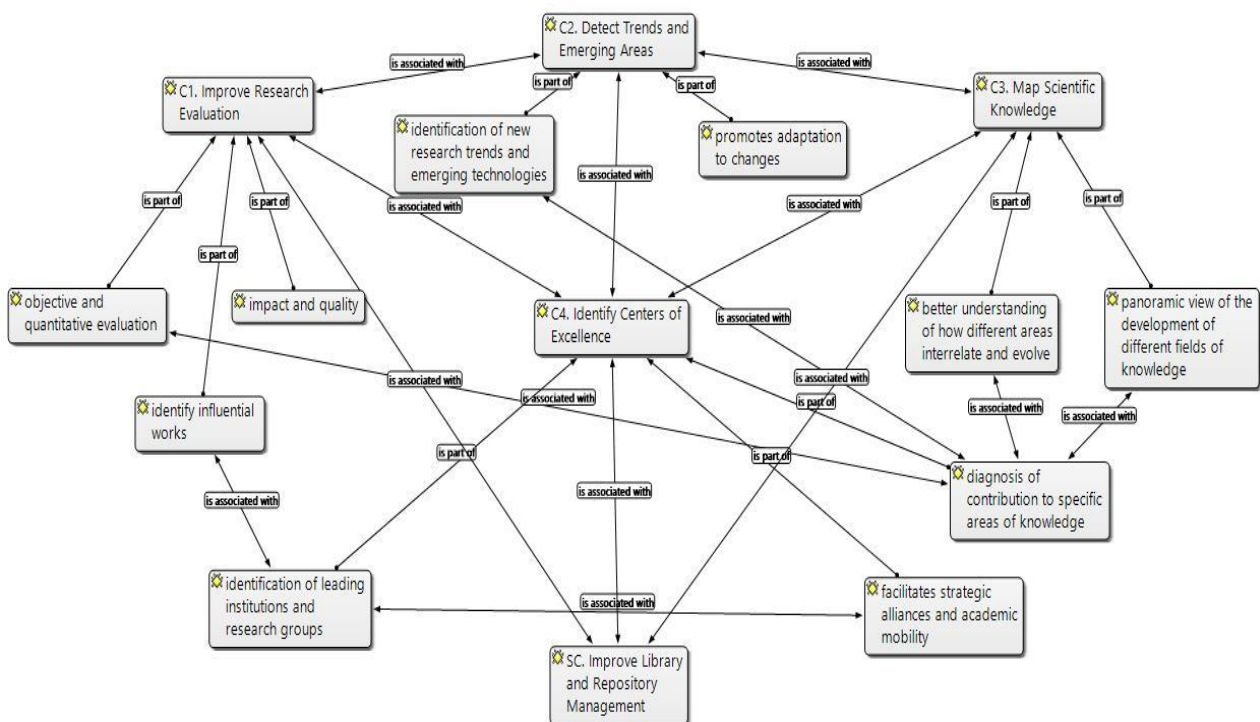
In the second case, the theme was marked by the interventional character that these studies acquire when used to transform reality, which highlights their instrumental nature and contribution to science, as well as to institutions and programs in a more academic and practical sense. Although developed manually, category 5 (Promote Access to Knowledge) stood out in this theme, demonstrating the importance of the democratization of knowledge for authors in both disciplines, a fact enhanced by the wide diversity of topics examined in bibliometric and scientometric studies. Other crucial aspects referred to the contributions to editorial and scientific transparency, the construction of academic networks for collaboration and mutual development, as well as facilitating decision-making. The latter was a cardinal element in both topics, and related pieces of

information appeared in all codes, which underpins the results obtained and emphasizes the importance of scientometric and bibliometric studies in the current scientific landscape.

Figure 13. Main theme IMPROVEMENT AND DEVELOPMENT
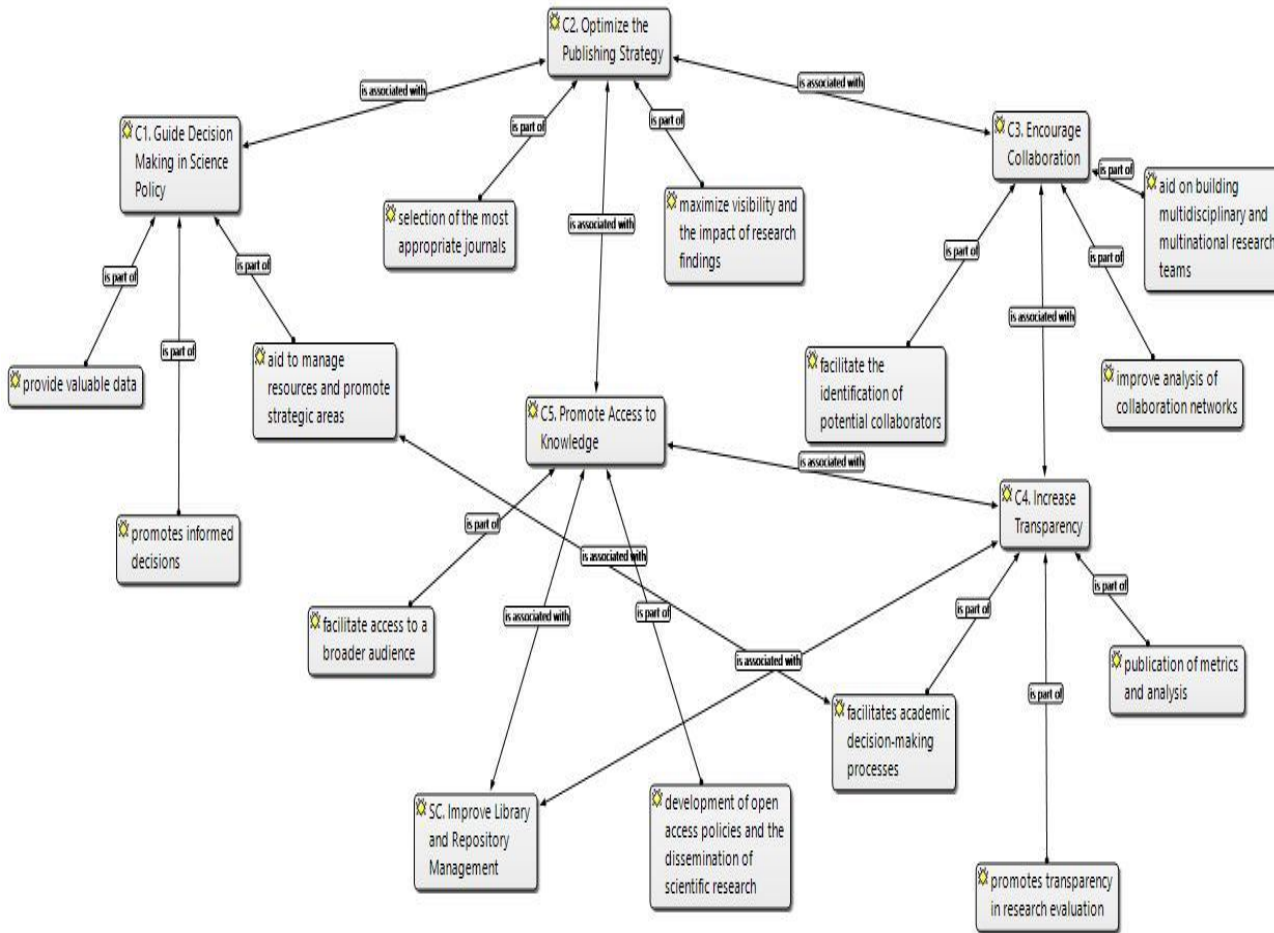
5. CONCLUSIONS

The study conducted made it possible to answer the research questions, especially through its sequential strategy, since it favored building the analysis on the results of the first stage and deepening the examination in the second stage. This approach was vital because it allowed the identification of key sources, the extraction of qualitative data, as well as the synthesis and integration of these. The possibilities and strengths offered by the design allow us to suggest similar protocols for future reviews with a mixed approach, although greater emphasis is needed on the data integration aspects.

Regarding the first stage questions, the results show a clear trend towards sustained growth, which can be seen in the increase in papers from one year to the next but also in the comparison between the papers published up to the date of the bibliometric study and those published each year in the period 2014-2018. These findings not only endorse the importance of bibliometric and scientometric studies but also point to key movements in terms of their exploitation, paper/research typology, and the cultural value given within academies and programs. Likewise, its multiple connections with various disciplines were evidenced; although the predominance of health sciences, mainly Medicine, was marked, these findings reaffirm the scope of the field and reposition Information Sciences as a fundamental discipline for current and future science.

Concerning to the stage two question, the data allowed us to identify two fundamental themes around which the fundamental functions of both types of studies were grouped. In summary, despite their diverse uses and

potential, these studies stand out for the possibilities they offer for the diagnosis of science and the use of information for the improvement of processes and informed decision-making. Likewise, a marked approximation of the sources towards the democratization of knowledge, the strengthening of the Open Access domain, the institutional character of current science, and the vitality of the representation of data to feed decisions.

As for future lines of development, it is necessary to highlight the need to delve deeper into the negative aspects or weaknesses of these types of studies since both bibliometrics and scientometrics have expanded beyond their initial limits, and this has led to adaptations, uses, and new proposals that require commensurate assessments. Similarly, there is a need to create and strengthen programs for the introduction of non-specialist researchers to both disciplines, the aforementioned epistemological mix, and the proposal of new methodologies.

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