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THEORETICAL ANALYSIS OF DIGITAL TRANSFORMATION IN APPLIED SOCIAL SCIENCES: A BIBLIOMETRIC REVIEW OF THE LITERATURE

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Abstract

Study Goals: Identify how the knowledge domain of digital transformation emerged and developed within the field of applied social sciences, as well as map the boundaries of knowledge and emerging themes in digital transformation, providing insights for the development of future studies.
Methodology: This is a bibliometric review, conducted through co-citation and bibliographic coupling techniques. Co-citation and coupling maps were created for the 727 articles from the sample collected from the Web of Science (WoS) database, using the VOSviewer software.
Relevance/Originality: The research can be seen as a preliminary effort that enhances our understanding of the formation and evolution of a scientific field. It outlines the current boundaries of knowledge and establishes a foundation for future descriptive and causal investigations.
Main Results: The research allowed for mapping the knowledge domain of digital transformation in the field of applied social sciences through the co-citation map, identifying eight clusters. Similarly, eight clusters were also mapped in the bibliographic coupling analysis.
Theoretical/Methodological Contributions: Our contributions stem from two groups: descriptive results and graphical mappings. Descriptive results included the evolution of papers by year, publications by author, and publications by journal, revealing the frequencies related to the theme over time. Graphical mappings were divided into co-citation analysis maps and bibliographic coupling maps. Among our main results, we identified 8 clusters of theoretical bases (co-citation) and 8 clusters of theoretical boundaries (bibliographic coupling).
Social Contributions: The study enables managers to identify barriers and challenges in implementing digital transformation processes, as well as recognize strategic benefits related to increased competitiveness and enhanced customer value perception.

Keywords: digital transformation, bibliometrics, Applied Social Sciences, theoretical evolution

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Análise teórica da transformação digital em ciências sociais aplicadas: uma revisão bibliométrica da literatura

Resumo

Objetivo do estudo: Identificar como o domínio de conhecimento da temática transformação digital emergiu e se desenvolveu dentro das áreas de ciências sociais aplicadas, como também mapear as fronteiras do conhecimento e os temas emergentes de transformação digital, possibilitando *insights* para o desenvolvimento de estudos futuros.
Metodologia: Trata-se de uma revisão bibliométrica, realizada por meio de técnicas de cocitação e pareamento bibliográfico, foram elaborados os mapas de cocitação e pareamento dos 727 artigos da amostra que foram coletados na base de dados Web of Science (WoS), os mapas foram elaborados por meio da utilização do software VOSviewer.
Relevância/originalidade: A pesquisa pode ser vista como um esforço preliminar que amplia nossa compreensão sobre a formação e evolução de um campo científico. Ela delineia as fronteiras atuais do conhecimento e estabelece uma base para futuras investigações descritivas e causais.
Principais resultados: A pesquisa realizada possibilitou mapear por meio do mapa de cocitação o domínio de conhecimento sobre transformação digital no campo de ciências sociais aplicadas, foram identificados oito *Clusters*, com relação ao pareamento bibliográfico também foram mapeados oito *Clusters*.
Contribuições teóricas/metodológicas: Nossas contribuições têm origem em dois grupos: resultados descritivos e mapeamentos gráficos. Nossos resultados descritivos incluíram evolução de trabalhos por ano, publicações por autor e publicações por periódico, revelando as frequências relacionadas à temática ao longo dos anos. Nossos mapeamentos gráficos foram divididos em mapa de análise de cocitação e mapa de acoplamento bibliográfico. Entre nossos principais resultados, identificamos 8 *Clusters* de bases-teóricas (cocitação) e 8 *Clusters* de fronteiras-teóricas (acoplamento bibliográfico).
Contribuições sociais: O estudo possibilita que os gestores identifiquem barreiras e desafios na implantação de processos de transformação digital, como também percebam benefícios estratégicos no que se refere ao aumento da competitividade da empresa e na percepção do valor dos clientes.

Palavras-chave: transformação digital, bibliometria, Ciências Sociais Aplicadas, evolução teórica

Análisis teórico de la transformación digital en ciencias sociales aplicadas: una revisión bibliométrica de la literatura

Resumen

Objetivo del Estudio: Identificar cómo emergió y se desarrolló el dominio del conocimiento sobre la transformación digital dentro del campo de las ciencias sociales aplicadas, así como mapear los límites del conocimiento y los temas emergentes en la transformación digital, proporcionando perspectivas para el desarrollo de futuros estudios.
Metodología: Se trata de una revisión bibliométrica, realizada mediante técnicas de cocitación y acoplamiento bibliográfico. Se crearon mapas de cocitación y de acoplamiento para los 727 artículos de la muestra recogida de la base de datos Web of Science (WoS), utilizando el software VOSviewer.

Relevancia/Originalidad: La investigación puede verse como un esfuerzo preliminar que mejora nuestra comprensión de la formación y evolución de un campo científico. Delimita los límites actuales del conocimiento y establece una base para futuras investigaciones descriptivas y causales.
Principales Resultados: La investigación permitió mapear el dominio del conocimiento sobre la transformación digital en el campo de las ciencias sociales aplicadas a través del mapa de cocitación, identificando ocho clústeres. De manera similar, se mapearon ocho clústeres en el análisis de acoplamiento bibliográfico.
Contribuciones Teóricas/Metodológicas: Nuestras contribuciones provienen de dos grupos: resultados descriptivos y mapeos gráficos. Los resultados descriptivos incluyeron la evolución de los artículos por año, publicaciones por autor y publicaciones por revista, revelando las frecuencias relacionadas con el tema a lo largo del tiempo. Los mapeos gráficos se dividieron en mapas de análisis de cocitación y mapas de acoplamiento bibliográfico. Entre nuestros principales resultados, identificamos 8 clústeres de bases teóricas (cocitación) y 8 clústeres de límites teóricos (acoplamiento bibliográfico).
Contribuciones Sociales: El estudio permite a los gestores identificar barreras y desafíos en la implementación de procesos de transformación digital, así como reconocer beneficios estratégicos relacionados con una mayor competitividad y una percepción mejorada del valor para el cliente.

Palabras Clave: ransformación digital, bibliometría, Ciencias Sociales Aplicadas, evolución teórica

1 Introduction

Recently, the digital transformation (DT) has become an emergent phenomenon in strategic management research (Bharadwaj *et al.*, 2013; Piccinini *et al.*, 2015; Vial, 2019), as well as in scientific researches on management behavior (Westerman e*t al.*, 2014, Vial, 2019). In a more specific form, the DT refers to the radical changes that occur in the society and in industries with the implementation of information technologies (Agarwal *et al.*, 2010). At organizational level, companies constantly aim at implementing new technologies as a way to innovate, developing *"strategies that manage the implications of digital transformations and foment the operational performance"* (Hess *et al.*, 2016, p. 123).

In such scenario, the digital transformation is understood as the implementation of new digital technologies, as for example, social media/collaborative media, cloud, mobility and data analysis, aiming at altering the way that an organization operates, conducts business and manages its workforce (Ponsignon, 2019). The digital transformation in the organizations is a continuous process with the new digital technologies (Kozanoglu,2021).

The perceptions in processes, products and services, organizational structures or business models, within he organizations have relation with the transformations (Riasanow, 2021). The digital transformation impacts on cost, quality, service and on other performance

indicators that the companies need to survive or to better develop themselves, therefore, traditional companies should reflect on their organizational functional structure adopting the administrative reform (Jin et al., 2020).

The published studies on the theme published from 2018 on have contributed to broaden our understanding on the concepts, definitions and specific characteristics of the DT phenomenon (Van Veldhoven & Vanthienen, 2022). Based on such findings from these prior researches on the transformations caused in companies with the implementation of IT technologies, it is possible to affirm that the technology itself is only one of the necessary strategies that companies should adopt so that they may continue competitive in competitive markets, global and each day more digital (Bharadwaj et al., 2013), in such sense, it is also necessary that companies implement other strategies, as for example, changes in the structure (Selander & Jarvenpaa, 2016), processes (Carlo et al., 2012) and culture (Karimi & Walter, 2015), such changes are necessary for the company to be able to compete in dynamic markets through new forms to create value to the clients and other *stakeholders* (Svahn et al., 2017). Nonetheless such contributions, currently, do not provide a broad understanding of the phenomenon (Hess et al., 2016; Van Veldhoven & Vanthienen, 2022), just as such, there are still doubts on their implications in several degrees of organizational analysis (Van Veldhoven & Vanthienen, 2022).

It is important that all collaborators have an understanding of the tools and digital transformation processes, this is essential for a well-succeed digital transformation (Ellstrom et al. 2022). Without a well-defined digital strategy, internal divergences may appear in the organization regarding which resources should be developed to support the digital trimming. The business should be defined and serve as guide to the creation of a business model, in addition to being necessary to ensure a good integration among strategies, structures and processes (Ellstrom et al. 2022).

The managers define the strategic direction of the business transformation and the multiple organizational and operational changes due to the new digital technologies. Managers should understand the impact of the existing or emergent digital technologies, in order to identify opportunities and challenges and to align the strategy of the company. Managers may use several strategic tools to help their decision process. In addition, such strategic change many times demands adjustment in the organizational structure (Vidal et al., 2022).

The digital transformation generates a huge amount of data, known as big data, which offers new business opportunities. Once again, companies have the choice of doing something with such data or take de plunge of being left behind when the competition stat to explore such

data. Therefore, many companies start to experiment the possibilities through the analysis, of machine learning and of AI. To enjoy all the potential of the big data, the companies also need to re-structure their data and their IT architecture and hire employees with the proper skills. Therefore, the big data generation causes multiple changes in the companies (Van Veldhoven & Vanthienen, 2022).

Even being consensus among the managers and researchers on the importance of such phenomenon and of the effects of the digital transformation on the competition and on the performance of the companies, as stated by Jin et al. (2020), the digital transformation directly impacts on the cost, quality, service and on other performance indicators that the companies need to survive or the better develop themselves, more specifically, the processes of digital transformation generate positive effects on the companies' competitiveness The literature still needs researches able to map with studies on the theme to appear and to have developed in the past years, since to understand the evolution of the researches on DT will allow to identify not approached gaps in such researches, to provide directions to future researches and to show new ways to implement strategies of digital transformation in the companies.

Based on the need of review researches on DT, this study focuses on a bibliometric review with the purpose of presenting the origin and the progression of the field of knowledge of digital transformation within the applied social sciences. In addition, it aims at identifying frontier studies and emergent themes related to the digital transformation in such specific field. The final delivery sketches possible future directions for the research, highlighting the use of innovative methods and the exploitation of seldom explored topics.

More specifically the research on digital transformation is fragmented and is not found in bibliometric reviews in the field of applied social sciences. By analyzing the literature it has been found a systematic review performed by Vial (2019), this study unlike the present research has a broader scope, including different purposes, since the author aimed at clarifying and uncovering the evolution and the frontiers of knowledge on DT in the context of the field of applied social sciences. The study of Vial (2019) was developed by a review with a sample of 282, such studies in a general form emphasize that the digital transformation regards a process where digital technologies generate disruptions, leading to strategic answers of the companies, with the purpose of adapting such disruptions, with this improving the perception of value from clients and other *stakeholders,* at the same time managing the structural modifications and the cultural barriers that lead to impacts on the organizational activities from such process (Vial, 2019). Based on such structure, we elaborated a research agenda that proposes [1] to examine

the role of the dynamic abilities and [2] to consider ethical issues as important paths to future strategic researches of information systems on digital transformation.

2 Methodology

This research was elaborated through bibliometric techniques, which mean, it is a bibliometric review, such type of review specially enables to systematize a domain of knowledge, since its appearance up to the state of the art of the current researches about such domain, which means, it allows to map the seminal studies and the emergent themes in the discussions of a certain theme (Zupic & Cater, 2015). Bibilometric studies are important to identify the authors with the greater volume of citations by other articles, being considered most influential, education institutions in which researchers are affiliated, co-authorship network, keywords with co-agreement and emergent research themes within the theme itself (Zupic & Cater, 2015). Bibliometrics are essential to the systematization of a great volume of documents/articles and data of quoted references, just as to clearly visualize the trend of increase of the research flow within a theme, as well as similar theoretical and contrasting perspective and possible obsolescence (Zhu et al. 2021; Ribeiro & Lima, 2023).

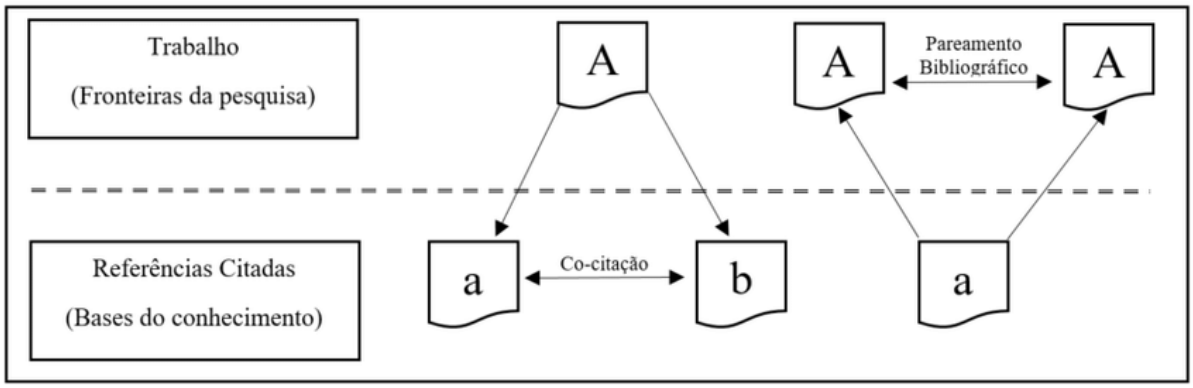
Due to the great data flow of publications present in the data bases with Web of Science, Scopus, EBSCO, PubMed the use of bibliometric technique has grown exponentially in the last years, presenting an average of publication of 1.021 in the last decade, in addition to the availability and concentration of data on scientific publications, it is also necessary to mention the increase of interest in research by the academics (Donthu el al. 2022). Bibilometric within such context should be understood as an essential tool for the analysis of big groups of bibliographic data, once that the common and traditional techniques are complex and unfeasible to group and to analyze an elevated volume of information (Ramos-Rodríguez & Ruíz-Navarro, 2004).

The emergency of scientific data bases such as Scopus and Web of Science enabled the gather of great volumes of research data, which has significantly contributed to the increase of bibliometric analysis. In addition, the development of softwares such as Gephi, Leximancer and VOSviewer has enabled a more practival analysis of such data, increasing the academic interest in the area of bibliometric recently (Lima e Ribeiro, 2023; Donthu et al., 2022).

The bibliometric review may be performed through five main techniques: a) analysis of citations; b) analysis of co-citation; c) bibilographic coupling (or pairing); d) analysis of co-authorship; e) analysis of co-words (Zupic & Carter, 2015; Donthu et al., 2021; Lima & Ribeiro,

2023). In this study, only techniques of co-citation and bibliographic pairing were selected, due to their relevance to the analysis of the relations among the citations in the studies (Marshakova, 1981; Lima & Ribeiro, 2023). The choice of such techniques was aligned to the scope and to the purposes of the research, with the purpose of examining the inter-connections between the citations of the sample and to systematize the knowledge in a specific field. The choice of such techniques was aligned to the scope and the purposes of the research, with the purpose of examine the inter-connections between the citations of the sample and to systematize the knowledge in a specific field (Zupic & Carter, 2015; Lima & Ribeiro, 2023). Figure 1 illustrates these two bibliometric techniques.

Figure 1 – Analysis of the Co-citation and Bibliographic Pairing



Source: Zupic & Cater (2015)

The bibliographic pairing technique involves identifying pairs of studies that reference one or more common sources (Zupic & Čater, 2015). This method is similar to co-citation analysis, as both rely on the reference lists cited in the analyzed publications (Glanzel & Czerwon, 1996). However, while co-citation reveals the knowledge base of a specific field by analyzing authors who are frequently mentioned together in various studies, bibliographic pairing tends to delineate the boundaries of research on a particular topic (Zupic & Čater, 2015).

For the collection of publications on digital transformation, the Web of Science (WoS) database was chosen. This choice was made due to its significance in scientific research, being the oldest and indexing the most relevant journals (Birkle et al., 2020). WoS, based on the Science Citation Index founded by Eugene Garfield in 1964, has expanded its coverage to approximately 34,000 current journals (Birkle et al., 2020).

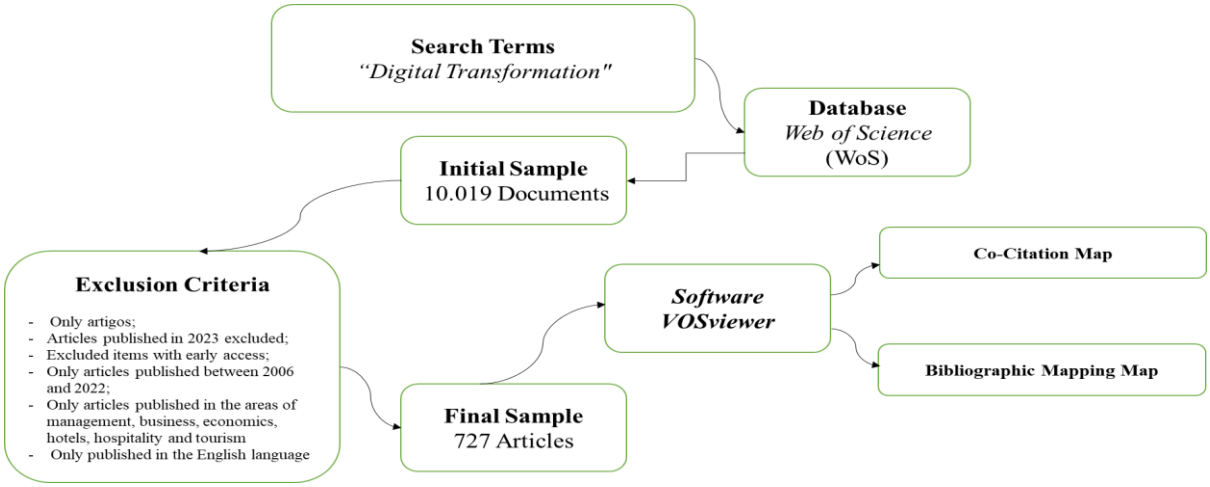
In selecting the articles for the sample, the term "Digital Transformation" was used in the topic field of WoS (title, abstract, and keywords). Initially, 10,019 results were found. To

ensure the replicability and reliability of the research, articles with early access and publications from 2023 were excluded, reducing the number to 8,241 publications. It is important to note that current years are not considered in bibliometric reviews. Subsequently, the applied filter selected only publications classified as "articles," as these undergo peer review, minimizing methodological risks and enhancing the quality of theoretical and managerial contributions. After this filter, 3,461 articles remained.

For the graphical mapping of the co-citation analysis and bibliographic pairing, we will use the Vosviewer software. Although there are several software options capable of performing these analyses, Vosviewer was chosen for its high-resolution graphical outputs and open access, making it easier for researchers (Van Eck & Waltman, 2018).

As follows, a time filter was applied, selecting only articles published between 2006 and 2022, to reflect the state of the art of the digital transformation. After this filter, the sample was reduced to 1,890 articles. A new refinement focused on the articles published in applied social sciences, specifically in the area of business, management, economy, hotel business, tourism, hospitality and leisure, reducing the sample to 739 articles. At last, only articles published in English were considered, resulting in a final sample of 727 articles. The methodological path of the research is illustrated in Figure 2.

Figure 2 – Methodological Path of the Research

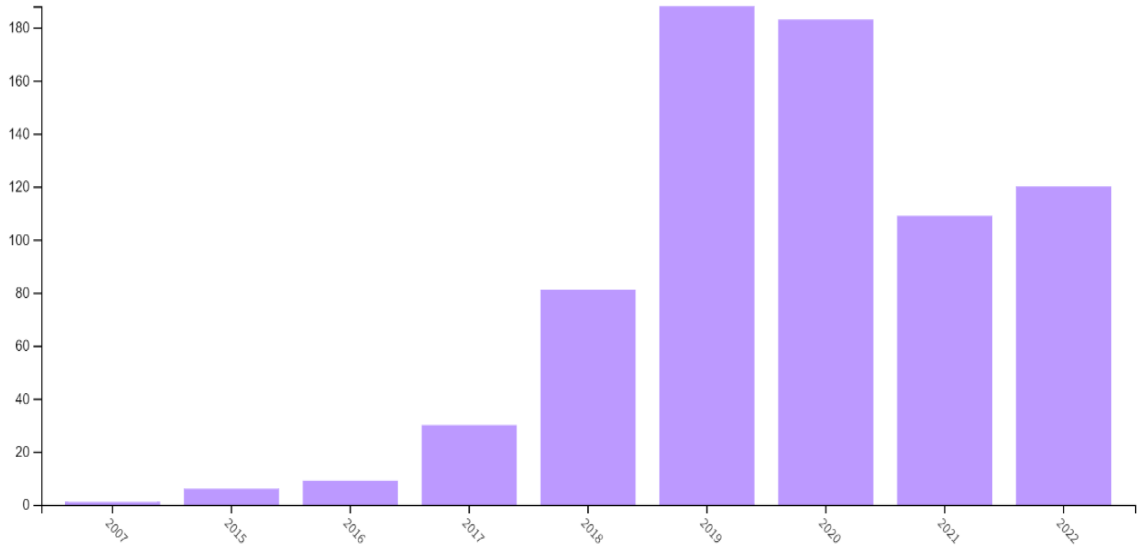


Source: The authors (2023)

Regarding the evolution of the publications on digital transformation in the field of applied social sciences, a gap of researches is noticed between the years of 2007 and 2015, this could be in part explained due to the digital transformation being related to the technological

development, more specifically with the technology of information and the processes and the applications based on information technology which have been intensified after 2010. In this context, it is worth noting that access to the internet and the application of information technology-based tools did not occur at the same speed across countries, which undoubtedly impacted interest in the topic. Finally, it should be highlighted that the peak of publications on the subject was in 2019, a year in which 186 articles on digital transformation were identified solely in the field of social sciences. The volume of research in that year can be explained by the introduction of new concepts such as Industry 4.0, blockchain, the Internet of Things (IoT), and the growth of solutions based on artificial intelligence.

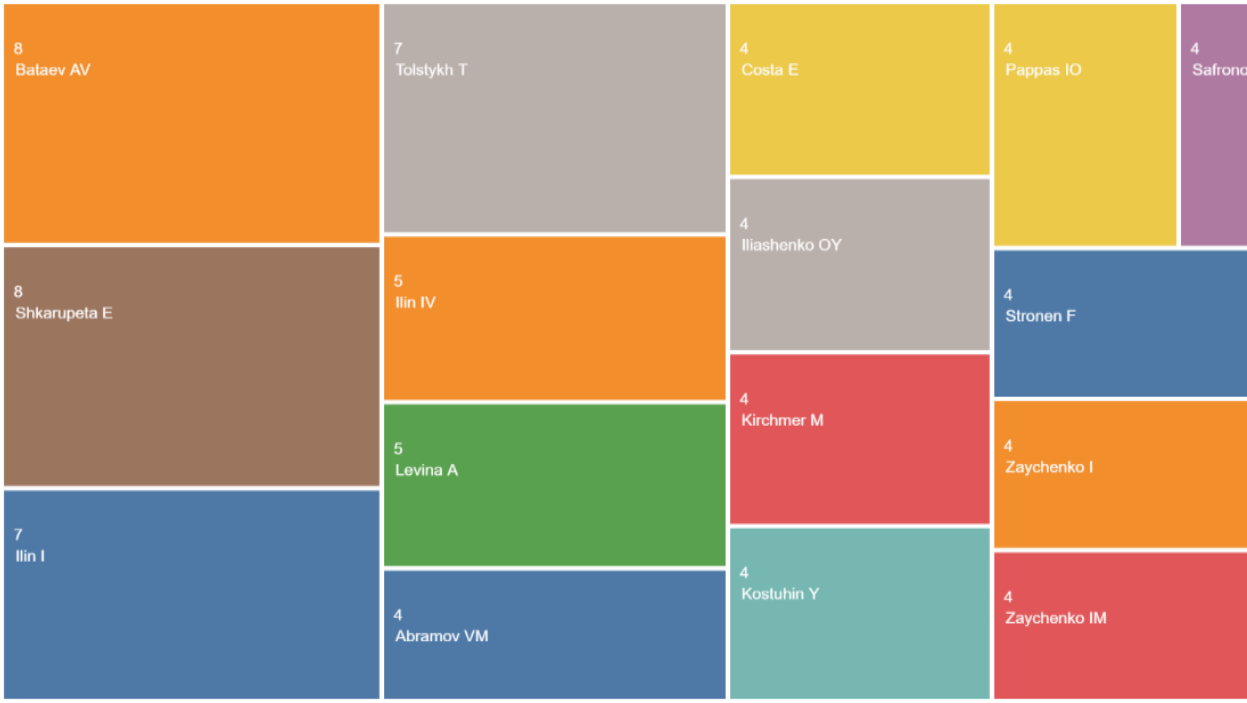
Figure 3 – Evolution of the Volume of Publications on Digital Transformation



Source: *Web of Science* (2023)

By analyzing the literature, it was possible to identify the authors with the highest number of publications on digital transformation in the field of applied social sciences. These authors are therefore the most influential in this area. Figure 4 shows the volume of publications by author on digital transformation. Due to word limitations and the size of this research, only the three authors with the highest number of publications will be addressed as follows.

Figure 4 – Map of Volume of Articles Published by Author on Digital Transformation



Source: *Web of Science* (2023)

The author with the highest number of publications is Alexander Bataev, who has a total of eight published works. He is a professor at St. Petersburg Polytechnic University and Peter the Great St. Petersburg Polytechnic University. Searches were conducted online to find information about the author, but no citation metrics for him were found on Google Scholar. The second author with the highest number of publications on digital transformation is Elena Shkarupeta, who is a professor at Voronezh State Technical University in the Department of Economics, Management, and Information Technology. It was also not possible to collect other profile data and citation metrics for this author. It is worth noting that both of the most influential authors are Russian, and possibly their data is not fully available on search engines and the internet in general. Finally, the third most influential researcher is Jesus Ramon-Llin, who has seven publications in this research sample. He is a professor at the University of Valencia (Spain) and works in the departments of creativity and sports. On Google Scholar, he has 808 citations and an H-index of 18.

In figure 5 the journals with the higher number of publications on digital transformation in the field of applied social sciences are presented by ranking and will be approached only the three journals with the highest number of publications.

Figure 5 – Amount of Publications on Digital Transformation by Journals

Source: *Web of Science* (2023)

The journal with the highest amount of published articles on digital transformation in the field of applied social sciences is the Technological Forecasting and Social Change with 75 publications of the total of the 727 articles of he sample, corresponding to 10.3%, such journal is an important forum for those who wish to deal directly with the methodology and practice of the technology prediction and studies of the future as tools of planning, since it inter-relate social, environmental and technological factors. The journal with the highest impact factor (12) and CiteScore of 17.2, being meticulous in the selection of published articles, which means, it concentrates rigorous researches in terms of methods and theoretical and management contributions

The second journal in the ranking in terms of the number of publications is the Journal of Business Research (JBR) from Elsevier. Of the 727 articles in the sample, 72 were published in this journal, accounting for 9.9% of the total. This journal also has a high impact factor in terms of article citation metrics (11.3) and a CiteScore of 16, meaning it rigorously selects the articles to be published. In terms of scope and objectives, the JBR aims to publish rigorous,

relevant, and potentially impact research. Recognizing the intricate relationships among various areas of business activity, the JBR examines a wide variety of contexts, processes, and business decision-making activities, developing insights that are significant for theory, practice, and/or society in general.

At last, the third journal in terms of volume of publications on digital transformation in the field of social sciences is the International Journal of Innovation Management, it presents 24 publications, corresponding to 3.3% of the total of the sample. Such journal is the offical journal of the International Society of Professional Innovation Management (ISPIM). Both the IJIM as well as the ISPIM adopt a multi-disciplinary approach to face the many challenges of innovation, instead of a strict focus in a single aspect, such as technology, research and development or development of new products. Both are also international, inclusive and practical and encourage the active interaction among academic, managers and consultants. Compared to the other two journals previously quoted, such journal has an impact factor considerably lower (2.1) and CiteScore of 3.2, which means, the criteria for the acceptance are less rigorous than of the JBR and the Technological Forecasting and Social Change.

It is worth highlighting that the remaining 76.5% of the studies of the sample of this research were written by several authors, but due to the amount of authors who have written at least one article on the theme, this shall not be discussed in this research.

3 Analysis and discussion of the results

The 727 studies which compose the sample of this research were imported to the software VOSviewer, which allowed the creation of the maps of co-citation and bibliographic pairing. In the map of co-citation, eight *Clusters were identified* meanwhile in the map of bibliographic pairing ten Clusters were mapped. As follows, we will approach the further details of the Clusters of co-citation and posteriorly, the Clusters of bibliographic pairing.

Analysis of Co-citation

The Role of the Dynamic Abilities on the Competitive Strategies of the Companies ad the Adoption of New Technologies (Red Cluster): Based on the manual of the software VOSviewer, the red *Cluster* is the most relevant in the map of co-citation, composed by 43 studies. The main theme approached by such studies is the role of the dynamic abilities and the dynamic resources on the competitive strategies and on the adoption of new technologies by the companies. The most influential study of such Cluster is the seminal of Teece et al. (1997),

widely used in researches on strategic management and competitiveness. In this study, the authors argue that the organizations may reach and maintain competitive advantage through the use of differentiated resources, such as equipment and technology. They highlight that the structure of the dynamic abilities examines the sources and the methods of creation and capture of wealth by companies that operate in environment with quick technological change. The competitive advantage is seen as based on distinct processes, influenced by the position of specific assets of the company (such as the portfolio of assets of knowledge hard to negotiate and complementary assets) and by the paths of evolution that the company either adopts or inherit. This study has a strength of link of 151, was quoted 14 times by other studies of the sample and has 85 links with other studies.

The second most influential study in this cluster is by Teece (2007), which complements his 1997 work. In this study, Teece draws on social and behavioral sciences to detail the nature and foundations of the capabilities necessary to sustain superior performance in an open economy characterized by rapid innovation and globally dispersed sources of invention, innovation, and manufacturing capability. Dynamic resources are presented as fundamental for companies to create, implement, and protect intangible assets that support long-term superior performance. This study has a link strength of 179, has been cited 16 times, and has 98 links to other studies.

The Importance of Digital Entrepreneurship and the Enterprising Abilities for Digital Transformation (Green Cluster): The second *Cluster* identified on the map of bibliographic pairing is the green Cluster, which includes 38 studies. The theme approached by such studies focus on the important of digital entrepreneurship and the enterprising abilities for digital transformation.

The main research when observing the relevance of this group was authored by Nambisan (2017), which has a link strength of 290, links to 131 studies, and has been cited 17 times by other publications. The author analyzed how new digital technologies transformed the nature of inherent uncertainty in business processes and outcomes, as well as the ways to cope with this uncertainty. This raised important questions at the intersection of digital technologies and entrepreneurship—about digital entrepreneurship. We consider two broad implications: less constrained business processes and outcomes, and a less predefined locus of entrepreneurial agency—and emphasized at the time that an explicit research agenda was needed to theorize concepts related to digital technologies.

The second most important publication of this *Cluster* was written by Li et al. (2017), its link strength is of 148, 12 citations by other researches and links with 99 articles of the

sample. The authors presented a model of process that aims at describing and explaining how entrepreneurs of small and middle-sized companies with the support of the service provider of the digital platform boost the digital transformation through the renovation of the management cognition, development of management social capital, formation of business teams and organizational capacitation. Such model expands our understanding of digital entrepreneurship and of digital transformation.

The Interdisciplinarity of the Digital Transformation and the Need of Adaptation of Traditional Business Models (Blue Cluster) The third cluster, in terms of importance on the co-citation map, consists of 37 studies. These studies generally investigated the interdisciplinarity of digital transformation and the need to adapt traditional business models in the implementation of digital processes within company operations.

The most relevant study in this group was conducted by Verhoef et al. (2021) (2018). This work has a connection index of 179, with 111 links to other studies, and was cited 15 times in research from our sample. The results of this study assert that changes in business models are necessary, as digital transformation requires specific organizational structures and has implications for the metrics used to calibrate performance. Finally, we provide a research agenda to stimulate and guide future research on digital transformation.

The second most relevant study in the blue cluster, conducted by Herrera (2019), has a link strength of 197, with 115 connections to other studies, and was cited 11 times in subsequent works. The aim of this article was to clarify the definition of digital transformation (DT) and to present a structured approach with phases, activities, and outcomes. Our research is based on a literature review that provides insights into the basic understanding of DT. Examples complement the research and demonstrate the practical application of DT. The main conclusions are that, although DT is a widely recognized concept, there is a lack of a structured approach to DT in business models.

Creation of Dynamic Abilities focused on Digital Transformation and the Need to Teach Fundamentals of Technology of Information in the Universities (Yellow Cluster) The yellow cluster, which ranks fourth in terms of importance on the co-citation map, consists of 26 articles. The predominant theme addressed by the studies in this cluster is related to the creation of dynamic capabilities focused on digital transformation and the need to teach foundational information technology concepts in universities.

The most significant study in this group was conducted by Fichman et al. (2014). This work has a link strength of 228, with 118 connections to other studies, and was cited 11 times in subsequent research. The authors emphasized the importance of business students having a

solid foundation in IT and digital innovation to manage, lead, and transform organizations that are increasingly dependent on digital innovation. However, they noted that, at the time, many educational institutions did not provide this foundation, since the essential information systems were outdated. As an answer, a vision to a main discipline was proposed in the higher education institutions that would integrate the digital innovation as a central concept in the curriculum.

The second most relevant study of the yellow group was performed by Warner & Wäger (2019). This study has a link strength of 226, with 128 connections with other studies and was quoted 16 times in the analyzed sample. The authors investigated how companies established in traditional sectors had developed dynamic abilities to the digital transformation. They have defined the digital transformation as the use of new digital technologies, artificial intelligence, cloud, blockchain and Internet of Things (IoT), to promote significant improvements in business, to increase the client's experience, to optimize operations or to create new business models. By studying the digital transformation, they have discovered that the leaders in several sectors use the term in an inconsistent form to describe several strategic and organizational activities; in addition, the concept has received limited academic attention as context to the study of the strategic change.

Prescription of Strategies for Digital Businesses through the Enhancement of Dynamic Capabilities of Organizations in Dynamic Markets (Purple Cluster): The purple Cluster is the fifth most relevant on the co-citation map, comprising 16 articles. The theme addressed by this Cluster is as follows: prescription of strategies for digital businesses through the enhancement of the dynamic capabilities of organizations in dynamic markets.

The most significant study in this Cluster was conducted by Bharadwaj et al. (2013). With a link strength of 320, it has been cited by 30 other studies and has connections with 133 research papers in the sample. The authors highlight that digital technologies—which combine information, computing, communication, and connectivity technologies—are profoundly transforming business strategies, operational processes, organizational capabilities, products and services, as well as key interactions within extended business networks. They argue that it is the right time to reassess the role of IT strategy, shifting it from a functional approach that is aligned but subordinate to business strategy, to a closer integration between IT strategy and business strategy. This integration is referred to as digital business strategy.

The second most relevant study in this Cluster was conducted by Eisenhardt and Martin (2000). With a link strength of 109, it has been cited by 11 studies and has connections with 58 research papers in the sample.

The authors state that, in markets with moderate dynamic, the dynamic abilities resemble the traditional routines, being detailed, analytical and stable process with predictable results. On the other hand, in high speed markets, such abilities are characterized by simple, highly experimental and fragile processes, with unpredictable results. At last, well-established learning mechanisms guide the evolution of the dynamic abilities, with an evolutive emphasis on the variation in moderate dynamic markets.

The Challenges and Opportunities to Directors and CEOs to Implement Processes of Digital Transformation (Light Blue Cluster): The light blue Cluster is the sixth most relevant on the map of bibliographic pairing, composed by 12 studies. The theme of such Cluster approaches the analysis of the challenges and the opportunities faced by directors and CEOs in the implementation of processes of digital transformation. The most significant study of such group was performed by Hess et al. (2016). It presents a link strength of 346, was referred by other studies in 26 occasions and it is connected to 142 studies of the sample. The authors state that the CEOs and other senior executives face the challenge to deal with the opportunities and risks of the digital transformation. To help the managers face such challenge in a more systematic form, we described how three companies from the German media have approached successfully the digital transformation. Based on their experiences, we provided a list of 11 strategic questions and possible answers that the managers may use as guidelines to formulate a strategy of digital transformation.

The second main article of such *Cluster* was written by Fitzgerald *et al*. (2020), it has a strength link of 199, was quoted 14 times by other studies and has connections with 110 studies of the sample. The authors performed a research with 1,559 executives and managers of companies from the most varied segments of the market, the results stated that the managers in general agreed that the digital technologies have changed the traditional business models, but that it hard to be able to achieve operational results with the implementation of the new technologies.

Structures of Governance and Organizational Strategies and the Effects on the Digital Transformation of the Companies (Orange Cluster): The seventh Cluster of the co-citation map, represented by the orange color, includes 11 studies and focuses on the analysis of the governance structures and organizational strategies, as well as their impacts on the digital transformation of the companies. The most relevant study of such Cluster was led by Matt et al. (2015), which represents a link strength of 366, was quoted 36 times and has connections with 137 studies of the sample. The authors argued that, although the digital generally approach the opportunities and the future directions of the business to companies based on digital

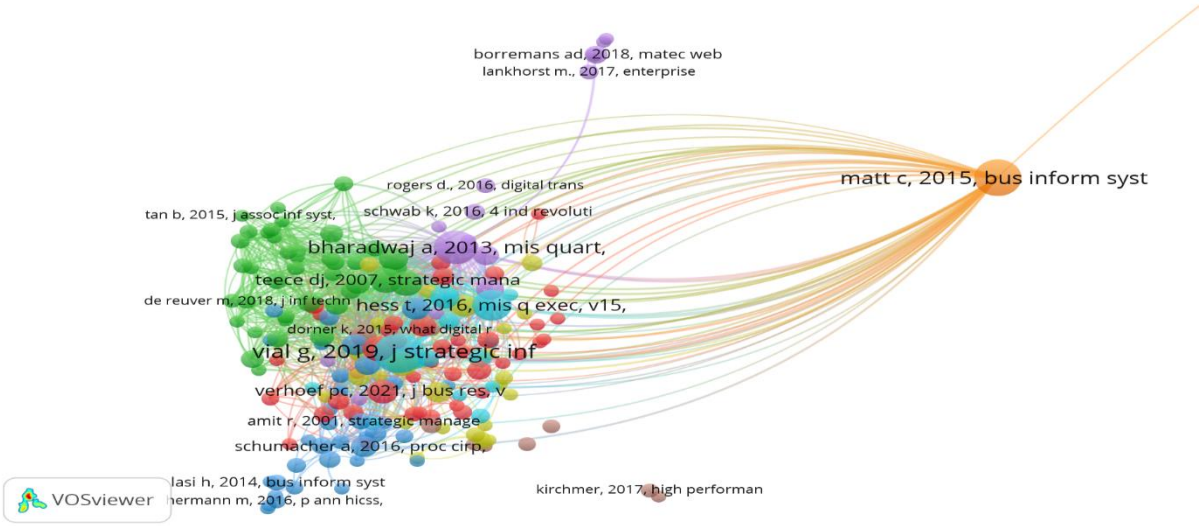
technologies, they frequently do not provide transformation insights on how to achieve such goals. On the other hand, a strategy of digital transformation is projected to help companies to manage the changes due to the integration of digital technologies and to adapt their operations after the transformation.

The second most significant study of such Cluster, performed by Davison & Ou (2016), has a link strength of 28, with 8 connections with other studies and was quoted 4 times by other studies of the sample. Such study highlights that collaborations with digital knowledge are used to the free access to technologies of the digital media. However, some organizations implement information technology governance structures that explicitly forbid the access to such technologies, creating a significant tension between the employees and the organization itself. The authors investigate such tensions in an exploratory analysis of the operations in a global net of hotels in China.

The Disruptive Technologies of Digital Transformation and the New Perspectives of Creation of Value to the Clients (Brown Cluster): The last Cluster analyzed in the co-citation was the brown one, composed by 8 studies. The central focus of such Cluster is the analysis of the disruptive technologies related to the digital transformation and to the new perspectives to the creation of value to the clients.

The most relevant study within such Cluster is the one by Vial (2019), which has a link strength of 487, was quoted 41 times and has connections with 159 studies of the sample. This study highlights the digital transformation as a process in which the digital technologies provoke disruptions, leading the organizations to adopt strategic answers to modify their forms of creation of value, at the same time when face structural changes and organizational barriers that influence both positive and negatively. Based on such structure, we elaborated a research agenda that suggests the exploration of the role of the dynamic abilities and the consideration of ethical issues as important areas for future strategic investigations in system of information on digital transformation.

Figure 6 – Co-citation Map of Digital Transformation



Source: VOSviewer (2023)

Analysis of Bibliographic Pairing

The analysis of bibliographic pairing enabled to present the frontier studies, which means, what the trends are of current researches and path for future researches on digital transformation. The map of bibliographic pairing resulted in the identification of eight *Clusters* that will be discussed deeply in this research.

The Role of Management of Innovations in Companies on the Processes of Digital Transformation (Red *Cluster*): According to the manual of the *software VOSviewer*, the main cluster of the map of bibliographic pairing is the red *cluster*, which is composed by 11 studies. The predominant analyzed theme by such studies refers to the analysis of the role of management of innovations in companies in processes of digital transformation.

The central study of such group, performed by Appio et al. (2021), has a link strength of 125 and received 125 citations of other studies, the authors presented an approach to open the black box of the interaction between digital transformation and management of innovation, providing a structure that identifies three levels of analysis (macro, meso and micro) throughout the existing researches and future researches may be organized. The second most significant

study was led by Vaio et al. em 2021. It was quoted 33 times and presents a link strength of 110. In such study the authors investigate the literary body on digital innovation in systems of knowledge management (SKM) to understand its role on business governance.

Challenges and Opportunities of Digital Transformation to the Companies:(Green *Cluster*): The most relevant study of such *cluster* was led by Favoretto et al. (2022). They highlight that the challenges associated to the digital transformation (DT) started to draw attention of the academics and professionals, once that a growing number of manufacture companies is eager to adopt digital technologies. The purpose of this study was to identify the obstacles of the DT in manufacture companies and to suggest new directions for future researches. With a link strength of 95, this study was quoted 24 times in other studies of the sample.

The second study with the greatest highlight from such group was performed by Durao et al. (2019). This study was a link strength of 25 and was referred 7 times by other studies in our sample. Th research analyzed specific aspects of the digital transformation (DT) and revealed that the technology is only a part of a complex puzzle that the organizations need to solve in order to maintain competitive in the digital scenario. It is crucial to evaluate whether the organizations in Portugal are already experiencing the DT or if they are aware of the need to adapt themselves to such new reality.

The Importance of Management of Processes and the Modeling of Processes (BPMN) on the Digital Transformation of Companies (Blue *Cluster*): The third *Cluster* of the map of bibliographic pairing, identified by the color blue, is composed by 10 researches. The main theme of this *Cluster* highlights the relevance of the management of processes and modeling of processes (BPMN) on the digital transformation of the organizations.

The most relevant study of such *Cluster* was led by Van Looy (2018). Such study presents a link strength of 49 and it is connected to other 22 studies, in addition to being quoted 7 times by researches from our sample. Van Looy states that, despite that previous investigations have highlighted a positive correlation between the *Business Process Management* (BPM) and the digital innovation (DI), the article proposed to broaden the role of the BPM regarding the DI and to examine the impacts on the processes of digital transformation in the companies.

The second most significant study of the blue *Cluster* was performed by Gollhardt et al. (2020). With a strength link of 33 and connection to 10 other studies, this study was quoted 24 times by other researches. Based on the literature on models of maturity in digital transformation and in eight interviews with specialists, the study develops and evaluates

interactively an individualized model of maturity for IT companies. The study summarizes five main dimensions: culture, ecosystem, operations, governance and strategy.

Technological Impact and Organizational Change and the Effects of the Digital Transformation in Companies (Yellow *Cluster*). The yellow *Cluster* was the forth group identified in the map of bibliographic pairing and it is composed by 09 articles. The approached theme by such studies focused on the analysis of the technological impact and the organizational changes, as well as their effects on the digital transformation in the companies.

The most relevant study from such *Cluster* was performed by Hanelt et al. (2021). This study has a link strength of 169, with 46 connection with other studies and it was quoted 304 times. The authors presented a multi-dimensional structure that summarizes the current knowledge on digital transformation (DT). We identified two main thematic patters: the DT is leading companies to adopt flexible organizational projects that favors the continuous adaptation and such process is boosted by ecosystems of digital businesses. Based on such patters, four perspectives on DT were developed: technological impact, shared adaptation, systemic change and holistic co-evolution.

The second most significant study of the yellow *Cluster* was led by Pousttchi et al. (2019). This study presents a link strength of 51, with 23 connections with other studies and it was quoted 19 times. The research proposes a generic model that explores the relation of cause and effect between the application of digital technologies and their impacts on companies, analyzing three distinct dimensions. Based on the 75 case studies, the main results are: (1) a systematic categorization of the digital technologies, (2) a detailed group of 10 types of impact of digital transformation, including subcategories, and (3) an integrated model of technologies, causes and types of impacts on the three dimensions of digital transformation.

Digital Strategies and New Business Models to Increase the Perception of Value by Clients (Purple *Cluster*): The purple *Cluster* is the fifth most important *Cluster* on the map of bibliographic pairing, composed by 09 studies, the theme of such *Cluster* refers to the analysis of digital strategies and new business models to increase the perception of value by the clients.

The first most important study from such *Cluster* was developed by Volberda *et al.* (2021), it has a link strength of 150, it was quoted 46 times by other studies and has links with 59 studies from the sample. The authors presented a structure of strategies in such new scenario of digital competition that highlights the importance of the interaction between (1) the cognitive barriers faced by the managers by trying to understand this new digital world and glimpse new digital business models, (2) the need to reconfigure and to broaden the digital routines and (3) new well-equipped organizational to create value and to obtain competitive advantage.

The second most important study of the yellow *Cluster* was developed by Zaki (2019), it has a link strength of 8, 6 links with other studies and it was quoted 78 times by other studies of the sample. This research discussed the digital transformation and its four paths – digital technology, digital strategy, experience of the client and business models guided by data – which may mold the new generation of services. This includes a discussion whether the market and the organizations are ready to the digital change and what the opportunities that will allow companies to create and to capture value through new business models are.

Digital Eco-systems, Big Data and the Technological Disruptions and the Effects of the Strategies of the Transformation of Companies (Light Blue *Cluster*): The Light Blue *Cluster* is the sixth most influential *Cluster* identified on the map of bibliographic pairing, formed by 07 studies, the theme of such *Cluster* refers to the analysis of digital eco-systems, big data and the technological disruption and the effects of the strategies of transformation of companies.

The most influential study of such *Cluster* was developed by Vial (2019), it has a link strength of 201, it was quoted 1,134 times by other studies from the sample and it has 43 links with other studies, the author developed in the research an articulated structure of digital transformation in eight construction blocks. It predicts the digital transformation as a process where technologies create disruptions unleashing strategic answers of the organizations that aim at altering their paths of creation of value at the same time that manage structural changes and organizational barriers that affect the positive and the negative results in such process.

The second most influential study from such *Cluster* was developed by Pappas *et al.* (2018), it has a link strength of 17, it was quoted 163 times by other studies and it has links with 14 studies of the sample. The study had as prpose to discuss the digital transformation and its four paths – digital technologies, digital strategy, experience of the client and business models guided by data – that may mold the new generation of services. This includes a discussion whether the market and the organizations are ready to the digital change and what the opportunities that will allow companies to create and to capture value through new business models are.

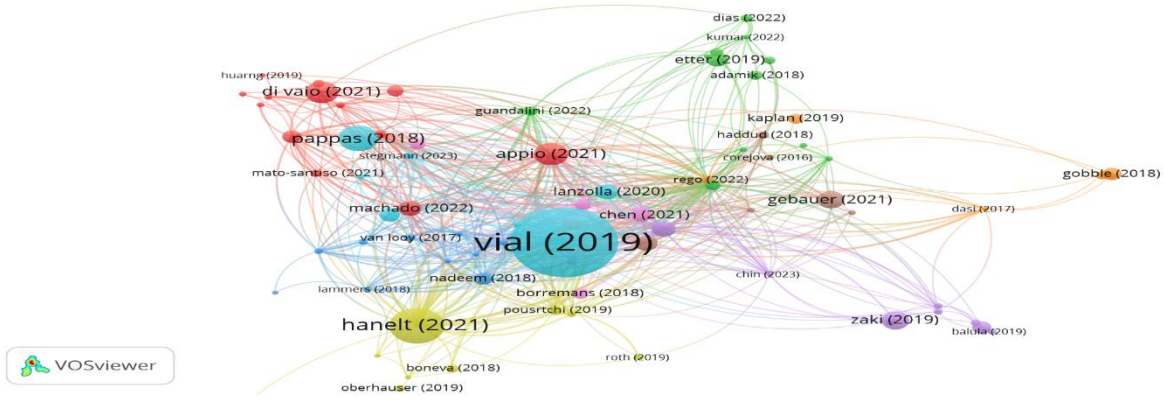
The Role of the Digital Strategy, Blockchain and Artificial Intelligence (AI) on the Digital Transformation (Orange *Cluster*): The seventh *Cluster* in terms of importance on the map of bibliographic pairing is the orange, which includes only 6 studies. The main theme approached in such *Cluster* is the analysis of the role of the digital strategy, blockchain and artificial intelligence (AI) on the digital transformation.

The highlighted study within such *Cluster* was led by Rêgo et al. (2022). Such study has a link strength of 89, it was quoted 14 times by other studies from the ample and it establishes 37 connections with other studies. The main purpose of the research was to understand how the digital transformation is influencing the business strategies. The results indicate that the literature on the relation between the digital transformation and the strategic management is still incipient. The existing studies were organized in six main areas of the research: (i) analysis of the external environment, (ii) analysis of the internal environment, (iii) formulation of strategy, and (iv) implementation of strategy., (v) evaluation and control, and (vi) feedback and learning**.**

Digital Servitization and Changes Caused by the Digital Transformation in the Ar-ea of Services (Brown Cluster): The last Cluster in terms of importance is the brown one, composed only by 6 studies, the main investigated theme refers to the analysis of the role of the digital strategy, blockchain and artificial intelligence (ai) on the digital transformation.

The main study from such Cluster was elaborated by Gebauer et al. 2021, it has a link strength of 89, it was quoted 14 times by other studies from the sample and it has 37 links with other studies. The study introduces key aspects of the emergent discussion on digital servitization and, as follows, describes through illustrative cases, the growing paths used by companies of industrial products when they seize the process of digital servitization.

Figure 7– Map of Bibliographic Pairing of Digital Transformation



Source: VOSviewer (2023)

4 Perspectives of future avenues

As follows, inspired by Ribeiro *et al.* (2023), we present in table 1 a non-exhausting list of future research paths using methods and exploring topics and seldom explored themes. The table is divided into three columns, in which the first broadly presents the issue, the second brings research issues related to the problem and, at last, the third brings a brief explanation on the opportunities that can be seized by researchers that wish to address the presented research issues.

Table 1

Research issues and paths for future researches

Problem	Research issue (RI)	Research opportunity
The need to evaluate the impact of the digital transformation on different types of researches.	RI1: How can the digital transformation impact on different scientific researches? RI2: What are the digital tools that can be used in researches? RI3: How (and which) interventions may be evaluated regarding the impact of the digital transformation?	Each day more themes such as "digital transformation", "artificial intelligence" "*machine learning*", and other emergent themes are quoted as the future of mankind. However, it is still not known exactly the impacts that such modernity has brought to researches and which current tools may collaborate to the development of qualitative, quantitative and mixed researches.
The need to understand the positive (and negative) impacts of the interactions from the stakeholders on the digital transformation.	RI4: How does the digital transformation influences the processes of co-creation and co-destruction of value? In what contexts is there more effect? RI5: What tools and applications intensify and broadens the interaction between organizational *stakeholder*s? RI6: What are the negative effects of the digital transformation of companies by participating in social media and other digital platforms (ex. Airbnb, TripAdvisor).	The interactions among the several organizational *stakeholder*s may generate positive results (co-creation of value) or negative results (co-destruction of value). To study how much the digital transformation (positively or negatively) moderates the relation between the interaction of the *stakeholder*s and the organizational effects (for example, the (dis) satisfaction, positive or negative word-to-mouth recommendation, seems as a promising research agenda.
The need to understand the positive (and negative) impacts of the digital transformation on the different business models.	RI7: How is the digital transformation affecting the processes of creation, distribution and capture of value in different businesses?	The digital transformation has been affecting different business models. New businesses have appeared with the advent of the digital transformation (ex.: Airbnb, Waze and Netflix) and others on the other hand, have been extinct (ex.: Blockbuster). To understand how the digital transformation has been affecting the business models seems as a fruitful research agenda.

Problem	Research issue (RI)	Research opportunity
	RI8: Which contexts are most affected by the digital transformation? RI9: How does the economy of knowledge and sharing of experience relate itself with the digital transformation?	
The need to understand which departments will be most affected by the digital transformation in the organizations and, consequently, which professional profiles will be necessary in the future to the organizations.	RI10: Which specific and general abilities will the organizational levels need to have to be fit in the digital context? (Directors, Managers and Operational). RI11: Which organizational departments will most feel the effects of the digital transformation in the companies? Will an integration be necessary between the departments?	The digital transformation is seen as an inter-disciplinary reality. Regardless of the segment, sooner or later, all companies will need to adequate themselves at some level of digital transformation. In such sense, it becomes important to understand which departments will be most impacted by the digital transformation, and which skills will be expected from the collaborators.
The need to understand the impact of the digital transformation on the shared economy.	RI12: What are the new business segments that are being created from the digital transformation in the era of shared economy? RI 13: How do such business segments co-exist with their previous versions? Will the previous versions be destroyed? Will both live in group? RI 14: How can the creative destruction of Joseph Schumpeter (1942) be understood under the light of the current examples of business based on digital transformation in the era of sharing.	Each day more the digital transformation has enabled the existence of new business models in different segments. For example, the Airbnb in hospitality and the Waze in transportation. It has become important to understand and to anticipate which business fronts may be developed with the advent of the digital transformation.

Source: the authors (2023)

5 Final Considerations

The conducted research revealed the intellectual structure of the literature on digital transformation in the field of applied social sciences through the construction of a co-citation map. The application of the techniques of bibliometric review enabled the creation of such map and the identification of eight distinct *Clusters*. The most significant *Cluster* (red) focused on the role of the dynamic abilities in the competitive strategies of the companies and the adoption of new technologies, highlighting how the organizations may achieve and maintain a competitive advantage through differentiated resources, such as machines and technology. The main study of such *Cluster* reinforced the importance of the structure of dynamic abilities in the analysis of sources and methods of creation and capture of wealth in environments of quick technological change.

The remaining *Clusters* of the co-citation map approached varied themes: the importance of digital entrepreneurship and the enterprising abilities to the digital transformation; the inter-disciplinary of the digital transformation and the need of adaptation of traditional business models; the creation of dynamic abilities focused on the digital transformation and the need to teach information technology fundamentals in the universities; the prescription of strategies for digital business through the potentiation of dynamic abilities of the organizations in dynamic markets; the challenges and opportunities for managers and CEOs in the implementation of processes of digital transformation; structures of governance and organizational strategies and their effects on the digital transformation; the disruptive technologies on the digital transformation and new perspectives to create value to the clients.

The map of bibliographic pairing also identified eight *Clusters* on digital transformation in the field of applied social sciences. The most relevant *Cluster* analyzed the role of innovation in the processes of digital transformation and the interaction between both, offering a structure that identified three levels of analysis (macro, meso and micro) to the organization of the existing researches and futures on the theme. Studies from such *Cluster* indicated that the digital innovation in the companies may be impacted by systems of knowledge management (SMN), which positively affects the processes of digital transformation.

The main purpose of the research was reached by providing an overview on the appearance, evolution and emergent studies on digital transformation in the field of applied social sciences. In addition, the bibliographic pairing helped identifying the frontiers of the areas of study on the theme, as well as the trends and insights for future researches. The main contribution of such study is exploratory and goes beyond the mapping of the theoretical and

conceptual evolution, offering a vision of the theoretical influences, existing currents and current fronts of research on digital transformation. The research serves as an initial effort to increase the understanding of the formation and evolution of the scientific field and defines a starting point for future descriptive and casual studies, specially within the identified *Clusters* on the map of bibliographic pairing.

However, the research presents some limitations. The first is the exclusive choice of data from the Web of Science (WoS), which, despite its high overlapping with the data base Scopus, it is suggested that future studies consider both basis to a more depth analysis. Another limitation is the used method, once, despite that the bibliographic review helps identifying the theoretical evolution of the digital transformation, it does not allow a deeper evaluation of the divergences among the studies from each *Cluster*, which could offer new insights. Therefore, it is recommendable that future studies perform systematic reviews of the literature, specially about the mapped themes on the bibliographic pairing, given that the identified *Clusters* approach research trends and the frontiers of knowledge on digital transformation in the applied social sciences.

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