SCIENTIFIC PRODUCTION OF THE RELATIONSHIP BETWEEN LEADERSHIP, HIGHER EDUCATION AND DIGITAL TRANSFORMATION: A BIBLIOMETRIC ANALYSIS

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SUMMARY

Digital transformation is a process of cultural change that has impacted all spheres of human endeavor, which is why it has become a strategic component to guarantee the success and competitiveness of all types of organizations; In this same category is leadership, considered by many scholars as the true differentiating factor and developer of competitive advantages. Higher education institutions do not escape this reality, and for this reason, given the relevance of this research topic, this work has been set as a central objective, to carry out a bibliometric analysis of the production of scientific articles that address the

relationship between the leadership, higher education and digital transformation in the Web of Science database, in order to identify the state of the art of knowledge, the contributions on the subject and future research lines of development. The methodology used is documentary review through bibliometric indicators that show trends in scientific production. Among the most significant results, it can be mentioned that it was found that digital transformation is an emerging issue, in sustained growth and scarcely addressed in the field of higher education, so it represents an opportunity to develop research on the subject.

Introduction



dergone notable changes in recent years, promoted mainly by the advancement of technology and innovation, which entails a review of its

igher education has un-

institutional mission, its structures, processes, results, and relationships with the environment. These changes became even more dizzying and unpredictable in recent times after the pandemic that forced institutions to generate rapid responses (Salazar-Rebaza et al., 2022), which evidenced what Mohammed et al.

(2022) qualify as fragmentation of competition in the context of almost involuntary adaptive digital processes, which is influenced by a variety of factors such as the emergence of Massive Open Online Courses (MOOC), the trend towards blended learning, the exchange of the commodifiinformation.

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cation knowledge and strategic decision making.

The text mentioned previously corresponds to the phenomenon called digital transformation, which involves the modification of the processes, procedures, capacities, and policies necessary to take advantage of the changes and opportunities presented by new digital technologies, as well as the impact they have on their environment, always thinking in both current and future trends (Guinan et al., 2019; Diaz-Garcia et al., 2023). In the educational field, factors such as training, digital teaching, student knowledge and skills, accessibility, infrastructure, and educational policies stand out, among other aspects (Rodríguez-Abitia et al., 2020).

According to Rodríguez-Abitia and Bibriesca-Correa (2021), the notion of digital transformation has gained momentum and has evolved in the last decade; Given that, currently, not only it's an organization's capabilities for the use of technologies which are measured, but it also becomes a fundamental element of daily life, affecting all dimensions that involve both people and the organization itself, which has transformed the economy and society.

The CEPAL qualifies the changes that have been generated in three stages: First, the connected economy, characterized by the mass use of the Internet and the deployment of broadband networks. Then, a digital economy resulting from the expansion of the use of digital platforms as business models for the supply of goods and services. And now progress is being made towards a digitized economy that bases its production and consumption models on the incorporation of digital technologies in all economic, social, and environmental dimensions (Cepal, 2022; Abad-Segura et al., 2020). The need for cleaner technologies aimed at reducing negative environmental impacts, improving energy efficiency and the sustainable use of resources or environmental protection activities are part of the sustainable development agenda (Abad-Segura et a., 2020).

There is no doubt that digital transformation is a disruptive process that impacts the entire organization, people, and generates new ways of working (Rodríguez-Abitia and Bibriesca-Correa, 2021; Niță and Gutu, 2023); constitutes a strategic factor that is part of the decision-making agenda as technological innovation accelerates and continues to influence daily life and organizations (Henderikx and Stoffers, 2022; Nadeem *et al.*, 2018), therefore, can act as an enabling force to develop competitive advantages among higher education institutions (Hashim *et al.*, 2022). Guinan *et al.* (2019) emphasizes that an adequate transformation requires establishing a strategy that serves as a central concept to integrate, coordinate, prioritize and implement the necessary changes to achieve the appropriate technological innovations for process automation.

Such a situation of permanent change and transformation becomes a challenge for the exercise of leadership, particularly when considering that influencing the behavior of individuals and monitoring their efforts plays a fundamental role (Ganga-Contreras et al., 2018; Mohammed et al., 2022; Carvalho et al., 2022). Therefore, understanding the phenomenon of leadership involved in the transition to digital transformation can help improve the creation of strategies to deal with organizational routines. (Ganga-Contreras *et al.*, 2016Mohammed et al., 2022; Almatrodi and Skoumpopoulou, 2023). In addition to this, leadership is a highly necessary skill to maintain the competitiveness of institutions, while supporting development, managing change, and building a culture of quality, with a view to achieving institutional effectiveness (Tejedor et al., 2020; Pedraja-Rejas et al., 2021).

In this regard, McCarthy *et al.* (2021) point out that not much is known about the role that leadership plays in the digital transformation of organizations, they affirm that the frequently coined concept is that of digital leadership, which is understood as doing things regarding digitization based on the strategic success of the company and its business ecosystem (Sawy *et al.*, 2016; Araujo *et al.*, 2021; Tagscherer and Carbon 2023).

With all of this in mind, it has been proposed to conduct a bibliometric analysis of the production of scientific articles in the Web of Science database that address the relationship between leadership, higher education, and digital transformation, in order to identify the state of the art of knowledge, contributions on the topic, and future lines of research.

The findings show significant patterns in the creation of papers in this field of knowledge, indicating that digital transformation is an emerging topic with sustained growth but is still hardly covered in the field of higher education, presenting an opportunity to do study on the topic. The information is obtained using a specific database (Web of Science) since it simplifies the handling of information backed by bibliometrics.

This study is designed to present a holistic picture of current research that integrates the concepts of leadership, higher education, and digital transformation. In addition to analyzing existing literature, identify possible areas for development and knowledge expansion in this domain. Bibliometric analysis allows us to detect research trends and developing areas in the field, pointing out potential avenues for future research and influresearch and development encing decision-making.

Materials and Methods

The methodology used is the bibliometric analysis that has been applied to the open access scientific production which is registered under the "Web of Science (WoS)" database, one of the two most important databases in the academic world (Pranckutė, 2021). The VOS Viewer software and the Biblioshiny package from Bibliometrix, were used for the purposes of processing and presenting the information. The main findings show that the digital transformation in higher education is an emerging issue, with little scientific production, especially if it is related to leadership in higher education institutions: but that has been growing exponentially in recent years; therefore, it could be affirmed that it constitutes a line of research with wide applications and projections in academic spaces.

The search for scientific articles that address the relationship between leadership, higher education and digital transformation, was carried out on June 4, 2023, in the Web of Science database, which is an online scientific information service, provided by the company Clarivate Analytics (formerly Thomson Reuters).

The search strategy was defined including the key terms: "Leadership", "Digital Transformation", "Higher Education" and terms like the latter such as "University", "Universities" and "College", which were grouped using the use of parentheses.

The Boolean operators such as AND and OR were used to define the relationships between the terms. In consideration of the above, the strategy was (leadership AND higher education OR university OR universities OR college) AND "digital transformation").

The initial results were later filtered by their level of access and by the type of document, to include only open access articles. Neither language nor year of publication filters were used. In total, the results obtained from Web of Science were 166 documents (Table I).

TABLE I INCLUSION AND EXCLUSION CRITERIA FOR THE SEARCH AND SELECTION OF SCIENTIFIC PRODUCTION, BASED ON 321 INITIAL RESULTS

Criteria	Inclusion	Exclusion	Results
Access	Open Access	Without Open Access	182
Temporality	Until May 2023	As of June 2023	188
180	108	125	150
Type of Document	Article	Early Access, Review Article, Editorial Material, Bibliographical Notice, Minutes	166

Source: Own designed based on Web of Science (2023).

The Biblioshiny tool was used in order to perform the bibliometric analysis which is one of the most complete software for bibliometric analysis (Silva et al., 2022). Biblioshiny operates through the RStudio work environment, which is a mathematical software that is oriented to process data, with a graphic work environment (Aria and Cuccurullo, 2017; Araya-Pizarro and Verelst, 2023). Thanks to this tool, the annual production of articles, the production by author, by entity, by country and by journal, was performed, thus, allowing a visualization in which its results are in accordance to the Bradford's law, which allows the estimating of the exponential decrease as well as the expansion when conducting different searches in scientific journals; This was done in order to identify the main sources of information in the area. (Urbizagástegui, 1996; Urbizagástegui, 2016).

Lotka's law was also used as a reference for the analysis, the purpose of which is to demonstrate that most of the articles come from a small group of authors (Urbizagástegui, 1999). Additionally, it allowed the elaboration of a Three Field Plot, which shows the production flow by combining the following variables: journals, authors, and affiliations (Bakshi and Verma, 2023).

Additionally, thematic maps were built through Biblioshiny which were based on the algorithm of Callon *et al.* (1991), who grouped the subtopics present in the literature according to their level of relevance, that is, how populated a cluster of key concepts is, and development, which refers to the interactions of a cluster with others.

The algorithm groups the keywords into semantic units that make up the clusters based on their frequency (Aria and Cuccurullo, 2017).

Taxonomic mapping considers the use of two variables: one is centrality, that is, the degree of interaction of the network with other networks; and the other variable is density, which refers to the strength of the internal associations of a group (Aria and Cuccurullo, 2017). Thus, the subtopics are divided into 4 different quadrants, ranging from the mix "high relevance" and "high development" to the combination "low relevance and low development" (Figure 1).

Motivating factors: Core network clusters that form the strategic center of the file and are systematically studied throughout time by a certain set of academics. Strong links with other clusters both within and externally define the terms they stand for.

Fundamental subjects: Low density internal link in the center clusters. They can serve as hubs for data between interconnected networks, or they can be signs of developing difficulties that are still underdeveloped and may eventually lead to motor disorders. *Niche topics*: Peripheral or non-central clusters with robust internal connections. They are poorly interacting subnetworks that reflect highly developed research areas that have gradually lost interest.

Developing themes: clusters that are undeveloped and on the edge of the theme network. Only dynamic or comparative analysis, which reveals its evolution and relationships with other networks, can fully comprehend its contribution to the field (Figure 1).

On the other hand, by using the VOSviewer v1.6.19 software it was possible to graph the co-authorship networks in the total set of documents analyzed (Kirby 2023; Van Eck and Waltman, 2018), without a normalization method and with a distribution of nodes based on the attribute total links strength. In the same way, it allowed to build the graph of the networks of co-occurrence of



Figure 1. Topics that have been analyzed according to the relevance-development variables (Callon et al. 1991).

keywords in the documents and to visualize the clusters in their entirety; For this, an association normalization method and a node distribution based on the total link strength attribute were applied, as with co-authoring. The properties of the software allowed a deep analysis of the clusters formed by all the terms (Moral-Muñoz *et al.*, 2020).

Results

Annual publishing

The first publication was published in 2017, and the scientific output that was examined ran until May 2023. As seen in Figure 2, the number of articles produced has increased steadily over the time, nearly doubling annually until 2022, when 70 works represent the maximum number. Note that 21 items are counted for the year 2023 up until the search date, which is more than what was created in the years 2017 and 2020.

Authors

There are 541 authors in all who have published in the field under study; of them, Zulu, Si has created the most relevant amount of papers (four), closely followed by four other authors who have produced three articles apiece. Three of the recognized authors—Kaygin, E., Oktaysoy, O., and Topcuoglu, E. have a close working relationship with Istanbul Arel University, with which they have published two works in 2023. This should be emphasized (Figure 3).

If the major co-authorship networks, such as those composed of authors like Burova, E., and others, are shown, there is no indication in the findings produced of leading writers in the field that stand out for a high number of publications, despite the aforementioned.

The collected data reveal a scientific production that conforms to the provisions of Lotka's law. In this sense, and as can be seen in Figure 4, 93.5% of the authors have published only one article.

Affiliations

Another important topic to consider has to do with the affiliations of each author; In this regard, it was found that the Peter the Great St. Petersburg Polytechnic University based in Saint Petersburg (Russia), is the most productive entity with a total of 14 published articles. This institution is followed by The University of Chicago and the



Figure 2. Number of publishing per years (2017-2023).



Figure 3. Authors with greater productivity and their networks of co-authorship.



nstitutions

Univ Zagreb

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Figure 4. Authors and Their Co Productivity, In accordance with the Lotka Law.

University of Seville, with 8 and 6 publications, respectively (Figure 5).

Journals

In regards to the journals and as it is shown in Figure 6, of the 107 that have published articles on the subject, *Sustainability* is by far the most prominent periodical publication, with 21 documents, which represents 12% of the journals total articles. Far behind are the International *Journal of Technology and Frontiers in Psychology*, with 9 and 7 articles respectively.

Applying the provisions of Bradford's law, 7 nuclear journals or "core sources" were identified. This group led the aforementioned: is by Sustainability, International Journal of Technology and Frontiers in Psychology. The Journal of Business Research, International Journal of Environmental Research and Public Health, International Journal of Organizational Leadership, and Administrative Sciences complete the picture. These scientific dissemination devices concentrate 33.1% of the publications (Figure 7).

Relation and affiliations – authors – journals

Figure 8 reveals that by constructing a three-field graph, the main networks and production flows between the mentioned variables can be visualized: authors, journals, and affiliations. In this sense, the significant flow of production generated between the authors Suloeva, S., Babkin, A. and Burova, E. and the *International Journal of Technology*, Peter The Great ST Petersburg Polytech Univ Univ Chicago Univ Seville

Number of articles

publications

where the Peter the Great St. Petersburg

Polytechnic University appears as an insti-

tution, stands out major. It is also observed how relevant the Sustainability magazine is, which generates 6 outgoing

mentioning has to do with the networks established between the authors Kaygin,

E., Oktaysoy, O., Topcuoglu, E. and Erdogan, Su. with the *International Journal of Organizational Leadership*, which in turn connects with Kafkas

University and Istanbul Arel University,

two countries have a production of

Another element worth

Figure 9 shows that only

15

links to the affiliation's column.

both entities based in Türkiye.

Countries with the large number of

10

Figure 5. Institutions with greater article production, according to the affiliation.



Figure 6. Journals with greater amounts of publishing.

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Figure 7. Nuclear Journals that are in accordance with the Bradford Law.



Figure 8. Main networks and production flows between authors, journals, and affiliations.





articles above 20 publications, those are England and Russia with 25 and 22 respectively. Subsequently are Germany (n= 16), China (n=13), Australia (n=12) and Spain (n=10).

Greatly referenced articles

According to the analyzed information 166 articles have been cited a total of 1,638 times, with an average of 9.87 citations per article. The most referenced is "The Coronavirus crisis in B2B settings: Crisis uniqueness and managerial implications based on social exchange theory" by Cortez and Johnston (2020) with 141 citations. This is followed by "Leadership matters in crisis-induced digital transformation: how to lead service employees effectively during the COVID-19 pandemic" by Bartsch et al., 2021 with 131 citations. These two articles are the only ones to exceed 100 citations (Table II).

Countries with greater reference

Figure 10 shows that the 1638 citations come from a total of 1462 documents, and mainly represent the countries of China (n=267), England (n=133), United States (n=119), Germany (n=103) and Italy (n=103).

By analyzing the frequency and distribution of keywords over time, some revealing trends, and changes in research topics in this field were identified. It can be seen how the words most frequently such as: "Digital Transformation, Digitalization", "Leadership" and "Covid-19", are concentrated especially in the period 2021-2022, evidencing the significant increase in discussion, research and academic attention about digital transformation, leadership in digital environments, digitization, and the impacts of the Covid-19 pandemic during those years. However, around 2020 there is a low presence of the keyword "Higher Education", despite having been included in the search strategy. From 2022 new themes emerge that translate into the inclusion of new and incipient key terms, such as " Digital Culture", "Qualitative Research", "Motivation" and "Leadership Competences" (Figure 11).

In the same way, the taxonomic map (Figure 12) shows the classification of the different themes according to their distribution, according to Cotten's algorithm (Callon *et al.*, 1991). In summary, the niche topics are "Digital communication" and "Job satisfaction"; the driving themes "Business strategy" and "Innovation"; and as an emerging theme "Digital Maturity". The most

TABLE II ARTICLES WITH THE GREATEST NUMBER OF CITATIONS BASED ON ANALYZED TOPICS

Title	Authors	Journal	Affiliation	Year	Number of Reference
The Coronavirus crisis in B2B set- tings: Crisis uniqueness and mana- gerial implications based on social exchange theory	Cortez, Roberto Mora; Johnston, Wesley J.	Industrial Marketing Management	University System of Georgia; Georgia State University	2020	141
Leadership matters in crisis-indu- ced digital transformation: how to lead service employees effectively during the COVID-19 pandemic	Bartsch, Silke; Weber, Ellen; Buettgen, Marion; Huber, Ariana	Journal of Service Management	University of Munich; University Hohenheim	2021	131
Exploring the impact of digital transformation on technology en- trepreneurship and technological market expansion: The role of te- chnology readiness, exploration, and exploitation	Jafari-Sadeghi, Vahid; Garcia-Perez, Alexeis; Candelo, Elena; Couturier, Jerome	Journal of Business Research	Coventry University; Coventry University; University of Turin; HeSam Universite; ESCP Business School	2021	99
How Does the Digital Transformation Affect Organizations? Key Themes of Change in Work Design and Leadership	Schwarzmueller, Tanja; Brosi, Prisca; Duman, Denis; Welpe, Isabell M.	Management Revue	Technical University of Munich	2018	97
Sustaining Enterprise Operations and Productivity during the COVID-19 Pandemic: Enterprise Effectiveness and Sustainability Model	Obrenovic, Bojan; Du, Jianguo; Godinic, Danijela; Tsoy, Diana; Khan, Muhammad Aamir Shafique; Jakhongirov, Ilimdorjon	Sustainability	Jiangsu University; University of Zagreb; Shanghai Jiao Tong University	2020	93
Organizational mindfulness towards digital transformation as a prerequisite of information proces- sing capability to achieve market agility	Li, Huanli; Wu, Yun; Cao, Dongmei; Wang, Yichuan	Journal of Business Research	Guangdong University of Finance; University System of Maryland; Salisbury University; Coventry University; N8 Research Partnership; White Rose University Consortium; University of Sheffield	2021	86

Source: Own Design based on Web of Science (2023).



Figure 10. Countries with greater number of reference.

important and substantial basic theme is "Digital Transformation", as it includes aspects such as the adoption of digital technologies, cultural change, the reorganization of processes and the implementation of digital strategies in organizations.

Areas of investigation

Of the 166 documents that were analyzed, a total of 30

different investigated areas were identified. To highlight the most prominent areas, the five categories with the largest number of articles were selected; These are: "Business Economics" (53), "Environmental Sciences Ecology" (n=29), "Science Technology Other Topics" (n=27), "Engineering" (n=26) and "Education Educational Research" (n=27). =13) (Figure 13).

Discussion

The analysis of the results obtained in the Web of Science platform show that digital transformation as part of leadership in higher education institutions is a subject in full growth and development. These aspects coincide with other evidence provided by similar studies such as Rocha *et al.* (2022) who also describe a substantial increase in publications over the years in publications related to leadership in university 4.0.

In any case, this important growth is limited to a certain group of publications with well-defined characteristics, while the rest of the articles, although they show sustained growth, do so at a much slower rate. This group of publications with outstanding growth has a common characteristic: its Russian origin. In this way, both the most productive authors and the most productive institutions originate from this country. This can be understood from the Strategy for the Digital Transformation of the Science and Higher Education sector,



Figure 11. Research trends in topics according to keywords.



Figure 12. Taxonomic map with the most significant research topics.

promoted by the Russian Ministry of Science and Higher Education in 2021, aimed at reaching "digital maturity" (Rogozin, 2022), which would explain the exponential increase in the number of publications associated with Russia in the last two years. The analysis of the keywords that are mostly in common between the articles that were studied, allows us to see the thematic evolution that the keyword term "Leadership" has had in the context of Higher Education and its relationship with Digital Transformation. In recent years, the term "Leadership" has been mainly linked to "Leadership competencies", "Competency framework" or "Digital leadership". This last term has been highly documented in recent years as the most frequent concept related to the role of leadership in institutions (Sawy *et al.*, 2016; Araujo *et al.*, 2021; Tagscherer and Carbon, 2023). This area represents an object with great study potential and that is in full evolution (Rocha *et al.*, 2022).

Esteve-Mon et al. (2022) affirm that generally, most of the investments to promote Digital Transformation by higher education institutions are focused on the development and implementation of technologies, without considering aspects of another nature. In the study carried out, there is a high correlation with these inquiries, while the analysis of keywords shows key terms such as 4.0". "Digital "Industry Business Development", "Digitalized Production" or more recently "Digital Business Models" as some of the topics more closely linked to digital transformation.

On the other hand, among the research areas identified in the literature, the most numerous is by far "Business & Economics", almost doubling the number of articles associated with "Environmental Sciences Ecology". This not only gives a predominant characteristic to the articles analyzed, but also marks a contrast with works such as that of Abad et al. (2020), which describes a fundamental relationship between Digital Transformation in Higher Education and Sustainability through the high presence of the Social Sciences and Environmental Sciences categories in their study. In the same sense, the thematic mapping indicated the "Fourth Industrial Revolution" as one of the most important motor themes of the analysis, that is, advanced digitization and work automation (Pauceanu et al., 2020), evidence of the thematic tendency of the documents.

Returning to the co-occurrence of keywords, the analysis allowed 5 terms to be positioned as the main terms to be used, with a chronological evolution in the following order: "Digitalization", "Leadership", "Digital Transformation", "Covid-19" and "Digital Leadership". This temporal evolution shows an evolutionary trend, especially regarding leadership, which incorporates new concepts in the digital age. In Abad *et al.* (2020), however, the evolution trend of the main keywords moves more towards improvements in digital technologies and the quality of higher education.



Figure 13. Categories with the largest number of articles.

Nevertheless, the presence of "Covid-19" marks, as in many studies, is an important milestone that affects the development of the evolutionary trends regarding the different themes and posed a challenge, above all, for the leadership in the various organizations (Schwartz and Holzwarth, 2021). Without a doubt, it has also affected higher education institutions in their digital transformation process (Esteve-Mon et al., 2022). In this same sense, "Covid-19" as a key term is closely linked to others such as "Work Balance", "Leadership Competences" or "Dynamics Capabilities", which describe the challenges that this meant for higher education institutions.

Digital transformation has been recognized as a basic theme, meaning that it is still in the early stages of growth and may eventually become a central or driving factor, based on the thematic analysis that was conducted. This discovery, which transcends the technological realm, is in opposition to the findings of previous studies that emphasize the term's inherent complexity (Ogrean and Herciu, 2021). While the frequency of the term "digital transformation" occurring together as a co-occurrence is comparable to other studies (Díaz-García et al., 2023), it should be noted that some authors have assessed digital transformation as a key idea in related studies (Shi et al., 2022).

Conclusions

The findings of this study suggest that there has been an effort to conduct a bibliometric analysis of scientific production (published articles) focusing on the relationship between leadership, higher education, and digital transformation in the Web of Science database. The foregoing, with the clear purpose of identifying the state of the art, the contributions on the subject and the future research lines that could be developed.

In the course of this investigation, the identification of various key terms, topics, and the distribution of research areas reveals a prevailing emphasis on "digital transformation" and "leadership" as opposed to "higher education". In the same way, 5 main clusters were identified through the years contemplated in the study, in the order "Digitalization", "Leadership", "Digital Transformation", "Covid-19" and "Digital Leadership".

It has also become clear that scientific production in this field is still low, despite the notorious increase that was observed as of 2019. In any case, growth is limited to a group of researchers and entities of Russian origin.

On the other hand, it can be highlighted that it was possible to identify that within the field of study, leadership is in full evolution and represents one of the topics with high study potential. In turn, the topic digital transformation is a basic topic in the literature and is closely related to the development, investment, and implementation of technologies.

When it comes to Higher Education and Leadership, the theme analysis reveals that Digital Transformation is an issue that is always evolving. This suggests that in the near future, it may take on a more central or driving role. This finding is in opposition to earlier study that emphasizes the term's inherent complexity, which goes beyond its technological aspect. While the co-occurrence of "digital transformation" is not as frequent as in previous studies, some authors' assessment—that it is essential to related research—highlights the necessity for a thorough and in-depth comprehension of this developing issue.

Among the limitations of this study, it is recognized that articles without open access were not considered for the purpose of the analysis, which could be leaving aside works that incorporate contributions to knowledge on the subject, articles in languages different from Spanish and English were also excluded from the analysis, which also restricts the possibility of knowing empirical studies that have been developed in other latitudes.

In the future, the research could focus on establishing comparisons with other databases such as Scopus, Scielo and Redalyc, the latter to know the literature that has been published in Latin America. Other variables that emerged from the findings could also be included in the analysis, such as "digital leadership" and "higher education". In the same way, more complex studies could be developed that allow for a systematic review of the literature to analyze results, methodological approaches, and quality of collaborations, among other aspects.

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REFERENCES

- Abad-Segura E, González-Zamar M, Infante-Moro J, García G (2020) Sustainable management of digital transformation in higher education: *Global research trends. Sustainability 12*: 2107. https://doi.org/10.3390/su12052107
- Almatrodi T Skoumpopoulou D (2023)Organizational Routines and Digital Transformation: An Analysis of How Organizational Routines Impact Digital Transformation Transition in a Saudi University. Systems 11: 239. https://doi. org/10.3390/systems11050239
- Araujo LM, Priadana S, Paramarta V, Sunarsi D (2021) Digital leadership in business organizations. International Journal of Educational Administration, Management, and Leadership 2: 45-56. https://doi.org/10.51629/ijeamal.v2i1.18
- Araya-Pizarro S, Verelst N (2023) Análisis bibliométrico sobre la calidad de la educación superior en Chile. *Educación 32*: 5-32. https://doi.org/10.18800/educacion.202301.010

- Aria M, Cuccurullo C (2017) Bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics* 11: 959-975. https://doi.org/10.1016/j.joi.2017.08.007
- Bakshi M, Verma R (2023) Trends in Cause-Related Marketing (Crm): Scientometrics Analysis Through Prism of Biblioshiny. International Journal of Professional Business Review 8: e0995. https://doi. org/10.26668/businessreview/2023.v8i4.995
- Callon M, Courtial JP, Laville F (1991) Co-word analysis as a tool for describing the network of interactions between basic and technological research: The case of polymer chemistry. *Scientometrics* 22: 155-205. https://doi. org/10.1007/BF02019280
- Carvalho A, Alves H, Leitão J (2022) What research tells us about leadership styles, digital transformation and performance in state higher education? *International Journal of Educational Management 36*: 218-232. https://doi.org/10.1108/IJEM-11-2020-0514
- CEPAL Naciones Unidas (2022) Tecnologías digitales para un nuevo futuro. Educitec - Revista de Estudos e Pesquisas Sobre Ensino Tecnológico 8: 98.
- Díaz-García V, Montero-Navarro A, Rodríguez-Sánchez JL, Gallego-Losada R (2023) Managing Digital Transformation: A Case Study in a Higher Education Institution. *Electronics* 12: 2522. https://doi.org/10.3390/ electronics12112522
- Esteve-Mon FM, Postigo-Fuentes AY, Castañeda L (2022) A strategic approach of the crucial elements for the implementation of digital tools and processes in higher education. *Higher Education Quarterly* 77: 558-573. https://doi.org/10.1111/hequ.12411
- Ganga-Contreras F, Villegas FV, Pedraja-Rejas L, Rodríguez-Ponce E (2016) Liderazgo transformacional y su incidencia en la gestión docente: el caso de un colegio en el norte de Chile. *Interciencia 41*: 596-604.
- Ganga-Contreras F, Rodríguez-Ponce E, Navarrete E, Pedraja-Rejas L (2018) Relevancia del liderazgo en el gobierno de las universidades iberoamericanas. *Interciencia* 43: 160-167.
- Guinan PJ, Parise S, Langowitz N (2019). Creating an innovative digital project team: Levers to enable digital transformation. *Business Horizons* 62: 717-727. https://doi. org/10.1016/j.bushor.2019.07.005
- Hashim MAM, Tlemsani I, Matthews R, Mason-Jones R, Ndrecaj V (2022) Emergent Strategy in Higher Education: Postmodern Digital and the Future? *Administrative Sciences 12*: 196. https://doi.org/10.3390/admsci12040196
- Henderikx M, Stoffers J (2022) An Exploratory Literature Study into Digital Transformation and Leadership: Toward Future-Proof Middle Managers. *Sustainability* 14: 687. https://doi. org/10.3390/su14020687
- Kirby A (2023) Exploratory Bibliometrics: Using VOSviewer as a Preliminary Research Tool.

Publications 11: 10. https://doi.org/10.3390/ publications11010010

- McCarthy P, Sammon D, Alhassan I (2021) Digital Transformation Leadership Characteristics: A Literature Analysis. *Journal* of Decision Systems 32: 79-109. https://doi.or g/10.1080/12460125.2021.1908934
- Mohammed NY, Omar HA, Aziz AA (2022) Contributions of Leadership Styles to Digital Transformation-An Exploratory Study of the Opinions of a Sample of Administrative Leaders at the Northern Technical University. *Ingenierie Des Systemes d'Information 27*: 865-873. https://doi.org/10.18280/isi.270602
- Moral-Muñoz JA, Herrera-Viedma E, Santisteban-Espejo A, Cobo, MJ (2020) Software Tools for Conducting Bibliometric Analysis in Science: An up-to-Date Review. *Profesional de la Información 29.* https://doi.org/10.3145/ epi.2020.ene.03
- Nadeem A, Abedin B, Cerpa N, Chew E (2018) Editorial: Digital transformation & digital business strategy in electronic commerce - The role of organizational capabilities. Journal of Theoretical and Applied Electronic Commerce Research 13: I-VIII. https://doi.org/10.4067/ S0718-18762018000200101
- Niță V, Guțu I (2023) The Role of Leadership and Digital Transformation in Higher Education Students' Work Engagement. *International Journal of Environmental Research and Public Health 20*: 5124. https://doi. org/10.3390/ijerph20065124
- Ogrean C, Herciu M (2021) Digital transformation as strategic shift-a bibliometric analysis. *Studies in Business and Economics 16*: 136-151. https://doi.org/10.2478/sbe-2021-0050
- Pauceanu AM, Rabie N, Moustafa A (2020) Employability under the fourth industrial revolution. *Economics and Sociology* 13: 269-283. https://doi.org/10.14254/2071789X.2020/ 13-3/17
- Pedraja-Rejas L, Rodríguez-Ponce E, Bernasconi A, Muñoz-Fritis C (2021) Liderazgo en instituciones de educación superior: Un análisis a través de Bibliometrix. *Ingeniare 29*: 472-486. https://doi.org/10.4067/s0718-330520 21000300472
- Pranckutė R (2021) Web of science (WoS) and Scopus: The titans of bibliographic information in today's academic world. *Publications 9*: 12. https://doi.org/10.3390/publications9010012
- Rocha Á, Gonçalves MJA, da Silva AF, Teixeira S, Silva R (2022) Leadership Challenges in the Context of University 4.0. A Thematic Synthesis Literature Review. Computational and Mathematical Organization Theory 28: 214-256. https://doi.org/10.1007/s10588-021-09325-0
- Rodríguez-Abitia G, Bribiesca-Correa G (2021) Assessing digital transformation in universities. *Future Internet* 13: 52. https://doi. org/10.3390/fi13020052
- Rodríguez-Abitia G, Martínez-Pérez S, Ramirez-Montoya MS, Lopez-Caudana E (2020)

Digital gap in universities and challenges for quality education: A diagnostic study in Mexico and Spain. *Sustainability 12*: 9069. https://doi.org/10.3390/su12219069

- Rogozin DM, Solodovnikova OB, Ipatova AA (2022) How University Teachers View the Digital Transformation of Higher Education. Voprosy Obrazovaniya / Educational Studies Moscow (1): 271-300. https://doi. org/10.17323/1814-9545-2022-1-271-300
- Salazar-Rebaza C, Zegarra-Alva M, Cordova-Buiza F (2022) Management and leadership in university education: Approaches and perspectives. Problems and Perspectives in Management 20: 130-141. https://doi. org/10.21511/ppm.20(3).2022.11
- Sawy OAE, Amsinck H, Kræmmergaard P, Vinther AL (2016) How LEGO built the foundations and enterprise capabilities for digital leadership. *MIS Quarterly Executive 15*: 5. https://doi.org/10.4324/9780429286797-8
- Schwartz J, Holzwarth A (2021) Insights from behavioural economics for effective leadership during the pandemic. *BMJ Leader* 5: 214-218. https://doi.org/10.1136/leader-2020-000405
- Shi L, Mai Y, Wu YJ (2022) Digital Transformation: A Bibliometric Analysis. Journal of Organizational and End User Computing (JOEUC) 34: 1-20. http://doi. org/10.4018/joeuc.302637
- Silva MST, Correia SÉN, Oliveira VM (2022) Scientific mapping in Scopus with Biblioshiny: A bibliometric analysis of organizational tensions. Contextus – Revista Contemporânea de Economia e Gestão 20: 54-71. https://doi. org/10.19094/contextus.2022.72151
- Tagscherer F, Carbon CC (2023) Leadership for successful digitalization: A literature review on companies' internal and external aspects of digitalization. Sustainable Technology and Entrepreneurship 2: 100039. https://doi. org/10.1016/j.stae.2023.100039
- Tejedor S, Cervi L, Pérez-Escoda A, Jumbo FT (2020) Digital Literacy and Higher Education During COVID-19 Lockdown: Spain, Italy, and Ecuador. *Publications* 8: 48 1-17. https:// doi.org/10.3390/publications8040048
- Urbizagástegui R (1996) Una revisión crítica de la Ley de Bradford. *Investigación Bibliotecológica: Archivonomía, Bibliotecológía e Información 10*: 16-26. https://doi. org/10.22201/iibi.0187358xp.1996.20.3835
- Urbizagástegui (1999) La ley de Lotka y la literatura de bibliometría. *Investigación Bibliotecológica: Archivonomía, Bibliotecología e Información 13*: 125-141. https://doi. org/10.22201/iibi.0187358xp.1999.27.3913
- Urbizagástegui R (2016) El crecimiento de la literatura sobre la ley de Bradford. *Investigación Bibliotecológica* 30: 51-72. https://doi. org/10.1016/j.ibbai.2016.02.003
- Van Eck NJ, Waltman L (2018) VOSviewer Manual version 1.6.10. CWTS Meaningful Metrics, January. Universitie Leiden, The Netherlands. 45 pp.

PRODUCCIÓN CIENTÍFICA DE LA RELACIÓN ENTRE LIDERAZGO, EDUCACIÓN SUPERIOR Y TRANSFORMACIÓN DIGITAL: UN ANÁLISIS BIBLIOMÉTRICO

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RESUMEN

La transformación digital es un proceso de cambio cultural que ha impactado en todas las esferas del esfuerzo humano, razón por la cual se ha convertido en un componente estratégico para garantizar el éxito y la competitividad de todo tipo de organizaciones. En esta misma categoría se encuentra el liderazgo, considerado por muchos académicos como el verdadero factor diferenciador y promotor de ventajas competitivas. Las instituciones de educación superior no escapan a esta realidad y, por esta razón, dada la relevancia de este tema de investigación, este trabajo se ha establecido como un objetivo central, llevar a cabo un análisis bibliométrico de la producción de artículos científicos que aborden la relación entre el liderazgo, la educación superior y la transformación digital en la base de datos de Web of Science, con el fin de identificar el estado del arte del conocimiento, las contribuciones sobre el tema y las futuras líneas de investigación. La metodología utilizada es una revisión documental a través de indicadores bibliométricos que muestran tendencias en la producción científica. Entre los resultados más significativos, se puede mencionar que se encontró que la transformación digital es un tema emergente, en crecimiento sostenido y escasamente abordado en el campo de la educación superior, por lo que representa una oportunidad para desarrollar investigaciones sobre el tema.

PRODUÇÃO CIENTÍFICA SOBRE A RELAÇÃO ENTRE LIDERANÇA, ENSINO SUPERIOR E TRANSFORMAÇÃO DIGITAL: UMA ANÁLISE BIBLIOMÉTRICA

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RESUMO

A transformação digital é um processo de mudança cultural que afetou todas as esferas do esforço humano e, por isso, tornou-se um componente estratégico para garantir o sucesso e a competitividade de todos os tipos de organizações. Nessa mesma categoria está a liderança, considerada por muitos acadêmicos como o verdadeiro fator de diferenciação e promotor de vantagens competitivas. As instituições de ensino superior não escapam a essa realidade e, por essa razão, dada a relevância desse tema de pesquisa, este trabalho estabeleceu como objetivo central realizar uma análise bibliométrica da produção de artigos científicos que abordam a relação entre liderança, ensino superior e transformação digital na base de dados Web of Science, a fim de identificar o estado da arte do conhecimento, as contribuições sobre o tema e as futuras linhas de pesquisa. A metodologia utilizada é uma revisão documental por meio de indicadores bibliométricos que mostram tendências na produção científica. Entre os resultados mais significativos, pode-se mencionar que a transformação digital é um tema emergente, em constante crescimento e pouco abordado no campo do ensino superior, o que representa uma oportunidade para o desenvolvimento de pesquisas sobre o assunto.