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Absorptive capacity: Overview of the evolutionary path of research networks (1976-2020)

Absorptive capacity: Um panorama da trajetória evolutiva de redes de pesquisas (1976-2020)

Capacidad absorptiva: Panorama del camino evolutivo de las redes de investigación (1976-2020)

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ABSTRACT

This study analyzes the evolution of scientific publications on absorptive capacity (Absorptive Capacity - ACAP) between 1976-2020 to construct a research panorama. It is a bibliometric study of cocitation analysis using cluster analysis, which was performed using the VOSviewer software. The results show the application of the absorptive capacity to explain organizational phenomena and reviewed the literature to identify its dimensions of achievement: acquisition, assimilation, transformation, and application. There are links between absorptive capacity and innovation, such as investing in Research and Development (R&D) projects as a relevant practice for promoting ACAP, stimulating the acquisition, assimilation, transformation, and exploitation of external knowledge in organizations.

Keywords: absorptive capacity; bibliometric study; scientific publications; research networks; VOSviewer.

RESUMO

Este estudo analisa a evolução das publicações científicas sobre capacidade absorptiva (Absorptive Capacity – ACAP) entre 1976-2020 para a construção de um panorama de pesquisas. Trata-se de um estudo bibliométrico de análise de cocitação utilizando análise de clusters, a qual foi realizada por meio do software VOSviewer. Os resultados mostram a aplicação da capacidade absorptiva para explicar fenômenos organizacionais e revisaram a literatura para identificar suas dimensões de realização: aquisição, assimilação, transformação e aplicação. Observam-se vínculos entre capacidade absorptiva e inovação, a exemplo do investimento em projetos de Pesquisa e Desenvolvimento (P&D) como uma prática relevante para o fomento da ACAP, estimulando a aquisição, assimilação, transformação e exploração de conhecimentos externos nas organizações.

Palavras-chave: capacidade absorptiva; estudo bibliométrico; publicações científicas; redes de pesquisas; VOSviewer.

RESUMEN

Este estudio analiza la evolución de las publicaciones científicas sobre Capacidad Absorptiva (Absorptive Capacity – ACAP) entre 1976-2020 para la construcción de un panorama de investigación. Se trata de un estudio bibliométrico de análisis de cocitación mediante análisis de conglomerados, que se realizó mediante el software VOSviewer. Los resultados muestran la aplicación de la capacidad absorptiva para explicar los fenómenos organizacionales y revisaron la literatura para identificar sus dimensiones de logro: adquisición, asimilación, transformación y aplicación. Existen vínculos entre la capacidad de absorción y la innovación, como la inversión en proyectos de Investigación y Desarrollo (I + D) como práctica relevante para la promoción del ACAP, estimulando la adquisición, asimilación, transformación y explotación del conocimiento externo en las organizaciones.

Palabras clave: capacidad de absorción; estudio bibliométrico; publicaciones científicas; redes de investigación; VOSviewer.

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1 INTRODUCTION

The search of organizations for external knowledge and the subsequent incorporation of this knowledge in their internal environment determine factors to achieve and sustain a competitive advantage. The absorptive capacity is seen as a vital instrument in this process (Cohen & Levinthal, 1990; Van Den Bosch et al., 1999; Zahra & George, 2002; Lane et al., 2006). A company can recognize the value of new external information, assimilate it and apply it for commercial purposes (Cohen & Levinthal, 1990).

The genesis of absorptive capacity emerged as discussions on the subject gained relevance in the 1990s, with the studies of Cohen and Levinthal (1990). Since then, they have undergone consolidation and propagation in various areas of knowledge (Lane et al., 2006). Zahra and George (2002) and Todorova and Durisin (2007) put focus on the attempt to reconceptualize the absorptive capacity; and Jansen et al. (2005) discuss how this theme is related to organizational antecedents, which it presents itself in potential and realized forms.

The definition with three components (recognition, assimilation and exploitation) in their 1990 paper was expanded by Zahra and George (2002) into four dimensions (acquisition, assimilation, transformation and exploitation). In this sense, the absorptive capacity depends on processes and routines within the organization, which allow sharing, communicating and transferring knowledge (Lane et al., 2006). The company needs to reconfigure and realign its knowledge management capabilities to adapt to changing environmental conditions better and earlier than its competitors (Lane et al., 2006; Lichtenthaler & Lichtenthaler, 2009).

In order to understand and trace the applications of absorptive capacity, some theoretical review studies or bibliographic analyzes have been carried out (Apriliyanti & Alon, 2017; Ciotti & Favretto, 2017; Santos & Finger, 2015; Marlana & Morozini, 2017; Moré et al. al., 2014). However, there are gaps to be filled to understand directions in this field: the antecedents of absorptive capacity, referring to the relationships between individuals and organizations; the interaction between interested parties, including external ones; and the role of innovation practices involved in the performance of absorptive capacity.

From this new perspective, this study intensifies the understanding of the characteristics of scientific production that has been built on the theme. It is also envisaged with this research to capture the richness of the construct and advance its understanding in integration between the sample discussions, extracted from the Web of Science (WoS) database from 1976 to 2020. In this way, a bibliometric study was adopted with the pertinent analyzes supported by maps constructed using the VOSviewer software.

With this in mind, this research aims to analyze the evolution of scientific publications on absorptive capacity between 1976-2020. A comprehensive overview of thematic

evolution in the holistic period is presented, including a perspective of scientific publications, the study of social networks of co-authorship, co-citation, main journals, institutions and countries that contribute most to the field. It also identifies gaps in the main theoretical frameworks of the field in the last five years and offer avenues of investigation to be explored as the main contributions of this paper.

2 THEORETICAL FRAMEWORK

2.1 Absorptive Capacity

Studies on absorptive capacity (ACAP) were relevant based on the definition proposed in the seminal paper of Cohen and Levinthal (1990). From a conceptual point of view, Cohen and Levinthal (1990) were the forerunners to analyze the absorptive capacity of organizations, defined as the company's ability or capacity to identify, assimilate and explore the knowledge of the environment and, based on this capacity, recognize the value of information to use for commercial purposes.

Tsai (2001) stated that absorptive capacity is used as a lens to explore the knowledge transfer process. Subsequently, a reconceptualization of absorptive capacity emerged in the literature presented by Zahra and George (2002) as a set of organizational routines and processes by which companies acquire, assimilate, transform and exploit knowledge to produce a dynamic organizational capacity. Zahra and George (2002) argued that absorptive capacity provides companies with strategic flexibility and a degree of freedom to adapt and evolve in high-speed, volatile environments.

Zahra and George (2002) take a more procedural perspective on absorptive capacity and argue that effective internal knowledge sharing and employee integration are a critical part of this capacity. Lane et al. (2006) corroborate by highlighting that absorptive capacity depends on processes and routines within the organization that allow it to share, communicate and transfer learning from the individual to the organizational level. In this sense, Todorova and Durisin (2007) propose a new concept to the term absorptive capacity by calling the first capacity, or dimension of the absorption process, as the capacity to "recognize the value" of new external knowledge.

In agreement with previous studies, Pinto (2015) emphasizes that absorptive capacity is a multidimensional construct formed by a set of organizational routines and processes through which firms generate dynamic organizational capacity. Silva et al. (2016) reflect that absorptive capacity is based on individual agents who engage in problem-solving and learning activities aggregated at the levels of groups and organizations.

In the organizational sphere, to explore the absorptive capacity, the company depends on its internal experience, specialized knowledge and appropriate processes, which allow the identification and use of the meaning of external ideas and opportunities for innovation (Cervo et al., 2016). In Table 1, it is possible to present an evolution of the core concepts of absorptive capacity.

Table 1

Evolution of the absorptive capacity concept

Author/year	Concept
Cohen & Levinthal (1990)	Consists on the organization's ability to assess the value of new external knowledge, assimilate and apply it for commercial purposes from 3 dimensions: 1) Recognition of the value of information; 2) The assimilation of knowledge by the company, and 3) Application of knowledge to generate innovations.
Lane & Lubatkin (1998)	Ability of one organization to learn from another. ACAP is determined by the relative characteristics of the two organizations.
Zahra & George (2002)	Organizational routines and processes by which firms acquire, assimilate, transform and exploit knowledge to produce a dynamic organizational capability.
Todorova & Durisin (2007)	Ability to recognize the value of new external knowledge, acquire it, transform it and apply it.
Flatten et al. (2011)	Source of competitive advantage through the organization's ability to acquire, assimilate, transform and apply external knowledge.
Méndez et al. (2016)	Opening up the search for external knowledge that contributes to exploratory and transformative learning processes.
Apriliyanti & Alon (2017)	Absorptive capacity reveals research flows in intra and inter-organizational learning.
Ávila (2021)	A collection of organizational routines and strategic processes through which companies acquire, assimilate, transform and exploit knowledge to create value, innovation and, ultimately, a competitive advantage.

Source: Elaborated by the authors.

Concerning the four dimensions of absorptive capacity, from the perspective of Zahra and George (2002) – Acquisition, Assimilation, Transformation and Exploration, it is possible to extract, in summary, the main contribution of each one of them. Acquisition refers to a company's ability to identify and acquire external knowledge crucial to its operations. Assimilation refers to the company's routines and processes that allow the analysis, processing, interpretation and understanding of information obtained from external sources. Transformation denotes a company's ability to develop and refine the routines that facilitate the combination of existing knowledge with newly acquired and assimilated knowledge. And, exploration is defined as an organizational capacity based on routines that allow companies to refine, extend and leverage existing skills or

create new ones, incorporating knowledge acquired and transformed into their operations (Zahra & George, 2002).

2.2 Dimensions of Absorptive Capacity

The four dimensions of absorptive capacity comprise two groups – Potential absorptive capacity (PACAP) and Realized absorptive capacity (RACAP). The potential absorptive capacity - PACAP captures Cohen and Levinthal's (1990) description of a company's ability to value and acquire external knowledge, but it does not guarantee the exploitation of this knowledge. The realized absorptive capacity - RACAP is a function of the transformation and exploration (application) capacities discussed above. That is, RACAP reflects the company's ab that has been absorbed (Zahra & George, 2002). Table 2 presents the ACAP model proposed by Zahra and George (2002).

Table 2

Absorptive Capacity Dimensions

Dimension	Definition
Absorption Capacity (PACAP) – Acquisition	It is the company's ability to locate, identify, value and acquire external knowledge.
Absorptive Capacity (PACAP) - Assimilation	They are processes and routines that allow new information or acquired knowledge to be analyzed, processed, interpreted, understood, internalized and classified.
Absorptive Capacity (RACAP) - Transformation	It refers to the refinement of externally acquired knowledge to adapt it to internal routines, in order to facilitate the transfer and combination of prior knowledge with new acquired and assimilated knowledge.
Absorptive Capacity (RACAP) – Application	Routines and processes that create new operations, knowledge, skills, goods and products.

Source: Elaborated by the authors.

Following the chronology of studies on the dimensions of absorptive capacity, Jansen et al. (2005) and Lane et al. (2006) describe three learning processes related to absorptive capacity: (a) exploratory learning that comprises the stages of recognition and assimilation of this external knowledge; (b) transformative learning that comprises the stages of maintenance of assimilated knowledge and reactivation of this knowledge; and (c) exploration that comprises the stages of transmutation and application of the assimilated knowledge.

Cassol (2014), based on studies by Zahra and George (2002) and other authors, divides the different levels

of absorptive capacity interaction into: (1) individual, in which the focus is on the employee; (2) group, in teams, business divisions and branches; (3) organizational; and (4) inter-organizational, when it involves different levels of interactions, such as strategic alliances, industrial clusters, joint ventures and national innovation systems.

Under the aegis of Zahra and George (2002) and Jimenez-Barrionuevo et al. (2011), it is argued that the dimensions differ between one organization and another, and also help to explain the distinctions in organizational performance between similar companies present in the same market environment. From these authors, Zahra and

George (2002) present the action triggers element (Figure 1), or activation triggers, which are the events that awaken the company to respond to specific internal or external stimuli. Some examples of these stimuli are company crises, poor production performance, technological changes, among others. In addition to activation triggers, the notion of

social integration mechanisms was developed, which have the function of reducing the gap between the potential absorptive capacity and the realized absorptive capacity, increasing, as a consequence, the action of the process as they facilitate the exchange of information (Santos & Finger, 2015).

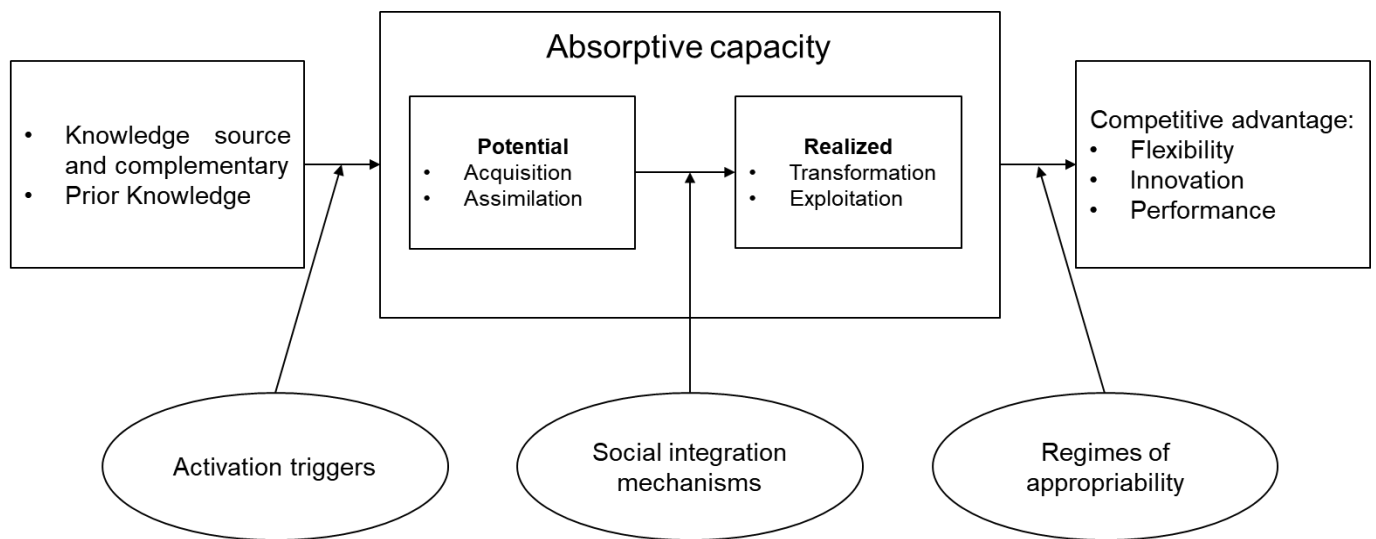


Figure 1. A model of absorptive capacity.
Source: Zahra and George (2002).

In this sense, Leal Rodríguez et al. (2014) highlight that absorption capacity depends on the source of knowledge and prior knowledge, and is conditioned to appropriation regimes, generating competitive advantage, flexibility to deal with changes, in addition to influencing the company's innovative performance. Camisón and Fóres (2010) add that absorptive capacity has become one of the most important constructions in the last twenty years, precisely because external knowledge resources are extremely important. According to the authors, this approach considers absorptive capacity as a by-product of R&D activities and the breadth of the company's knowledge base, as well as its previous learning experience and the organization's members' ability to solve problems.

The authors Méndez et al. (2016) assert that organizations can develop different strategies to facilitate the acquisition of external knowledge needed for their learning processes. And how these different relationships and strategies occur, can affect the different stages of absorption of external knowledge (Volberda et al., 2010). Apriliyanti and Alon (2017) consider that the absorptive capacity is based on the argument that organizations establish relationship learning with other organizations to acquire more control and reduce external restrictions. It is understood that positive alliances can be seen as a means of organizational learning since the motivation of alliances is driven by the companies' willingness to obtain knowledge from each other.

Furthermore, Zhang et al. (2019) postulate that integrating transformative and exploitative capabilities with internal process innovation practices not only contributes to organizational change but also sheds light on why an integrative approach should be taken to explain

organizational outcomes. Based on this and other approaches encapsulated by the various authors mentioned, it is imperative to understand the absorptive capacity as a set of skills needed to deal with the tacit component, with the knowledge arising from the transferred environment and the need to modify this imported knowledge.

3 METHOD

The methodology of this study is bibliometrics, in which two approaches stand out, one normative and the other descriptive. The normative perspective establishes norms, rules and heuristics for the progress of a scientific field. At the same time, the descriptive approach observes and reports the fundamental activities of researchers in a given field (Serenko et al., 2010). Bibliometrics consists of the statistical analysis of scholarly communication through publications (Solla Price, 1965; Ruas & Pereira, 2014; Merig et al., 2016). Bibliometric analysis refers to combining different structures, tools and methods for examining the literature (Ponce & Lozano, 2014). It provides relevant analyzes to analyze scientific production in a given field of knowledge through keywords, researchers' networks, identification of institutions and countries where researchers maintain affiliation, among other information.

3.1 Data Collection and Analysis

The software used, VOSviewer, supports the generation of a map with terms of higher recurrence, as this software is especially oriented towards the graphical representation of bibliometric maps (Van Eck & Waltman, 2010). The results tried to facilitate the analysis and

understanding of information researched, scientific articles published between 1976 and 2020 in the primary collection of the Web of Science (WoS) database, with the search criteria containing the word 'absorptive capacity' in the title of the article, refined by document types: (article) and Web of Science categories: (management or business or economics or regional urban planning or environmental sciences or geography or urban studies). It is also worth mentioning that the period of scientific articles published was between 1976 and 2020, as there was no publication prior to 1976.

3.2 Sample

The search was carried out in March 2021 and obtained 703 articles, published between 1976 and 2020, which were analyzed using the VOSviewer version 1.6.13 software technique, a tool specifically designed to build and visualize bibliometric maps through graphical representation. Furthermore, using the same database as the Web of Science (WoS), the ten most cited articles with a stipulated time were compiled: last five years. Moreover, given some gaps observed in the studies, it is suggested to point out directions for future research that contribute significantly to the area.

The studies analyzed to demonstrate a low growth trend in the topic of absorptive capacity until the year 2007. However, in the 703 articles identified in their chronological distribution, there is a growing disposition from 2008, that is, an increase in the number of publications of researchers for the theme, and a sharp growth trend is present in 2019 and 2020 with more significant numbers of publications.

3.3 Data Analysis Procedures

To achieve it, this research uses a descriptive approach through cluster analysis techniques, analysis of the cocitation network, co-occurrence of keywords, researchers' networks, identification of institutions, more productive journals, most cited articles that cover the holistic period of the trajectory and, in particular, the ten most-cited authors in the last five years.

The VOSviewer software was used to support the analysis of co-occurrence of keywords, cocitation of authors and co-authorship of countries. Keywords from all collected articles are extracted to conduct keyword matching analysis in general perspectives. By collecting keywords from all 703 articles in the dataset, the topics that receive the most attention and interest from researchers in the research field can be identified. Oliveira et al. (2018) argue that the bibliometric study with the VOSviewer software indicates the intellectual traditions of a field. Descriptive data are presented and, finally, the "limitations and future research" section is presented.

4 ANALYSIS AND DISCUSSION OF RESULTS

Regarding the most productive authors in the literature on absorptive capacity, ten researchers have, on

average, five publications on the subject, among the 703 identified, as shown in Figure 2.

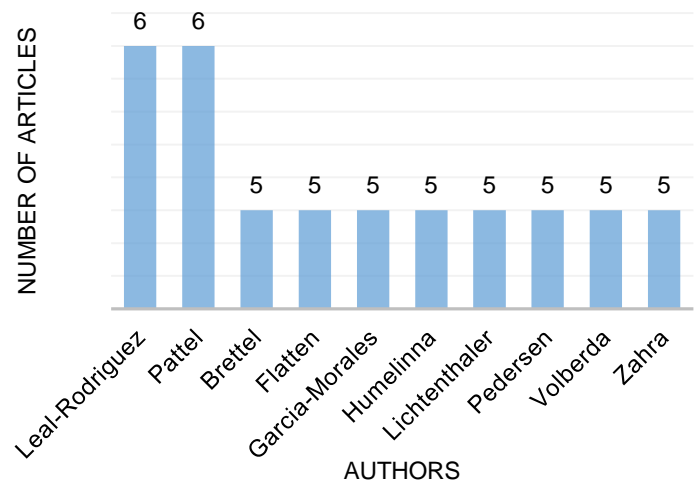


Figure 2. Ranking of the ten most productive authors in the period 1976-2020.

Source: Elaborated by the authors from WoS.

Leal-Rodríguez and Patel are equal with six publications. There is a similarity between the number of articles published by the listed authors that stand out in the ranking of the ten most productive: Brettel, M., Flatten, TC, Garcia-Morales, VJ, Hurmelinna, L., Lichtenthaler and Lichtenthaler, Pedersen, T., Volberda, HW, and, Zahra, SA, who occupy the same place considering five as the number of publications of each of them. Knowing them can reveal sources for new research directions, as they strive to contribute to the theme, having a considerable number of articles indexed in the same database. However, the total productivity is not very expressive, and suggest research into what contributions these articles bring.

It should be noted that the studies by Leal-Rodríguez and by Patel in the Journals of Business Research predominantly refer to the relationship between absorptive capacity and innovation and corroborate the study by Zahra and George (2002). These papers demonstrate that capacity absorption depends on the source of knowledge and prior knowledge and is conditioned to appropriation regimes influencing the innovative performance of the company. Innovation is given to reach competitive advantages reducing the gap between potential and realized absorptive capacity.

Concerning the most influential scientific journals, Figure 3 describes the impact of the most productive journals that publish the topic of Absorptive Capacity. This information helps in choosing which vehicles researchers can use to propagate their studies. Among the 703 articles, a total of 156 articles were identified in the ten most productive journals. Founded in 1928, the Journal of Business Research, covered several areas, being one of the most prestigious academic journals globally, published by the University of Chicago - USA. It is the journal with the highest concentration of published articles, accounting for 22 publications.

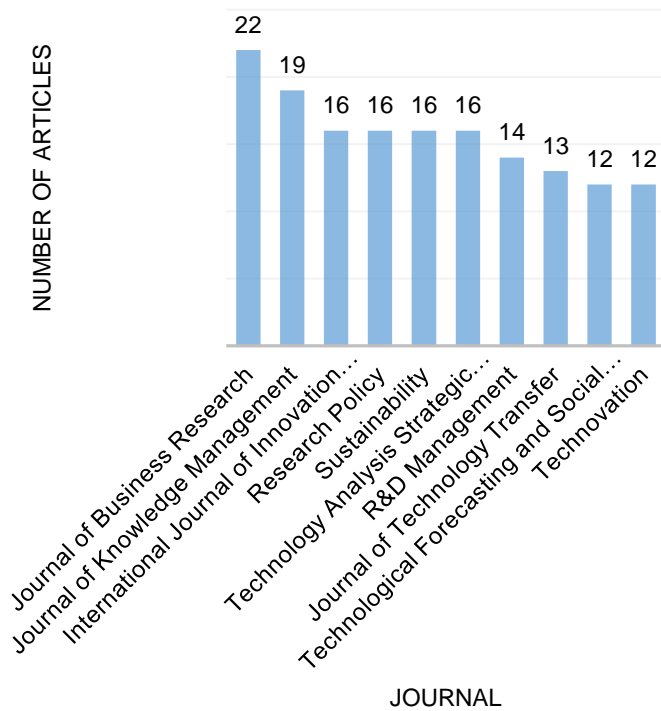


Figure 3. Ranking of the ten most influential magazines in the period 1976-2020. Source: Elaborated by the authors from WoS.

The journal *Journal of Knowledge Management* is interdisciplinary, dedicated to the publication of research related to the area of knowledge management, is the second most influential journal with 19 articles. The *International Journal of Development Research*; the *Research Policy*; *Sustainability*; and *Technology Analysis & Strategic Management* are four journals that occupy the same place, considering 16 as the number of publications in each of them.

As for the number of publications by the ten institutions in the sample, the impact of the most productive institutions of absorptive capacity is described (Figure 4).

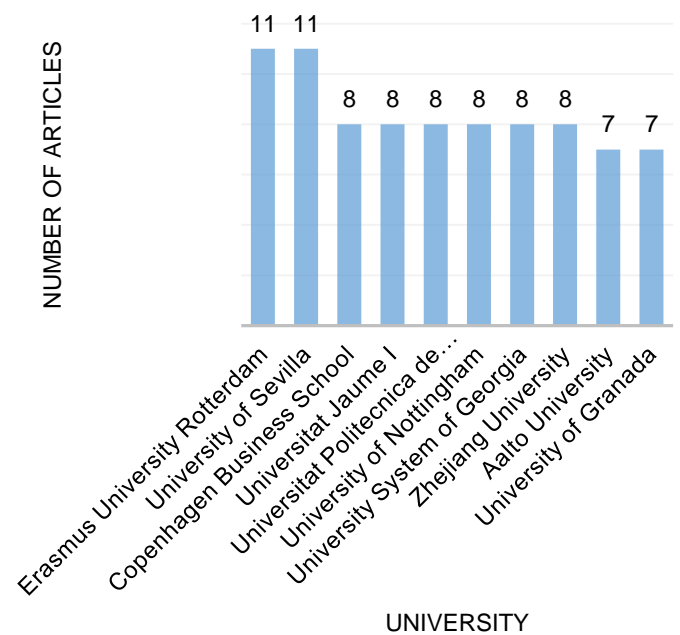


Figure 4. Ranking of the most influential institutions in the period 1976-2020.

Source: Elaborated by the authors from WoS.

Erasmus University (Rotterdam, Netherlands) and the University of Sevilla (Spain) are the most influential institutions with the highest number of articles published, accounting for 11 articles in each university. Then, the other universities observed a small number of published articles (Figure 4). There is no Brazilian university in this ranking. Therefore, it is noted that the representation of universities that develop research on Absorption Capacity is scarce. Despite the small number of articles published, there is continuous productivity in the ten universities.

With regard to the most cited articles, this study reveals the ranking of ten articles, formed by exponential papers in the period 1976-2020, with the highest number of citations received in the Web of Science (Table 3).

Table 3
Ranking of the most cited articles in the period 1976-2020

Cited articles	Journal	Total	Annual average
Absorptive-capacity - a new perspective on learning and innovation (Cohen & Levinthal, 1990)	Administrative Science Quarterly	12875	429,17
Absorptive capacity: A review, reconceptualization, and extension (Zahra & George, 2002)	Academy of Management Review	3685	204,72
Relative absorptive capacity and interorganizational learning (Lane & Lubatkin, 1998)	Strategic Management Journal	2076	94,36
Knowledge transfer in intraorganizational networks: Effects of network position and absorptive capacity on business unit innovation and performance (Tsai, 2001)	Academy of Management Journal	1800	94,74
Absorptive capacity, learning, and performance in international joint ventures (Lane et al., 2001)	Strategic Management Journal	933	49,11
Managing potential and realized absorptive capacity: How do organizational antecedent's matter? (Jansen et al., 2005)	Academy of Management Journal	857	57,13
Absorptive capacity: Valuing a reconceptualization (Todorova & Durisin, 2007)	Academy of Management Review	644	49,54
Coevolution of firm absorptive capacity and knowledge environment: Organizational forms and combinative capabilities (Van den Bosch et al., 1999)	Organization Science	581	27,67
MNC knowledge transfer, subsidiary absorptive capacity, and HRM (Minbaeva et al., 2014)	Journal of International Business Studies	552	32,47
Optimal cognitive distance and absorptive capacity (Nooteboom et al., 2007)	Research Policy	542	41,69

Source: Elaborated by the authors from WoS.

The review provides an overview concerning the first five articles. These are articles to be considered with particular attention to substantiate further research. The first article, “Absorptive Capacity: A New Perspective on Learning and Innovation” (Cohen & Levintal, 1990), is the most cited in the collection, with 12,875 citations. This study argues that a firm's ability to recognize the value of new external information, assimilate it, and apply it for business purposes is critical to its innovative capabilities.

The discussion first focuses on the cognitive basis of an individual's absorptive capacity, then characterizes the factors that influence absorptive capacity at the organizational level, how an organization's absorptive capacity differs from its individual members and the role of diversity knowledge within an organization. Furthermore, it formulates a firm investment model in research and development (R&D), in which R&D contributes to a firm's absorptive capacity.

Zahra and George (2002) are the second most cited article, “Absorptive Capacity: A Review, Reconceptualization, and Extension” corresponding to 3685 citations. Researchers used the absorptive capacity construct to explain various organizational phenomena. The article reviews the literature to identify the main dimensions of absorptive capacity and offer a reconceptualization of this construct. Based on the vision of the firm's dynamic resources, ACAP distinguishes between a company's potential and the capacity realized. It then advances to a model that describes the conditions under which the firm's potential and realized capabilities can differentially influence the creation and sustaining of its competitive advantage.

The third most cited article is “Relative Absorptive Capacity and Interorganizational Learning” (Lane &

Lubatkin, 1998). The present study reconceptualizes firm-level absorptive capacity as a construct at the level of the learning dyad and argues that the ability of one firm to learn from another depends on the similarity of (1) the knowledge bases of the two, (2) structures organizational and remuneration policies and (3) dominant logics.

The fourth most cited article in the collection is “Knowledge Transfer in Intraorganizational Networks: Effects of Network Position and Absorptive Capacity on Business Unit Innovation and Performance”, corresponding to 1800 citations. Tsai (2001) argues that organizational units can produce more innovations and obtain better performance if they occupy positions in the core network that provide access to new knowledge developed by other units. This effect, however, depends on the units absorption capacity or their ability to replicate new knowledge successfully.

The fifth most cited article, “Absorptive Capacity, Learning, and Performance in International Joint Ventures”, Lane et al. (2001) proposes a model of learning and performance in international joint ventures that segments absorptive capacity into the three components originally proposed by Cohen and Levinthal (1990).

The result of the co-occurrence analysis of keywords used by the authors of the articles generated the mapping of four clusters associated with studies of absorptive capacity (Figure 5). These clusters derive from a total of 2136 keywords found in 703 articles, but when the criterion of the word having been used at least 10 times is added, they are reduced to 106 occurrences in finite groups. For example, absorptive Capacity (ACAP) is the most common keyword, and it appears 381 times as shown on the map.

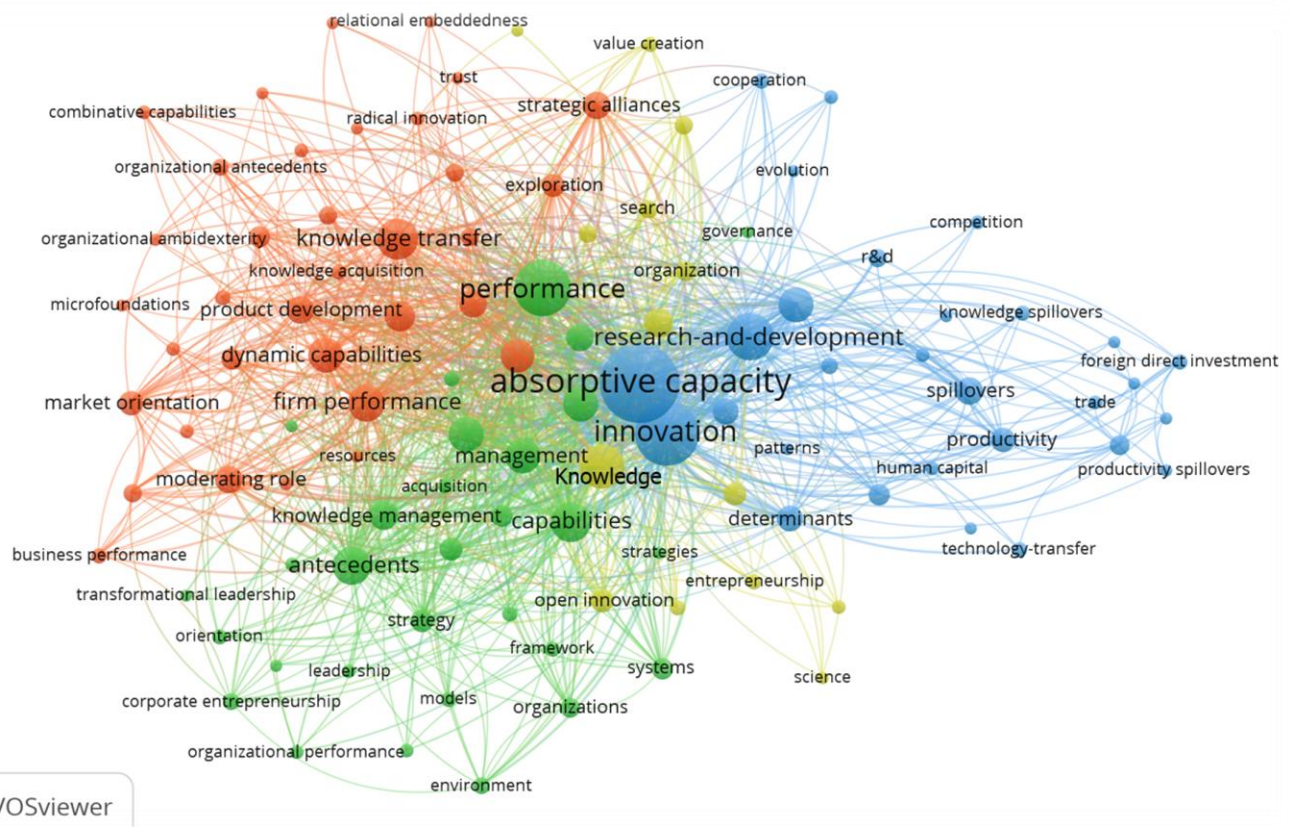


Figure 5. Keyword co-occurrence map.

Source: Elaborated by the authors from VOSviewer.

When analyzing the scenario of world scientific production, it is possible to allocate data in clusters to categorize them into research directions. This is evidenced in Figure 5, which demonstrates the interaction between the keywords in their co-occurrences. Then, it is possible to demonstrate which are the prominent authors of each cluster and their themes and research directions.

Cluster 1 (red) can be called Confluence between knowledge transfer, competitive advantage and dynamic capabilities, which can be evidenced by the terms that compose it: knowledge transfer (105 occurrences); competitive advantage (71); dynamic capabilities (80); product development. Studies in this cluster explore absorptive capacity, seen as a dynamic capacity based on knowledge. These themes corroborate the study by Teece (2007), which states that dynamic capacity is the ability to feel the context of the environment, seize opportunities, manage threats and transformations. They are competencies that determine the ability to integrate, build and reconfigure resources, and they are internal and external abilities to meet the demands of rapidly changing business environments.

Cluster 2 (green) can be characterized by organizational performance and capabilities from internal and external antecedents, referring to it as an 'activation trigger' to initiate the knowledge transfer process. Terms such as: performance (197 occurrences); background (87); perspective (83); and, impact (78). The studies of this group highlight issues related to the identification of aspects that precede and impact organizations, inducing them to absorptive capacity.

The prominent Cluster 3 (blue), which includes the central word of this study (absorptive capacity), can be called Convergence between Absorption Capacity, Innovation and Research and Development. Here are concentrated papers that predominantly explore the relationship between Research and Development (R&D), ACAP and innovation. Among the present terms, the following should be highlighted: absorptive capacity (381 occurrences); innovation (260); research and development (141); spillovers (46); productivity (38); firms (44). Studies by this group advocate that R&D projects encourage the acquisition, assimilation, transformation and exploitation of external knowledge. They consider a first factor related to the acquisition of knowledge, the investment in R&D activities that have been a relevant practice for promoting ACAP and contributing to the development of innovations. It is noticed that the Research and Development area is related to the absorptive capacity, enhancing the generation of innovation in organizations.

In cluster 4 (yellow) called Knowledge, linked to strategic alliances; terms such as: knowledge (125 occurrences); networks (55); strategic alliances (54), and collaboration (21). This group centralizes studies based on the exchange of knowledge in strategic alliances that encourage the acquisition, assimilation, transformation and exploration of external knowledge.

These data suggest that researchers are highly interested in understanding how to apply absorptive capacity to explain organizational phenomena and identify their dimensions. There are links between absorptive capacity and innovation. It is noticed that the Research and Development (R&D) projects, established from strategic alliances, stimulate the acquisition, assimilation, transformation and exploration of external knowledge in organizations. The role of knowledge diversity within an organization as a generator of innovation is remarkable.

Under the conditions, the company's potential and realized capabilities can differentially influence the creation and maintenance of its competitive advantage, making it seize opportunities and manage threats and transformations. Absorptive capacity has the competency to integrate, build and reconfigure resources and go even further when it brings to light the ability to meet the demands of rapidly changing business environments. The identification of aspects that precede and impact organizations induce absorptive capacity.

Regarding the authors of the thematic absorptive capacity, 12,970 researchers were being cited, but when defining the criterion of having been cited at least 20 times, it reduces to 292 authors grouped into 4 clusters. Thus, the curiosity arises to identify how the networks of co-citation of authors occur, which demonstrate which sources they seek in their studies, jointly validating the relevance of certain authors in the literature.

Four papers appear in more significant evidence in Figure 6. These are the most contributory theorists who have exponentially impacted other authors, exploring the theme in different sectors, bringing contributions ranging from the reconceptualization of the construct to its reflections on innovation. It is worth referring to the ranking of the ten most cited articles, formed by exponential papers in the period 1976-2020 with the highest number of citations, according to Web of Science. It is axiomatic to substantiate Cohen's seminal contribution, which is associated with recognition with the initial study of absorptive capacity in academia.

As for the co-authorship of countries, this study reveals that researchers are working in international networks in research on absorptive capacity. In a view related to geographic origin, the United States, Spain, and England might have the densest network, being central components of the transfer of knowledge worldwide on the theme of absorptive capacity.

Considering the ten countries leading research in absorptive capacity, according to the parameters adopted in this bibliometric analysis, the United States is the most influential nation during the period 1976 to 2019, appears at the top with 118 publications. Spain is the second most productive country with 77 articles, followed by England with 74 articles published on the subject. Subsequent places are occupied by China (59), Germany (45), Australia (38), New Zealand (33), Italy (32), South Korea (29) and Taiwan (28).

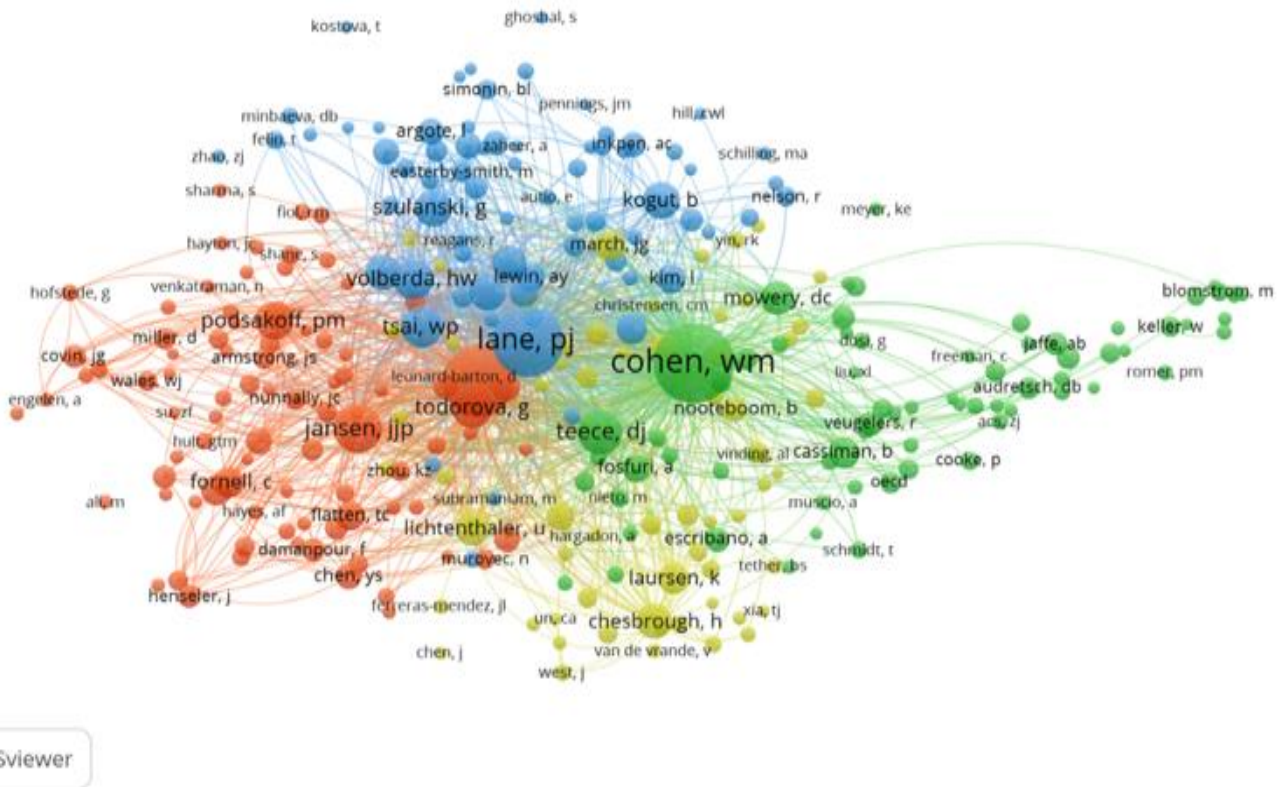


Figure 6. Bibliometric social network of cocitation.
Source: Elaborated by the authors from VOSviewer.

It is worth mentioning that the authors of the seminal articles, in their origins, are predominantly North American, legitimizing the influence of North American literature. Moreover, concerning the most cited articles in the last five

years on the subject, the ranking of the ten articles with the highest number of citations received on the Web of Science is revealed below (Table 4).

Table 4
Ranking of the most cited articles in the last five years

Article	Journal	Total
The effect of social networking sites and absorptive capacity on SMES' innovation performance (Scuoto et al., 2017)	Journal of Technology Transfer	47
Bibliometric analysis of absorptive capacity (Apriliyanti & Alon, 2017)	International Business Review	39
The mediating role of an innovative culture in the relationship between absorptive capacity and technical and non-technical innovation (Ali & Park, 2016)	Journal of business Research	39
The relationship between knowledge search strategies and absorptivecapacity: A deeper look (Mendez et al., 2016)	Technovation	36
Direct and configurational paths of absorptive capacity and organizational innovation to successful organizational performance (Ali et al., 2016)	Journal of Business Research	36
Knowledge transfer in university quadruple helix ecosystems: an absorptive capacity perspective (Miller et al., 2016)	R & D Management	36
Benefiting from Open Innovation: A Multidimensional Model of Absorptive Capacity (Zobel, 2017)	Journal of Product Innovation Management	32
Examining the Complementary Effect of Political Networking Capability With Absorptive Capacity on the Innovative Performance of Emerging-Market Firms (Kotabe et al., 2017)	Journal of Management	32
Overcoming the false dichotomy between internal R&D and externalknowledge acquisition: Absorptive capacity dynamics over time (Denicolai et al., 2015)	Technological Forecasting & Social Change	31
Beyond absorptive capacity in open innovationprocess: the relationships between openness,capacities and firm performance (Ahn et al., 2016)	Technology analysis & Strategic Management	31
Knowledge transfer in university quadruple helix ecosystems: an absorptive capacity perspective (Miller et al., 2016)	R & D Management	36
Benefiting from Open Innovation: A Multidimensional Model of Absorptive Capacity (Zobel, 2017)	Journal of Product Innovation Management	32
Examining the Complementary Effect of Political Networking Capability With Absorptive Capacity on the Innovative Performance of Emerging-Market Firms (Kotabe et al., 2017)	Journal of Management	32
Overcoming the false dichotomy between internal R&D and externalknowledge acquisition: Absorptive capacity dynamics over time (Denicolai et al., 2015)	Technological Forecasting & Social Change	31
Beyond absorptive capacity in open innovationprocess: the relationships between openness,capacities and firm performance (Ahn et al., 2016)	Technology analysis & Strategic Management	31

Source: Elaborated by the authors from VOSviewer.

In summary, the main points can be extracted from the different perspectives in which the absorptive capacity studies are being analyzed in relation to the first five articles. The first, "The effect of social networking sites and absorptive capacity on SMES' innovation performance" (Scuotto et al. 2017), is the most cited in the collection, with 47 citations. This study argues for the combination of knowledge and innovation. In this context, companies actively interact with external actors, such as customers, public institutions and other companies, to acquire and absorb external knowledge and then generate innovation.

The second most cited article is the "Bibliometric analysis of absorptive capacity" (Apriliyanti & Alon, 2017), with 39 citations. The study is a literature review that reveals research flows in AC: (1) Intra organizational learning; (2) inter-organizational learning; (3) knowledge transfer; and (4) dynamic capability. "The mediating role of an innovative culture in the relationship between absorptive capacity and technical and non-technical innovation" (Ali & Park, 2015) is the third most cited article, with 39 citations. The study proposes an integrated model to investigate the relationship between the two subdimensions of absorptive capacity (ACAP) - potential absorptive capacity (PACAP) and realized absorptive capacity (RACAP).

The fourth article is "The relationship between knowledge, search strategies and absorptive capacity: A deeper look" (Méndez et al., 2016), with 36 citations. This study analyzes how the breadth and depth of search strategies affect the dimensions of the company's absorptive capacity. It is revealed that the opening of the search for external knowledge contributes to the exploratory and transformative learning processes.

The fifth most cited article is the "Direct and configurational paths of absorptive capacity and organizational innovation to successful organizational performance" (Ali et al., 2016), with 36 citations. The study investigates how companies can achieve high levels of organizational performance under different configurations of absorptive capacity and organizational innovation. It can be seen from the analysis carried out that there are several possibilities and research themes that are found in the field of studies aimed at absorptive capacity. A highlight is the recurrence of studies on innovation, both in the most cited articles in all the years of the analyzed clipping and in articles from the last five years, which reinforces the innovative character of the consequences of the absorptive capacity of knowledge. This understanding is essential for advancing further investigations into the central debates and new possibilities for approaching the theme, delimiting the objects of study and proposing concepts and analyses.

4.1 Discussions

The results can provide subsidies to identify the main trends in the field of research on the subject, which indicate that, initially, the studies focused on conceptualization and reconceptualization, and its dimensions, later, the relevance of the usefulness of the absorptive capacity of knowledge

effectively in organizations, resulting in the generation of innovation. It appears that academic studies on absorptive capacity are increasing in the management literature. It is possible to state that to deepen the concepts related to ACAP, and it is necessary to carry out research that expands the value of effective absorption of knowledge in organizations, favouring its development as a field of investigation.

The most influential institutions in absorptive capacity research are concentrated in countries like the United States, Spain and England. Cohen, Zahra, Lane and Jansen and their co-authors appear among the most cited authors, as many others followed from their studies. Furthermore, Universities in the Netherlands and Spain are predominant in research in this field. Even considering the recent growth in published studies on absorptive capacity, there are still gaps. Brazil can be a driver of absorptive capacity researchers, given that absorptive capacity is used as a lens to explore the process of knowledge transfer (Tsai, 2001).

Regarding the panorama of scientific production, a growing disposition of researchers from 2009 on the theme of absorptive capacity was noticed, and a sharp growth trend is present in 2018 with a more significant number of publications. As for the most cited articles, most researchers used the absorptive capacity construct to explain various organizational phenomena and reviewed the literature to identify the main dimensions of absorptive capacity. It is possible to confirm by the different areas studied that this is a multidimensional theme.

Links between absorptive capacity and innovation are observed, that is, the reflexes of absorptive capacity on innovation performance, enhancing the generation of innovations. Furthermore, Research and Development (R&D) projects established through strategic alliances encourage the acquisition, assimilation, transformation and exploitation of external knowledge in organizations. It is inferred that the absorptive capacity significantly affects the innovation and performance of the business units.

It is essentially concluded that there is a relationship between the antecedents of knowledge organizations and the absorptive capacity, with the interaction of stakeholders in the transfer of knowledge between institutions and companies. The effects of absorptive capacity are still understood as a driving force for innovation, mainly related to organizational change. In this way, the management of internal relationships gains a new body, both in the national and international context, presenting a competitive advantage in the knowledge absorption process.

4.2 Future Research

Based on the investigation of the content of seminal articles and the most cited articles in the last five years on the subject, it is proposed directions of future research shown in four gaps observed in this field of study. The first gap is associated with neglecting the study of ACAP's antecedents, such as interactions between individuals and organizations (Méndez et al., 2016). It is possible to confront

this gap with Volberda et al. (2010) studies when evaluating the process and the antecedents and mediators of ACAP. Nevertheless, and in response to the appeal, it is suggested to identify strong and weak ties, how the network of social relationships is structured (Granovetter, 2007) and to analyze the contribution of these ties in the development of ACAP in companies.

The second gap refers to the importance of stakeholder interaction in knowledge transfer between institutions and companies. Miller et al. (2016) portray the ACAP process between universities and their constituent stakeholders in the quest for innovation within a quadruple helix context. A challenge would be to use the four dimensions of absorptive capacity as a lens to explore the flows and exchanges of knowledge between university incubators and enterprises to promote the growth of companies, the development of the local economy, family farming in the region and the University. Universities are expected to assume a more entrepreneurial role in the ACAP process within the regional ecosystem (Urbano & Guerrero, 2013).

The third gap is related to the role of innovation practices in the ACAP process. Although previous studies have built these perspectives and examined the respective effects of absorptive capacity in innovation on organizational change, studies on the integrated effects of innovation capacities and practices on organizational change are superficial (Scuotto et al., 2017). Therefore, there is an opportunity to understand how sustainable innovation is associated with the continual conversion of potential absorptive capacity into actualized capacity or the influence of ACAP on product and service innovation.

The fourth gap is associated with the argument that companies need to manage internal relationships, both in the national and international context, presenting a competitive advantage in the ACAP process. Apriliyanti and Alon (2017), in a meta-analysis, found intersecting currents between international business and ACAP as intra-organizational learning, inter-organizational learning, and knowledge transfer. The challenge would be to analyze the acquisition of international knowledge and the role of partner alliances in the ACAP process. Also, analyze how small businesses use new knowledge and what the long-term benefits are.

4.3 Limitations

This article has unique academic contributions by investigating the research scenario on absorptive capacity and listing new research questions. Thus, it is pointed out that the results enrich the theoretical and practical background and, through research suggested in this paper, perhaps shortly, they awaken a breadth of knowledge by improving the attributes of the absorptive capacity process.

As limitations of the study, the research is restricted to data from the Web of Science database. Despite this being one of the most influential bases, as a suggestion, it is valid to analyze studies included in other platforms, such

as Scopus, and use other complementary software. The present selection of studies was chosen due to the interaction with the software used, VOSviewer, which demands this base and represents a world literature sample on a high-reliability basis.

Furthermore, it is emphasized that the purpose of this study is to present a descriptive panorama capable of accustoming interested researchers to the discussions of the literature clipping on absorptive capacity, bringing as its main contribution a scenario of authorship on this topic and directions for further research. From this perspective, limitations also become opportunities for further research.

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