Information Technology Capabilities: A bibliometric vision of the conceptual and intellectual structures and the past and future research directions

Abstract

Purpose: Scientific production on the topic of information technology (IT) capabilities grows each year, leading researchers working in the field into difficulties to keep abreast of the new research flows, as well as to know the intellectual and conceptual structures that sustain the area. Thus, the present study is the result of the application of a quantitative approach on the international scientific production on the subject.

Design/methodology/approach: Several complementary bibliometric techniques were combined, such as keywords co-occurrence, bibliographic coupling and cocitation analysis. Considering that the bibliometric research support software currently available to the academic community has strengths and weaknesses, the present study uses three recent tools of analysis (VOSviewer, SciMAT and Bibliometrix), in order to explore the best that each can offer.

Findings: We analyzed 219 scientific papers available on the Web of Science. We identify the origins of the current literature on IT capabilities, as well as its foundations and main intellectual and conceptual structures, including a longitudinal view of the development of the theme. The paper also presents the main research fronts in the field, as well as several opportunities that can contribute to the advancement of research involving IT capabilities.

Originality: The fundamental themes for structuring the whole of the scientific production on IT capabilities, which had a higher level of development and connection with external research flows, are organizational performance, strategic management, resource, and value-based view. Thus, future researchers will find underlying literature on IT capabilities in the context of business a rich and varied literature involving these major themes.

Keywords: IT Capabilities; Bibliometrics; VOSviwer; SciMAT, Bibliometrix; State of the Art.

Article classification: Literature review

1. INTRODUCTION

The IT Capabilities theme has increasingly drawn the attention of researchers worldwide, including those in the business field. Defined as an organization's ability to mobilize and deploy IT resources in conjunction with other organizational assets to achieve strategic and

operational objectives, IT capabilities are recognized as pivotal for enhancing competitiveness and fostering innovation within modern enterprises (Bharadwaj, 2000; Li & Chan, 2019). This recognition has led to significant growth in related global scientific production, which has accelerated since 2005. Such growth presents increasing challenges for researchers in maintaining up-to-date knowledge, as well as in identifying and monitoring the various research fronts. Consequently, it is not trivial for researchers dedicated to the field to identify and comprehend the intellectual and conceptual structures of the field, which are essential for conducting consistent research projects and for training new researchers.

On the other hand, despite the undeniable potential of literature reviews based on traditional methods to illuminate a field, they are not free from several limitations, such as researchers' bias, lack of objectivity, and difficulty in reproducibility (Aria & Cuccurullo, 2017; Tranfield et al., 2003; Zupic & Čater, 2015). To minimize these difficulties, a third approach to dealing with literature, including in the area of management and organizations, is gaining space: scientific mapping. This strategy is based on the use of several bibliometric methods and is supported by new and powerful software. With this, we aim to conduct transparent, reproducible, and less biased investigations (Zupic & Čater, 2015). According to Aria and Cuccurullo (2017), the use of bibliometric methods is expanding to all disciplines, and its application is recommended, especially in the face of large and growing research flows.

Although the literature already includes reviews that address IT capabilities, gathering insights on the topic through studies such as those by Mamonov and Peterson (2021), Werder and Richter (2022), Schäfferling (2013), and Turulja and Bajgoric (2018), this study stands out for its innovative methodology in the field and the wide range of analytical possibilities it offers, considering that the literature on IT capabilities still lacks studies of this nature. Thus, the purpose of this study is to help fill this gap by seeking to answer the following research questions: i) what are the conceptual and intellectual structures of literature that involves IT capabilities? ii) what are the main research fronts and the opportunities for the evolution of related scientific production?

In this sense, this study aims to identify, analyze, and map the high-impact literature on IT capabilities, reveal their conceptual and intellectual structures, as well as review and present the state of the art of research in the field, accompanied by indications of opportunities for future researchers. The information presented in this study contributed to the advancement of scientific production on IT capabilities by providing an overview of the high-impact scientific production in the area. Thus, future researchers will have at their disposal relevant information that can provide insights for the development of the field. Furthermore, the present study, by

demonstrating the simultaneous and complementary use of three software for bibliometric analysis, aims to contribute to the quality of the results of literature reviews to be conducted by future researchers, reviews that are fundamental to any research project, whether theoretical, empirical, or summaries of previous contributions.

This article is structured as follows: in the introductory section, we contextualize the growth and importance of information technology (IT) capabilities and identify existing gaps in the current literature. Next, in the literature review section, we explore the fundamental concepts and intellectual structures that underpin the field of IT capabilities, using a bibliometric approach to map significant contributions and identify key research streams. In the methods section, we detail the bibliometric procedures and tools employed, including the use of VOSviewer, SciMAT, and Bibliometrix software for co-word analysis, bibliographic coupling, and co-citation analysis. Subsequently, we present the results of these analyses, highlighting the main conceptual and intellectual structures, as well as emerging research fronts and future opportunities. Finally, in the conclusion section, we discuss the implications of our findings for future research and propose directions for new studies, reinforcing the importance of IT capabilities for organizational competitiveness and innovation.

2. LITERATURE REVIEW

The effective deployment of Information Technology (IT) is crucial for organizations to reap significant organizational benefits, as pointed out by Yoon (2011). This starting point opens the discussion to the ability of organizations to assemble, integrate, and utilize IT resources to meet the requirements of business processes, as defined by Liu, Huang, Wei, and Huang (2015). In this perspective, Stoel and Muhanna (2009) detail IT capabilities as a complex combination of IT-related resources, skills, and knowledge, which are applied through business processes. This complexity is grounded in the seminal research of Bharadwaj (2000), which identified specific organizational IT resources, including infrastructure, human resources, and intangible IT resources, essential for optimizing organizational outcomes.

Transitioning to the relationship between IT capabilities and improvements in performance, the literature have consistently demonstrated how IT capabilities are linked to advances in business processes, enhanced organizational performance, increased innovation capacity, and the generation of competitive advantage. The development of the concept of IT as an organizational capability by Bharadwaj (2000) and the exploration of the association

between IT capability and company performance illustrate the superiority of companies with high IT capability across a variety of performance measures based on profits and costs.

This view is reinforced when analyzed through the lenses of the Resource-Based View (RBV) and the theory of competition, which emphasize the dependence of organizational performance on IT capabilities more than on direct technology expenditures. Research conducted by Kucharska and Erickson (2023) and Li and Yoo (2022) underscores the importance of IT capabilities for improving business processes, innovation, and organizational performance, suggesting the importance of strategic management of these capabilities.

This line of thinking leads to the consideration of variability in the importance of IT competencies for knowledge sharing and how the effectiveness of technological capabilities in promoting innovation depends on industry-specific and country-specific factors. The need for a contextualized approach, as discussed by Kucharska and Erickson (2023) and Li and Yoo (2022), highlights the importance of network integration and how such integration can amplify the benefits of information system resources for innovation and knowledge sharing.

Moving forward, studies such as those by Mata et al. (1995), Powell and Dent-Micallef (1997), and Ray et al. (2005) offer additional insights into the contribution of IT capabilities, especially those related to strategic management and integration, to the sustainability of competitive advantage and superior customer service process performance. These research collectively emphasize the synergy between human, business, and technological resources as the foundation for acquiring and maintaining a lasting competitive advantage.

This understanding is complemented by the exploration of the intersection between IT capabilities, innovation, and business performance, which argues that IT capability, along with process-oriented dynamic capabilities, is essential for optimizing financial efficiency and driving service process innovation. Research conducted by Chen and Tsou (2012) and Kim et al. (2011) suggests that strategic alignment between IT capabilities and adaptable business strategies is crucial for achieving superior financial performance. As organizations continue to navigate an increasingly digital and interconnected business environment, the effective management of IT capabilities emerges not only as a strategic imperative but also as a competitive differentiator that can determine success or failure in the global market. Thus, IT capabilities stand out as central elements in fostering innovation, optimizing business processes, and sustaining competitive advantages in the contemporary business landscape.

Emphasizing the importance of IT capabilities in organizational management and the enhancement of business processes, Yoon (2011) introduced a new concept called perceived enterprise IT capability. This instrument encompasses four dimensions of IT capabilities: IT

strategy, IT knowledge, IT operations, and IT infrastructure. In turn, Marchiori et al. (2022) indicated that IT human capital, composed of technical and behavioral skills, as well as attitudes towards technology, is distinct from IT capabilities, serving as an independent construct. While this human capital contributes positively to organizational IT capabilities, it does not form their composition, remaining a distinct corporate resource that deeply influences IT capabilities, driving organizational innovation.

IT capabilities emerge in the literature as an element to sustain competitiveness and foster innovation within modern organizations, involving various aspects of this theme, from defining and developing a framework to understand the dynamic capability of IT (Li & Chan, 2019), to investigating its role in organizational innovation (Mamonov & Peterson, 2021) and analyzing its effects on organizational agility and performance (Werder & Richter, 2022). Schäfferling (2013) discusses how IT capability, when properly implemented, can transform IT investments into effective daily operations, thus leveraging the business value of IT. On the other hand, Turulja and Bajgoric (2018) investigate the interactions between IT capability, knowledge management, human resource management, and organizational performance, concluding that IT capability enhances human resource management and knowledge management capabilities, positively impacting organizational performance. This body of sutides highlights the multifaceted nature of IT capabilities and their interconnection with other organizational capabilities.

In the empirical field, the study conducted by Lu and Ramamurthy (1989) on the influence of IT capabilities on organizational agility reveals an interesting duality, with some scholars seeing IT as a facilitator of agility, while others point to factors that may impede organizational agility. The discussion on organizational agility is deepened by Lu and Ramamurthy (2011), who detected a positive relationship between IT capabilities and organizational agility. In this line, Mao et al. (2023) examined how different aspects of IT capability affect operational agility in organizations, finding that IT infrastructure and IT reconfiguration have a complementary relationship, i.e., they amplify the positive impact of one another on operational agility. Conversely, IT coordination and IT integration have a substitutive relationship, meaning they reduce the positive impact of one another on operational agility. The authors suggest that managers should consider these interactions when designing and implementing IT strategies.

The investigation of IT capabilities and organizational phenomena is not limited to these aspects. For example, the Dynamic Capabilities approach was used by Kim et al. (2011) to explore the relationships between IT capabilities, process-oriented dynamic capabilities, and

the financial performance of companies. They discovered a significant causal relationship between these dimensions and financial performance, highlighting the importance of IT infrastructure flexibility, IT expertise, and IT management capability.

Similarly, Chen and Tsou (2012) highlighted the role of customer service as a critical mediator through which IT capabilities and service process innovation influence company performance. They argue that IT capabilities are critical factors that facilitate service process innovation, suggesting that management initiatives should focus on developing IT capabilities and innovation in the service process to improve customer service and achieve superior performance.

Exploring further the effects of IT capabilities and employee empowerment on innovation and performance in micro and small enterprises, Kmieciak et al. (2012) observed that innovation in these companies is positively associated with technological turbulence, innovation climate, innovation investments, and the use of IT in internal communications, highlighting the positive impact of innovation activity and IT knowledge on subjective measures of company performance. Using the Theory of Hierarchy, Lim et al. (2012) proposed a positive relationship between the structural power of IT executives and the likelihood of a company developing higher levels of IT capabilities, as well as suggesting that the contribution of IT capabilities to achieving a competitive advantage is greater in organizations where the IT executive has more power, finding evidence to support these hypotheses. From the perspective of Dynamic Capabilities, Liu et al. (2013) examined the mechanisms through which IT capabilities influence organizational outcomes, proposing that two specific IT capabilities, IT flexibility and IT assimilation, support the development of absorptive capacity and supply chain agility, affecting company performance.

Recent research has also focused on the relationships between IT capabilities and various organizational phenomena. For instance, Makhloufi et al. (2021) demonstrated how IT flexibility is a key factor in achieving a sustainable competitive advantage (SCA) in core business activities, arguing that the combination of IT knowledge resources and the business skills of IT personnel enhances market competence and SCA.

Wang (2022) explored how Artificial Intelligence (AI) in IT capability influences budget management and organizational performance in high-tech companies, concluding that AI improves the accuracy of financial budgets and, in turn, mediates the relationship between IT capability and organizational performance, suggesting that high-tech companies should invest in AI to improve budget management and enhance competitiveness.

Finally, the importance of green innovation (GI) as a strategy for corporate sustainability was emphasized by Li et al. (2022), who highlighted the enhancing effects of exploration and exploitation aspects of ambidexterity on GI and, consequently, on various facets of sustainable corporate development. Notably, IT capability positively moderates only the exploitation-GI relationship, reinforcing the case for companies, especially in developing markets, to invest in GI to promote corporate sustainability.

3. METHODS

We conducted the study according to the proposed by Zupic and Čater (2015). Initially we designed the research and defined the research question and the methods necessary for its response. We then select the database, as well as the search filters. Following, we defined the software appropriate to the defined methods, and performed the pre-processing of the data (Cobo et al., 2011a). The fourth step was the selection of the most appropriate methods and software to visualize the results, focusing on their interpretation. Figure 1 graphically presents a summary of the steps followed.

Step 1: Research project

a. Definition of research questions
b. Selection of analysis methods
    - Keyword co-occurrence (conceptual structures).
    - Cocitation analysis -> (intellectual structures).
    - Bibliographic coupling (Research fronts).

Step 2: Compilation of bibliometric data

a. Choice of database:
    - Main collection of Web of Science.
b. Identification of search terms.
    - Exploratory research.
c. Conducting the research
    - Titles, abstracts and keywords.
    - SCI-Expanded, SSCI and A&HCI.
    - Articles and literature reviews.
    - Writtings in English.
    - Management and Business.
    - Published until 2018.

Step 3: Analysis

a. Choice of bibliometric software
    - SciMAT, VOSviewer and Bibliometrix.
b. Data cleaning
    - Pre-processing with SciMAT.
    - Importing of the “clean” base” (SQL and Python).
c. Data analysis
    - Clustering.
    - Network analysis.
    - Strategic mapping.

Step 4: Visualization

a. Visualization methods
    - clusters (keywords, documents and authors).
    - maps (co-occurrence of words, strategic, cocitation, evolution of publications, worldwide scientific production, interest of journals).
b. Simultaneous use of tools (SciMAT, VOSviewer and Bibliometrix).

Step 5: Interpretation

a. Qualitative approach
    - Higher impact jobs (clusters)
    - Full reading (research fronts)

Figure 1: summary of the applied steps
Source: Authors own work

Considering the amplitude of the research question, we used different units of analysis and bibliometric methods (Aria & Cuccurullo, 2017; Zupic & Čater, 2015). To identify the conceptual frameworks of the field, we chose the use of the keyword as the unit of analysis, and we used the word co-occurrence method. For the identification of the intellectual structures of the field, the choice of the unit of analysis was cited references and we applied the analysis of cocitation as the method of analysis. In turn, the research fronts were scanned through the technique of bibliographical coupling of documents, published in the last five years exclusively in high impact journals (Zupic & Čater, 2015). This group of recent publications, which represent the state-of-the-art literature, allowed to identify research opportunities not yet explored.

The studies were extracted from the main collection of the Web of Science (WoS), the world's most traditional scientific indexing base (Zupic & Čater, 2015). The search terms were "INFORMATION* TECHNOLOG* CAPABILIT*", "IT CAPABILIT*", "INFORMATION* TECHNOLOG* CAPACIT*", "IT CAPACIT*", associated with the Boolean operator "OR". We searched the titles, abstracts and keywords of publications indexed to the indices: Science Citation Index Expanded (SCI-Expanded), Social Sciences Citation Index (SSCI) and Arts & Humanities Citation Index (A&HCI). Thus, the search string used was "Refine results for "INFORMATION* TECHNOLOG* CAPABILIT*" OR "IT CAPABILIT*" OR "INFORMATION* TECHNOLOG* CAPACIT*" OR "IT CAPACIT*" (Title) OR "INFORMATION* TECHNOLOG* CAPABILIT*" OR "IT CAPABILIT*" OR "INFORMATION* TECHNOLOG* CAPACIT*" OR "IT CAPACIT*" (Abstract) OR "INFORMATION* TECHNOLOG* CAPABILIT*" OR "IT CAPABILIT*" OR "INFORMATION* TECHNOLOG* CAPACIT*" OR "IT CAPACIT*" (Author Keywords) and Article (Document Types) and Management or Business (Web of Science Categories)". We retrieved 219 studies published in English until April 5, 2019, in the categories Management and Business, considering that the focus of the present study is the business area.

The academic community now has a variety of bibliometric tools with complementary features. Some software have efficient functions for data preprocessing, while others are suitable for map visualization (Cobo et al., 2011b). Thus, the present study was based on the associated use of three tools, exploring the strongest characteristics of each software. SciMAT broadly covers the flow of scientific mapping, with emphasis on the resources of pre-processing and variety measures of similarity and techniques for building networks. The tool also allows the production of a longitudinal view of scientific topics. The VOSviewer (van Eck & Waltman, 2010) features the ability to represent large maps, a variety of bibliometric techniques available

and ease of operation. However, it has limited capabilities for preprocessing. Finally, the Bibliometrix (Aria & Cuccurullo, 2017) offers a variety of analysis and visualization features, some of which are not available in SciMAT and VOSviewer. However, the package also does not have efficient mechanisms for pre-processing. Thus, the combined use of the three tools allowed the literature on the subject to be scrutinized in several aspects.

The pre-processing was fully realized with the support of SciMAT, from the creation of groups of authors, documents and references. Several types of problems were identified and corrected. For example, during the pre-processing of the authors names with small differences of spelling were grouped (e.g., Coltman, T and Coltman, TR), but it was avoided to group different authors identified in the same way (e.g., Liu, Yan and Liu, Yu). In the same way, the application of the technique of analysis of co-occurrence of keywords, basis for thematic mapping, would be compromised if the pre-processing step. For example, the term "Total Quality Management" appears in some studies as "TQM". It was also possible to standardize the identification of authors in the main references (e.g., Bharadwaj, AS and BHARADWAJ, A). In view of the large number of references (10.971), we chose to carry out this intervention in the studies with 30 citations or more. We also used the pre-processing of references to standardize the various editions of books. As highlighted by Cobo et al. (2012), the preprocessing step is one of the most important in the flow of scientific mapping. Further, the "clean" base was then exported from SciMAT and loaded into VOSviewer and Bibliometrix. For this purpose, a script was produced, based on Structured Query Language (SQL) and in the Python programming language. Thus, the analyzes performed on the three tools were based on the same data set. which ensured the consistency of the information and the possibility of comparing the results generated by the different software.

To visualize the results, bibliometric maps were constructed for each unit of analysis. To identify the conceptual frameworks of the field, we used the keyword co-occurrence technique (He, 1999). With the support of SciMAT, it was possible to construct strategic maps, including longitudinal cuts, according to the proposed by Cobo et al. (2011a). On the other hand, to identify the intellectual structures underlying the literature on IT capabilities, we applied a cocitation analysis (Small, 1973), from the assumption that the bond strength between two articles grows in the measure more often are cited together (Marchiori et al., 2020). From the reference lists of articles and using the VOSviewer, we elaborated a map in which we identified the main clusters present in the literature, defined on conceptual bases. Other display artifacts were also produced, as the graph with the evolution of publications (SciMAT), the map

of world scientific production (VOSviewer) and the graph with the dynamics of interest of the main journals by the theme (Bibliometrix).

Considering that the bibliographical references of a scientific study are the reflection of the intellectual environment in which the authors acted and that the link strength between two articles increases according to the level of sharing of references (Marchiori et al, 2020), we applied the technique of bibliographic coupling (Kessler, 1963) on the most recent literature (2014-2019), as recommended by Zupic and Čater (2015). In order to allow the comparison of results and enable a more precise identification of the research fronts, we used the three tools applied in the present study (VOSviewer, SciMAT and Bibliometrix). Thus, the conceptual and intellectual structures of the literature on IT capacities were identified and analyzed, as well as a longitudinal analysis of the themes that guided the development of the field. A quantitative approach of a scientific field does not replace the reading of the studies but can reveal its structures and provide an objective guide for more analytical examination (Zupic & Čater, 2015). Thus, the research opportunities present in the most recent literature were selected from reading and from a qualitative approach of the studies.

4. RESULTS AND DISCUSSION

4.1 Origins and description of the field

Scientific output on IT capabilities remained relatively small by 2005, year in which 8 papers on the subject were published. Since then, the scientific production has grown considerably, as can be observed in Figure 2, in which it is possible to observe a strong increase of the interest on the subject in the last years. In this sense, the literature produced only in the last period (2015-2019) represents 42% of the total.

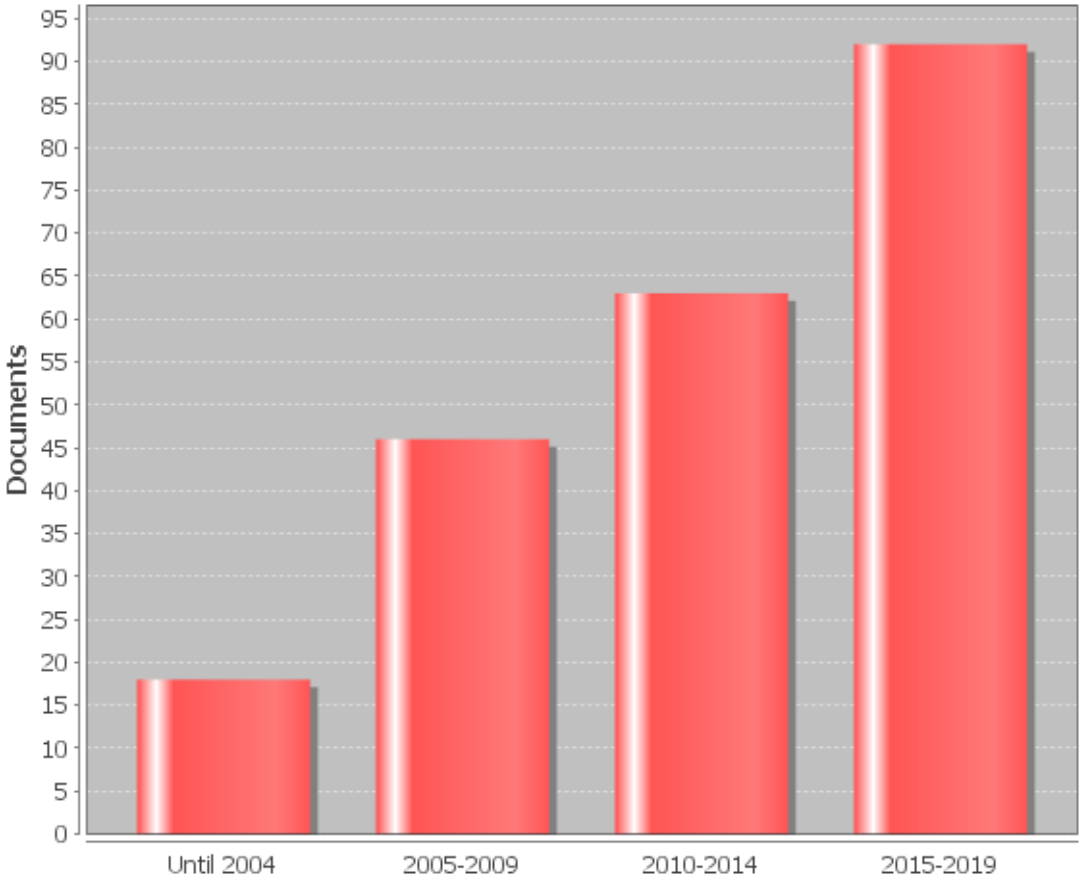

Figure 2: Evolution of publications (Source: SciMAT)

Source: Authors own work

The study with the greatest impact, with the highest total number of citations (1,477) and the highest annual average (73.85), in the WoS database, is "A resource-based perspective on information technology capability and firm performance: An empirical investigation" (Bharadwaj, 2000). The list of the 10 studies of greatest impact in the area can be seen in Table 1.

Table 1: Studies with greater impact

Article	Title	Source	Total of citations (WoS)	Annual average
Bharadwaj (2000)	A resource-based perspective on information technology capability and firm performance: An empirical investigation	MIS Quarterly	1.477	73,85
Newbert (2007)	Empirical research on the resource-based view of the firm: An assessment and suggestions for future research	Strategic Management Journal	684	52,62
Santhanam & Hartono (2003)	Issues in linking information technology capability to firm performance	MIS Quarterly	383	22,53
Ray et al. (2005)	Information technology and the performance of the customer service process: A resource-based analysis	MIS Quarterly	370	24,67

Bhatt & Grover (2005)	Types of information technology capabilities and their role in competitive advantage: An empirical study	Journal of Management Information Systems	345	23,00
Mithas et al. (2005)	Why do customer relationship management applications affect customer satisfaction?	Journal of Marketing	268	17,87
Piccoli & Ives (2005)	Review: It-dependent strategic initiatives and sustained competitive advantage: A review and synthesis of the literature	MIS Quarterly	256	17,07
Aral & Weill (2007)	IT assets, organizational capabilities, and firm performance: How resource allocations and organizational differences explain performance variation	Organization Science	227	17,46
Lu & Ramamurthy (2011)	Understanding the link between information technology capability and organizational agility: an empirical examination	MIS Quarterly	181	20,11
Mithas et al. (2011)	How information management capability influences firm performance	MIS Quarterly	180	20,00

Source: Authors own work

Moving towards the scientific production of countries, in Figure 3 a map with studies in each country is presented, considering the minimum of 2 articles published by its researchers. The area of the circles represents the number of articles published by the researchers of the countries. The proximity between countries indicates their level of collaboration, which is reinforced by the thickness of the lines connecting them. Finally, the color of the circles indicates the impact of the scientific production of each country, obtained by means of the average number of citations of the respective articles.

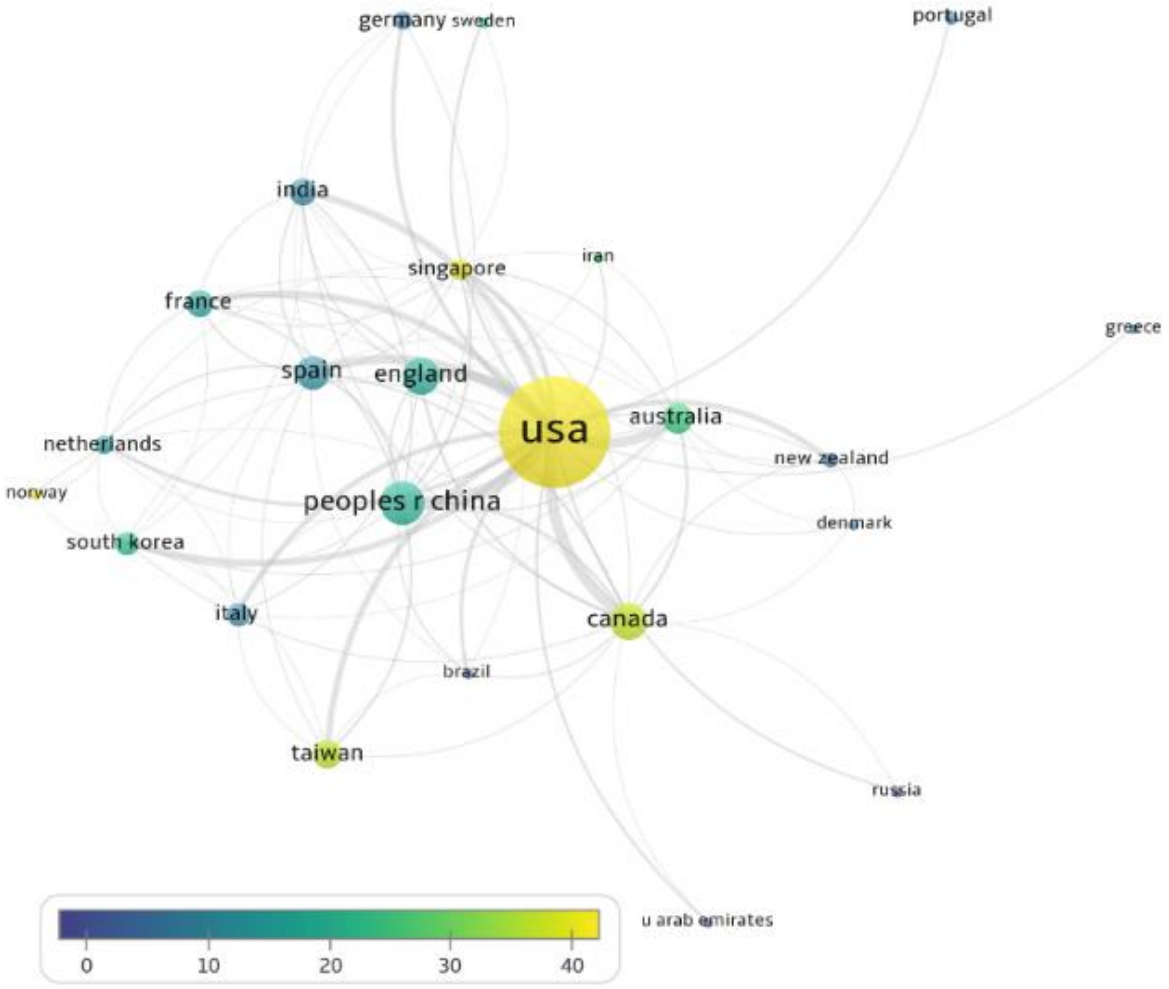

Figure 3: International scientific production and relative impact

Source: VOSviewer

Dominating the scientific production on IT capabilities are the United States, with 55% of production and an average of 68.1 citations per article). Then there is China, with 10.9% of production and its articles having been cited 18.7 times on average. However, the results showed that, although smaller in terms of quantity, the literature produced in Canada, in Taiwan and Singapore has a high impact in terms of citations.

Finally, in order to establish the journals with the greatest impact on the topic of IT capabilities in the business area, that is, those who were responsible for the largest number of articles, we applied Bradford's (1934) law. Along these lines, a small number of journals are responsible for most publications. Figure 4 presents the most productive journals on the topic of IT capabilities. Among the 69 journals that published studies on the subject, 5 can be considered as the nucleus of scientific production.

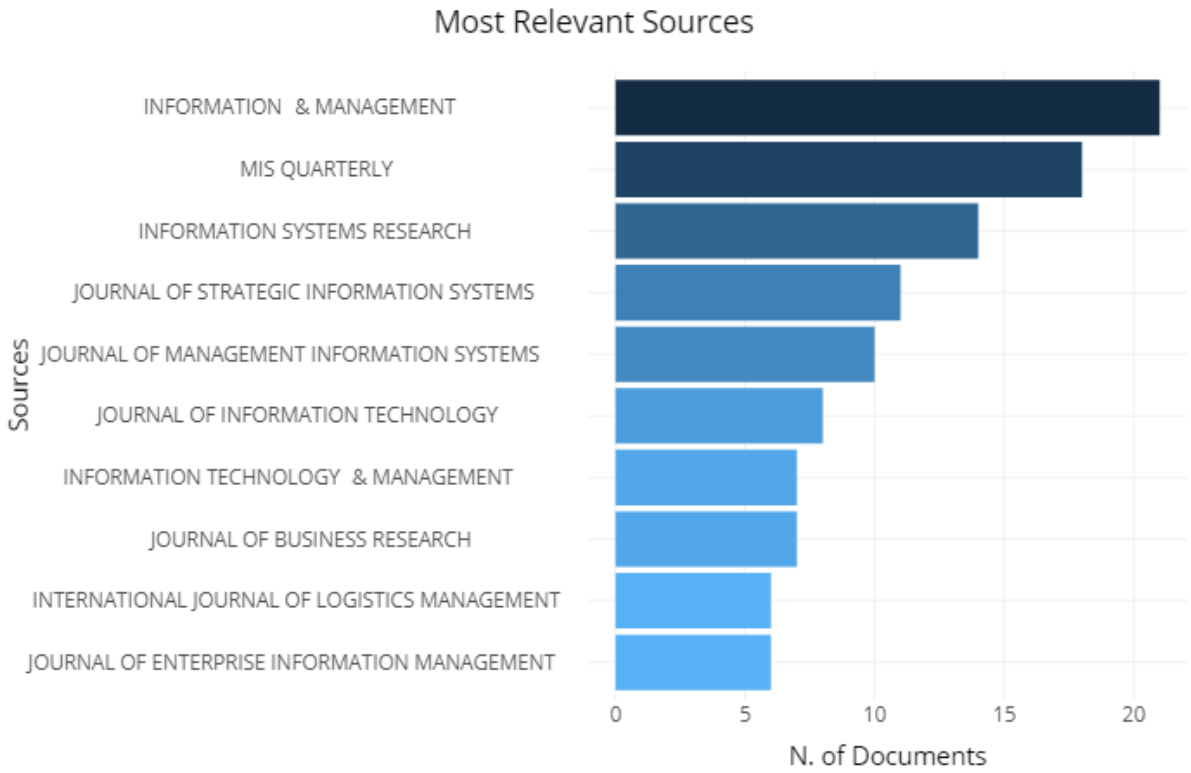

Figure 4: Core of journals on the subject of IT

Source: Bibliometrix

4.2 Conceptual structure

4.2.1 Thematic mapping

Studies involving the topic IT capabilities can be grouped into thematic clusters, which have varying dynamics and importance in scientific production. To locate the main clusters and how to identify their relative roles in the set of studies, we use the strategic thematic mapping approach (Cobo et al., 2011a). The clusters were positioned in a two-dimensional plane, distributed in quadrants that represent the driving-themes (well developed and important for the structuring of the field, having strong relations with external themes), themes of marginal importance (well-developed internally but with weak external relations), weakly developed themes (emerging or disappearing) and cross-sectional themes (important for the field, but with low level of development).

We analyzed the keywords chosen by the authors and those extracted from the WoS database (ISI Keyword Plus). In view of the large number of identified keywords, it was necessary to reduce the network. For this purpose, we established as a parameter that the keywords should have four occurrences or more. The method option for network normalization

in SciMAT was by the Inclusion Index, considering its suitability to measure similar sets, without being influenced by the quantity of items of each set (Cobo et al., 2011a). For clustering algorithm, we chose the Simple Centers Algorithm, also in line with Cobo et al., (2012a). Figure 5 presents the general strategic diagram of the literature on IT capabilities.

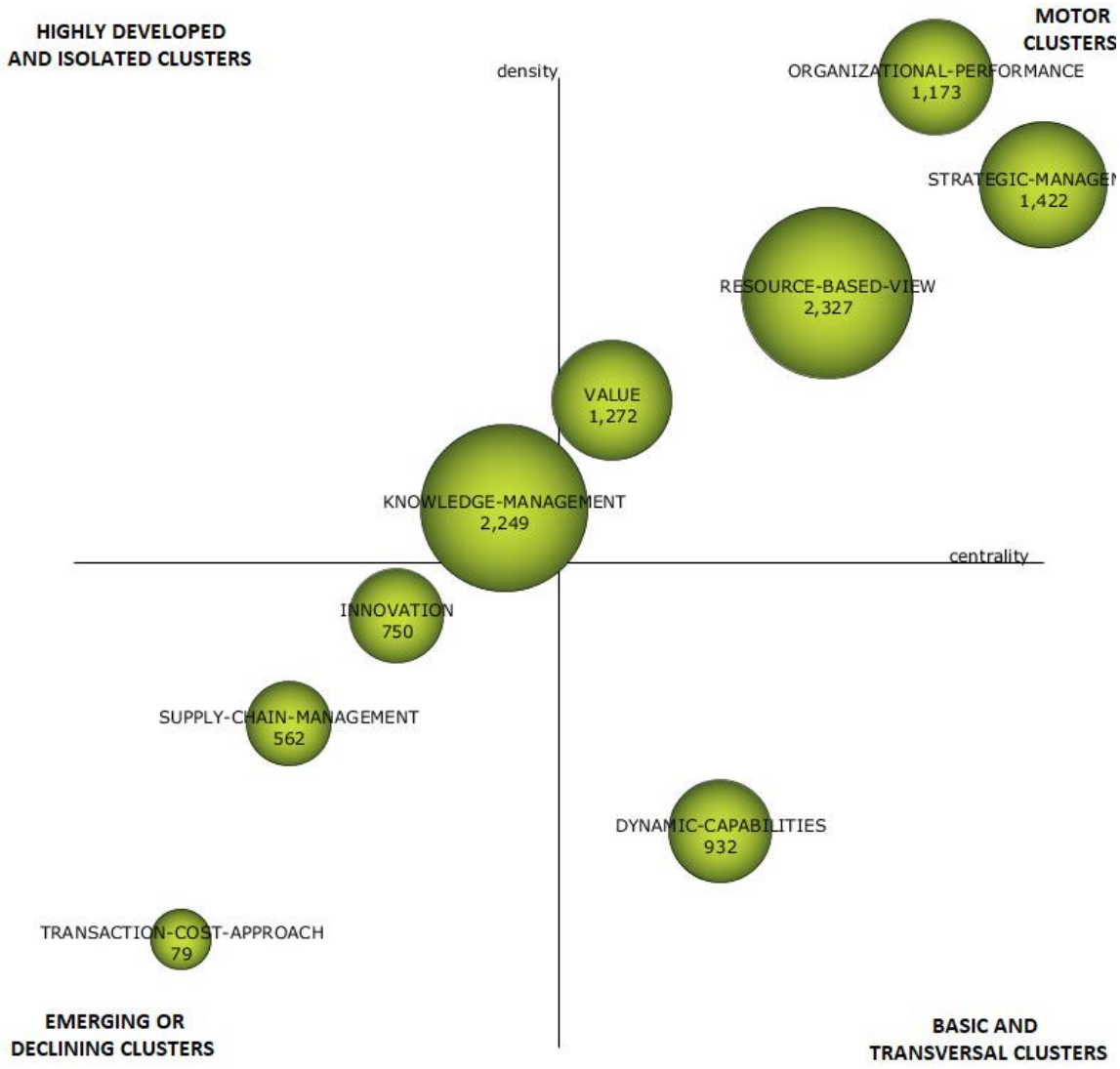

Figure 5: Strategic diagram of IT skills theme

Source: SciMAT

The driving themes of the area are organizational performance, strategic management, resource-based view and value. More precisely, the resource-based view (RBV) is the connecting factor between studies that form the driving theme with the greatest impact in the field of IT capabilities, with 18 papers published and with 2,327 citations in the WoS database (Lioukas et al., 2016). The cluster also covers topics such as environmental dynamism (Soto-Acosta et al., 2018), service quality (Choy et al., 2014) and quality management (Benitez-

Amado et al., 2015), as well as presenting areas in which research on IT capacities develops from RBV, such as health (Mandal, 2018) and customer relationship management (Keramati et al., 2010).

In turn, the cluster that brings together the 18 papers that focus on organizational performance accumulates 1,173 citations (Miao et al., 2018). The study of this cluster includes the themes of entrepreneurship (Chen et al., 2015), advertising (Dong & Wu, 2015) and financial performance (Popa et al., 2018). Another driving theme of research involving IT capabilities is strategic management, which brings together 16 papers, cited 1,422 times (Côrte-Real et al., 2017). Among the main topics associated are marketing (Zhao & Priporas, 2017), relationships between buyers and sellers (Rai et al., 2012), orchestration of IT resources (Queiroz et al., 2018) and multiple business enterprises. In turn, the 26 papers that deal with the value theme were cited 1,272 times (Krishnamoorthi & Mathew, 2018). Among the main topics associated are IT investments (Kim et al., 2017), productivity (Han et al., 2011), business intelligence (Ghasemaghaei et al., 2018), IT enabled resources (Nevo & Wade, 2010) and management capacity (Braojos et al., 2019).

Despite not being in the driving theme quadrant, the theme of knowledge management presented the greatest impact in the literature on IT capabilities, with its 21 papers having been cited 2,249 times (Bamel & Bamel, 2018). The cluster involves studies on organizational learning (Koo et al., 2017), absorption capacity (Wang & Byrd, 2017) and business process management (Giacosa et al., 2018). Finally, although they are not among the most developed, other themes have also proved important for research on IT capacity, especially innovation (Zhang & Hartley, 2018) and management of supply chains (Cai et al., 2016), as well as the application of the theoretical lenses of dynamic capabilities (Wamba et al., 2017) and transaction costs (Tebboune & Urquhart, 2016). One aspect worth highlighting are the methods used by the research. Older studies (for example Bhatt & Grover, 2005; Keramati et al., 2010; Tippins & Sohi, 2003) mostly used surveys, collecting data from managers, mainly IT. The most recent studies mainly use secondary data, most of which come from companies, official data from governments and, more currently, Big Data (for example Li & Yoo, 2022; Soto-Acosta et al., 2018; Wamba et al., 2017)). We also observed that qualitative research is rare and little used on the topic of IT capabilities (one of the few examples is Mao et al., 2023).

4.2.2 Thematic evolution

However, over time, the keywords in a research field do not remain the same (Cobo et al., 2011a). Thus, the literature on IT capabilities evolved over the period using different keywords to describe the content of the study, with new topics and others disappearing, but a subset of keywords that remained unchanged during consecutive subperiods. Figure 6 shows the evolution of the keywords used in the studies on IT capabilities. As explained in Cobo et al., (2011a), the circles indicate each period. The number of keywords of the period is represented inside. The arrows between consecutive periods represent the number of keywords shared between them. In addition, the index of similarity (or overlapping) of keywords between periods is shown in parentheses. The top input arrows represent the number of new keywords in each period. Finally, the top exit arrows represent the number of keywords that were discontinued in the next period.

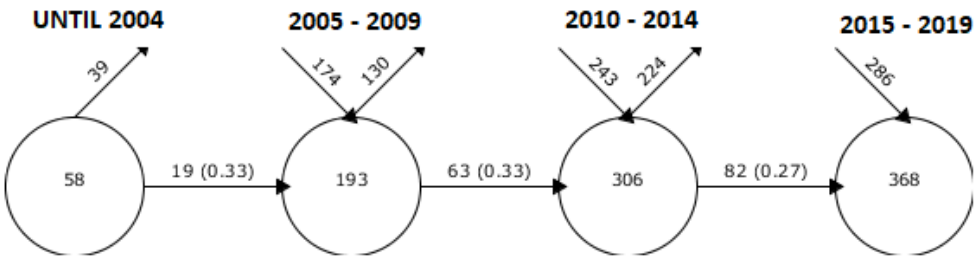

Figure 6: Keywords renewal dynamics

Source: SciMAT

For example, in the third period (2010 - 2014) 306 keywords were registered, of which 82 remained for the following period (2015 - 2019) and 224 were no longer used. That is, the index of similarity between periods was 0.27 (27%). Similar dynamics are observed between the other periods. Thus, the number of new and transient keywords is high, revealing a hight level of thematic renewal in IT capability research. Therefore, the research fronts evolved over time, with Figure 7 showing the mapping of this evolution.

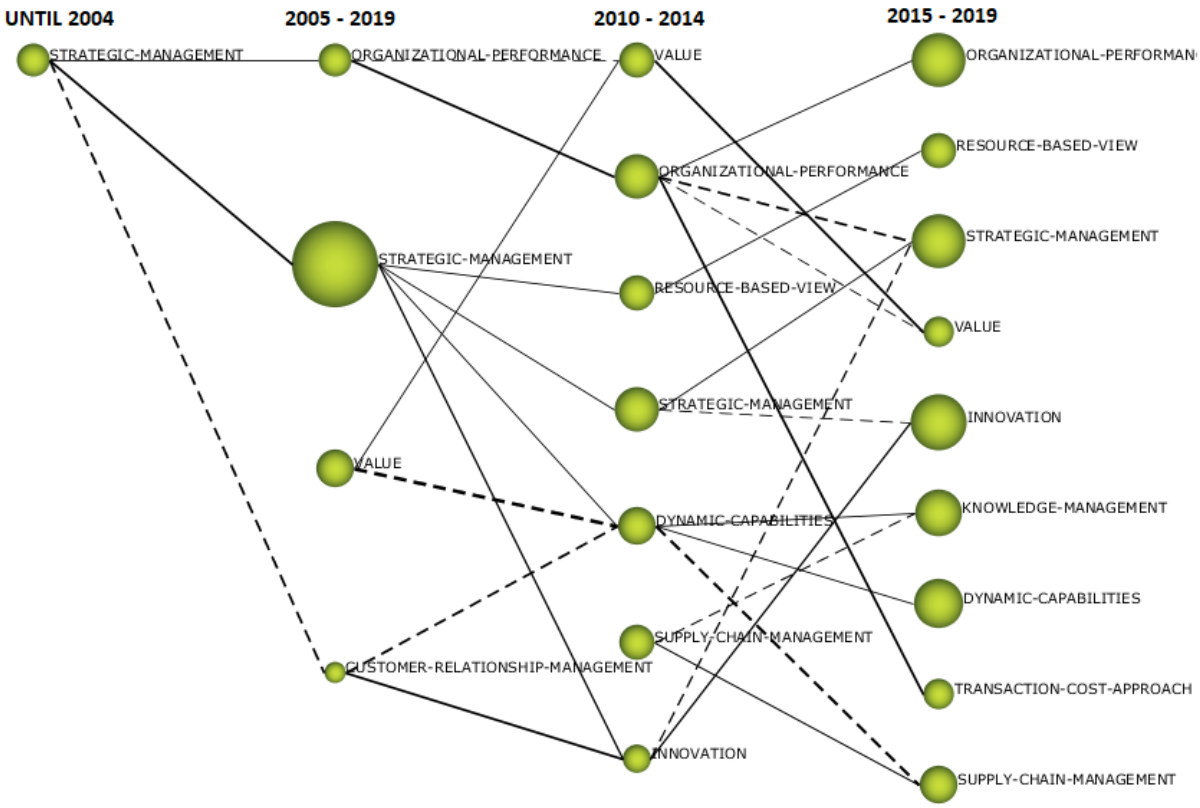

Figure 7: Thematic longitudinal analysis

Source: SciMAT

It is possible to visualize graphically the longitudinal evolution of the research fronts. The solid lines indicate that the existence of a relevant connection between thematic areas present in distinct periods. The dotted lines indicate that the connection, although present, is less relevant. The strength of the connection is also reinforced by the thickness of the lines. Finally, the volume of the spheres indicates the number of published studies (Cobo et al., 2011a). Thus, it is possible to identify the contributions and interrelations between the fronts over time. For example, studies associating IT capabilities and supply chain management have gained relevance between the years 2010 and 2014 (Liu et al., 2013). In the following period (2015 to 2019), the supply chain theme, in addition to forming a front, also contributes with research on IT capabilities and knowledge management (Leal-Millán et al., 2016).

4.3 Intellectual Structures

To identify the most important documents that gave rise to or influenced the current literature on IT capabilities, we applied the cocitation document analysis (Small, 1973). In view of the large number of articles, we established that references would be analyzed with at least 5 citations, that is, those with the greatest impact on the development of literature. In

addition, we manually excluded specific research methodology assignments to avoid distortions in the relations established by the citations. At the end, we selected 356 references for analysis. Considering the large number of references cited (10,967), we selected the fractional counting method, as recommended by Perianes-Rodriguez et al. (2016). The parameters for attraction and repulsion were set at 1 and 0 respectively.

Figure 8 shows a density map in which it is possible to observe the relations between the references. The studies located in the red areas present the greatest weight in terms of the total binding force of the references in the analyzed set. That is, they are those that are linked to several other references, forming pairs that are more frequently cited in the analyzed sample. This indicates that these are fundamental studies that represent the main intellectual structures of the literature on IT capabilities.

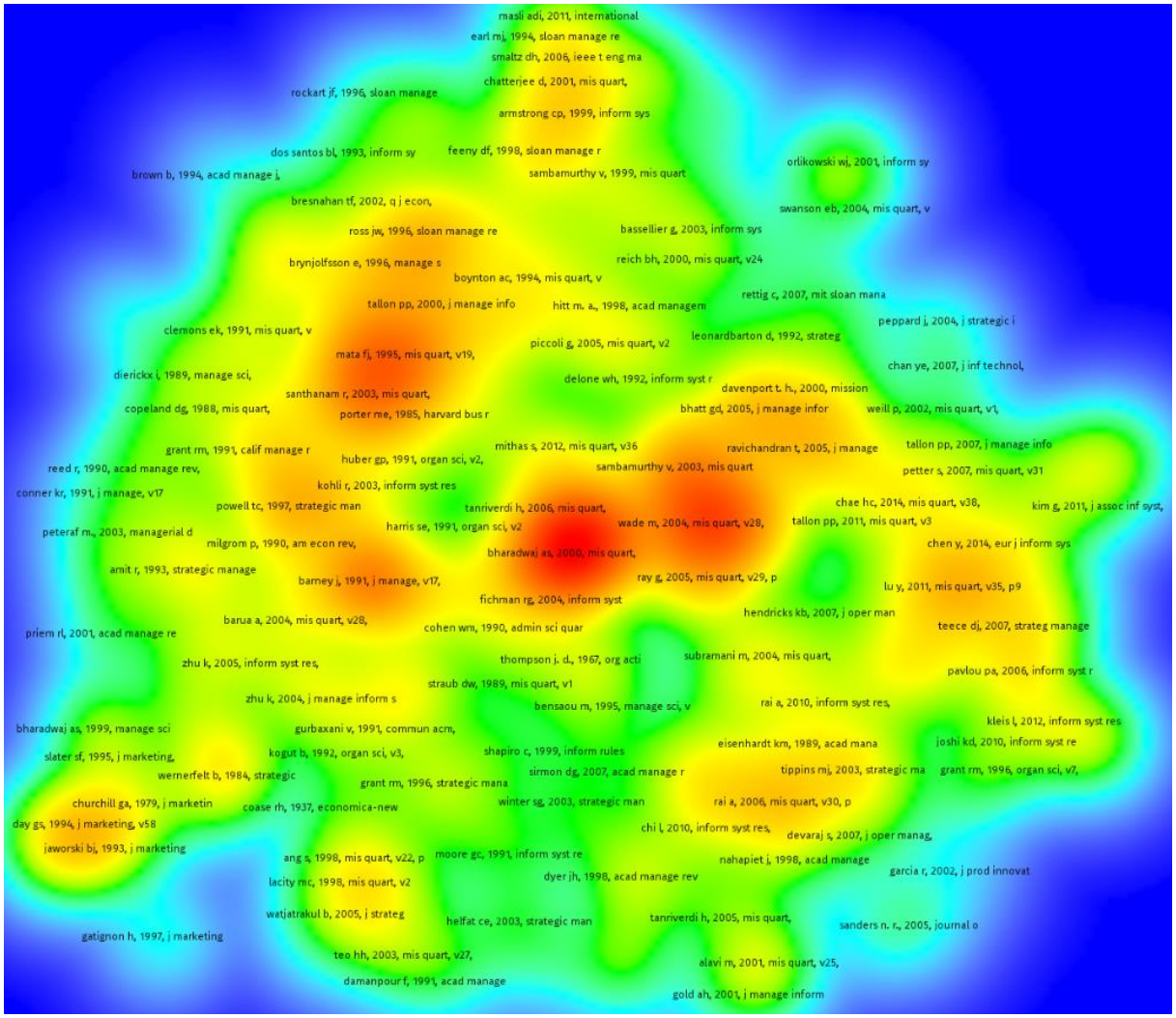

Figure 8: Intellectual Structures of the IT Capabilities Field

Source: VOSviewer

Among the main themes addressed by this central set of references, we highlight organizational performance (Bharadwaj, 2000; Ravichandran & Lertwongsatien, 2005), competitive advantage (Bhatt & Grover, 2005; Mata et al., 1995; Piccoli & Ives, 2017), organizational agility (Lu & Ramamurthy, 2011; Sambamurthy et al., 2003), leadership (Sambamurthy et al., 2003), IT and value (Melville et al., 2017), organizational learning and knowledge management (Tippins & Sohi, 2003), supply chain management (Rai et al., 2017; Subramani, 2017). The results also revealed that core study in various fields of the business area are fundamental for studies on IT capabilities, such as resource-based view (Barney et al., 2001; Wernerfelt, 1984), dynamic capabilities (Eisenhardt & Martin, 2000; Teece et al., 1997), absorption capacity (Cohen & Levinthal, 2006), as well as the literature on competitive advantage (Powell & Dent-Micallef, 1997; Ray et al., 2004).

4.4 Research fronts

In order to identify the latest research fronts involving IT capabilities, we applied the technique of the bibliographic coupling of articles on the scientific production published between the years of 2015 and 2019 (until April 5, 2019, date of the survey), as directed by the specialized literature (Zupic & Čater, 2015). We collected 92 studies, without applying criteria of number of citations. Thus, it was possible to identify the five fronts of research that presented themselves more clearly in the mapping process, as well as being very active, both in terms of production and quotations.

4.4.1 Business analytics

In the set of studies on IT capabilities, we identified an important research front whose studies involve the use of Big Data Analytics (BDA) in organizations. For example, Gupta and George (2016) identified several organizational level of resources that, in combination, build the capacity of analysis with DBA, as well as empirically validated the relationship between DBA and organizational performance. Jeble et al. (2018) analyzed the impact of the BDA and predictive analytical capacity on the sustainability of the supply chain, from the theoretical lenses of the resource-based view (RBV) and contingency theory. Wang and Byrd (2017), from the theories of dynamic capabilities and RBV, conceptualized the ability of business analysis as a multidimensional construct and have suggested that the effective use of data analysis and

interpretation tools in health units indirectly influences the effectiveness of decision making, this impact is mediated by the absorption capacity. Still in the health field, Wang and Hajli (2017) used the RBV and the capacity development vision to explain how BDA resources can be developed and what potential benefits can be derived from these resources. Wamba et al. (2017) associated the RBV theoretical lens with the literature on the success of information systems and the commercial value of IT to examine the effects of the BDA on organizational performance. Other relevant studies were on this front of research (Côrte-Real et al., 2017; Ghasemaghaei et al., 2018).

4.4.2 Ambidexterity

The results indicated that another recent and promising research front underlying the literature on IT capabilities of organizations involves the ambidexterity. For example, Heckmann and Maedche (2018) emphasize, from a qualitative approach, the importance of balancing the exploitation and exploration capacities of IT-based business processes. Ferraris et al. (2018) empirically addressed the relationship between the ambitious IT capabilities and the performance of business processes. Soto-Acosta et al. (2018) studied how IT, knowledge management and environmental dynamism influence the ambitious characteristics of innovation in the context of small enterprises based on the theory of Technology-Organization-Environment and the Knowledge-Based Vision. For example, Lee et al. (2015) empirically identified that IT ambidexterity increases organizational agility. On the same line, Mao and Quan (2015) studied the conditions under which IT capabilities enable agility, paying special attention to IT exploitation and exploration capabilities. Organizational agility, in turn, revealed the third research front identified in the present study.

4.4.3 Organizational agility

A central study for the research front that studies the subtopic organizational agility, in the context of IT capabilities is Felipe et al. (2016), in which the authors proposed an explanatory and predictive model of organizational agility, from the theory of dynamic capabilities. On the other hand, Queiroz et al. (2018) empirically studied the role of the orchestration capability of IT applications to improve agility and organizational performance. Panda and Rath (2016) investigated the apparently contradictory effect of IT ability on organizational agility. The authors identified that IT capacity acts as a facilitator for the

business process and for organizational agility. However, if IT investments are not adequately directed towards building higher capacity, can have a negative effect on organizational agility. Other important jobs that link IT capabilities and organizational agility have also been identified (Liang et al., 2017; Tan et al., 2017).

4.4.4 New products development

Another important focus of recent research involving IT capabilities is the new products development (NPD). For example, Kawakami et al. (2015), based on VBR, analyze whether there are three conditions (an IT executive advocate, global engagement, and organizational innovation) influence IT capabilities, which in turn affect the NPD results. Shortly after, Reid et al. (2016) empirically identified the impact of the use of IT artifacts on pre-development performance in the NPD process. On the other hand, Addas and Pinsonneault (2016), based on the literature on knowledge management, conceptualize team knowledge processes as distinct channels of influence and examine their mediating role in the relationship between IT resources and NPD performance. Finally, Mauerhoefer et al. (2017), based on IT value business literature, investigated empirically how the organizational antecedents, involving or not IT, translate into IT skills and competences, in the context of NPD, as well as its impact on NPD performance.

4.4.5 IT Supply

Finally, the last research front selected for the present research studies the various means, conditions, and strategies for IT supply. For example, Tebboune and Urquhart (2016) studied the phenomenon of netsourcing (rent or payment by consuming access to centrally managed business applications and made available to third parties via the internet) from the RBV and the theory of transaction costs. On the other hand, Schneider and Sunyaev (2016) studied the determining factors for IT outsourcing decisions based on the cloud computing strategy, by means of an extensive literature review. Tiwana and Kim (2016) dedicated to studying the growing trend of simultaneously, internally structure and hire the same IT activity (concurrent IT sourcing). According to the authors, the results indicated that when an organization's internal resources complement the resources of its IT vendors, companies can internally maintain and simultaneously outsource the same IT activities, to improve the performance of internal and outsourced IT structures. This theme has also been studied by Hanafizadeh and Zare Ravasan (2018).

4.6 Opportunities for new IT Capabilities research projects

Based on these active research fronts identified in section 4.4 of this paper, we were able to identify a diverse range of untapped opportunities that could generate insights for new research projects on the topic of IT Capabilities. Therefore, as a complement to the analysis of the bibliographic coupling and the mapping of scientific production, we carry out a qualitative analysis of the studies associated with each front. Thus, several research opportunities related to each front can provide valuable insights for researchers interested in the field. About business analytics, for example, in view of the growth in the number of data-driven companies, future research can compare the adoption and development of BDA between these companies and the traditional ones (Gupta & George, 2016). Future research may also operationalize the construct analysis capability from the actual impact of the use of BDA, and not just based on perceptions (Jeble et al., 2018). Another opportunity is to apply, in a sample with characteristics different from the original, a confirmatory factor analysis on the new scale of analytical capacity proposed by Wang and Byrd (2017). Alternating to the front that studies the ambidexterity, future research can take a quantitative approach to validate the recent model of IT business process capabilities proposed by Heckmann and Maedche (2018). Future research may also direct the focus to strategies involving explorative change, as well as to analyze if different combination strategies have the same impact depending on the uncertainty characteristics of this business process, considering that exploitation is more valuable in dynamic environments (Ferraris et al., 2018). At the front on organizational agility, it is still necessary to identify the main antecedents of the orchestration capacity of IT applications, as well as investigating how the orchestration capability of IT applications and the characteristics of the resource allocation process jointly influence the agility and performance of the enterprise (Queiroz et al., 2018). Another possibility on this front involves investigating whether social alignment between IT and business executives can lead to cognitive inertia, negatively impacting organizational agility (Liang et al., 2017). In relation to the front involving IT and NPD capabilities, future studies may consider the differences in country infrastructure when examining the impact of the frequency of use of IT artifacts on NPD performance, as well as examining the frequency and importance of IT artifacts at any stage of the NPD process, not just from the pre-development stage (Reid et al., 2016). Future studies can examine how NPD-related IT capabilities and competencies affect other organizational capabilities (as marketing capability) or organizational results (such as product quality or degree of innovation). Another gap is the need to explore tools or IT functionalities directed to NPD project management, not only those applicable at the operational level (Mauerhoefer et al., 2017). Finally, in the field of IT supply,

future research can adopt a quantitative approach to empirically validate the propositions about net sourcing strategies presented by Tebboune and Urquhart (2016), as well as to extend the investigation using other theoretical references, such as agency theory or resource dependency theory, in order to increase the consistency of results. Other examples of advancement opportunities can be the conceptualization of IT resources in a multidimensional way, including infrastructure assets and cultural elements of the organization. Further studies may also consider other delivery modalities related to IT outsourcing, such as multisourcing, conic integration or parallel outsourcing (Tiwana & Kim, 2016). These and other opportunities fostered by the research fronts indicate that the topic of IT capabilities still has much to develop, which makes it a fertile and promising path for researchers in the area of management and IT.

Table 2 summarizes these and other opportunities identified for advancing research in the context of IT capabilities.

Table 2: Research opportunities on each research front

Research Front	Source	Opportunities
BUSINESS ANALYTICS	**Gupta and George (2016)** Toward the development of a big data analytics capability	- Extend the Big Data Analysis Capability model from tangible, human and intangible resources, specifically related to the context of "big data". - Assess the differences between traditional companies and new generation companies, strongly based on Technology (such as UBER, AirBNB) in terms of adoption and development of Big Data Analyzes Capability. - Validate the research tool presented by the authors, from data sources other than Linkedin, as well as validating the results achieved in other cultural and economic contexts, in addition to the United States.
	Jeble et al. (2018) Impact of big data and predictive analytics capability on supply chain sustainability.	- Evaluate the causal relationships proposed by the study, involving Big Data & Predictive Analytics and supply chain performance, from a longitudinal perspective. - Build and validate more comprehensive scales for BDPA capacity, as well as measuring its real (not just perceptual) impact on sustainable supply chain performance measures. - Obtain and analyze data from a larger number of markets, countries and informants with different experiences to improve the generalization of the conclusions of the presented study.

Wang and Byrd (2017) Business analytics-enabled decision-making effectiveness through knowledge absorptive capacity in health care.	- Investigate possible facilitating, moderating and mediating effects of factors such as IT human resources, dynamic and improvisational capabilities, as well as specific organizational resources (such as data governance, synergy and culture) in the relationship between knowledge absorptive capacity and Business analytics-enabled decision-making effectiveness. - Analyze the complexity of the interaction and possible interdependence between the factors described above, as well as examining how different organizational settings influence value creation.
Wang and Hajli (2017) Exploring the path to big data analytics success in healthcare	- Validate the model proposed by the authors from the use of academic data and information, in view of the evolution of research in the area studied by the authors, as well as assessing the role of additional variables, such as hospital size and type of institution (public or private). - Apply the Big Data analysis model proposed by the authors to other sectors besides the health sector, in order to validate the general use capacity of the model. - Apply quantitative approaches to validate the proposed model, to obtain empirical evidence that corroborates the results presented by the authors.
Wamba et al. (2017) Big data analytics and firm performance: Effects of dynamic capabilities.	- Apply the conceptual model presented in other market and cultural contexts. - Apply a longitudinal approach to validate the results presented. - Use objective performance measures (not perceptual) - Adapt the research tool presented to other contexts (for example, customer analysis, supply chain analysis, etc), through rigorous statistical procedures. - Analyze the effects of organizational culture and senior management commitment, possibly with a moderating effect on the relationships proposed by the authors.
Côrte-Real et al. (2017) Assessing business value of Big Data Analytics in European firms.	- Apply a longitudinal approach to validate the results found by the authors. - Adapt and test the conceptual model, moving from the organizational level to the process level, in specific business areas. - Use objective (non-perceptual) performance measures - Apply the model to countries that are not fully developed, to compare the results and identify any differences with the results

		achieved in the European context. - Identification of possible differences between European regions.
	Ghasemaghaei et al. (2018) Data analytics competency for improving firm decision making performance	- Analyze the influence of other organizational factors, such as, for example, the type of organizational structure or the specificity of the business processes, in the relationship between competence for data analysis and the performance of the decision-making process. - Validate the results found in longitudinal surveys and in economic and cultural environments other than the North American. - Include other 'big data' features in the model, such as Value, and Veracity. - Include the decision type variable in future tests of the conceptual model, to identify the application of the model to specific decision-making contexts, such as marketing, recruitment, for example.
AMBIDEXTERITY	**Heckmann and Maedche (2018)** IT ambidexterity for business processes: the importance of balance	- Continue the process of theoretical development initiated by the authors, based on the application of complementary approaches, such as configurational, for example, as well as the inclusion of contextual factors. - Replicate the proposed model to other cultural, organizational and economic contexts, besides the German electric sector, to increase the power of generalization of the model. - Identify the impact of business process ambidexterity on the company's performance, based on a real process. Apply longitudinal approaches, considering that the organizational ambidexterity, by nature, evolves during the temple.
	Ferraris et al. (2018) Ambidextrous IT capabilities and business process performance: an empirical analysis	- Investigate more focused exploratory change to the detriment of exploitative execution, especially at the business process level, as well as different if combination strategies have the same impact, depending on the uncertainty characteristics of each business process. - Investigate the generalization potential of the results presented by the authors, from the replication of the study in other cultural and economic contexts, in addition to the Italian hospitality industry, as well as from the extension of the study with the application of longitudinal approaches.

	Soto-Acosta et al. (2018) Information technology, knowledge management and environmental dynamism as drivers of innovation ambidexterity: a study in SMEs	- Expanding the base of companies to be studied in future research, from a sampling base that brings together companies from different countries could be used to provide a more international perspective on the subject, as well as the use of different informants in each organization, not being restricted to the key informant method used by the authors. - Expansion of the number of factors whose relationships can be studied together with although the IT capacity, knowledge management capacity and environmental dynamism, such as organizational culture, leadership and open innovation. - Use objective financial indicators to measure organizational performance, going beyond the application of perceptual measures.
	Lee et al. (2015) How Does IT Ambidexterity Impact Organizational Agility?	- Investigate possible changes in the relationship between ambidexterity and IT agility in different business environments and conditions (high and low dynamics, for example). - Examine further how other potential capabilities and conditions can interact with the IT ambidexterity to enable organizational agility or other types of dynamic capabilities (for example, ability to develop new products), especially under the different environments conditions. - Expand research on the emerging capacity of IT ambidexterity and its impact on companies. In particular, instead of examining IT ambidexterity as a combined capability, IT exploration and IT exploitation resources can be segregated and examined in terms of different values of their various combinations in different business conditions.
ORGANIZATIONAL AGILITY	**Queiroz et al. (2018)** The role of IT application orchestration capability in improving agility and performance	- Investigate whether the characteristics of the resource allocation process, as formalization and centralization incorporated into IT governance processes, structures, and relationships, influence the orchestration capacity of IT applications. - Analyze how the orchestration capacity of IT applications and the characteristics of the resource allocation process jointly influence the agility and performance of the company. - Study how the orchestration capacity of IT applications relates to the ability to achieve and maintain the alignment between IT and business strategy - Investigate the main antecedents of IT application orchestration capacity, such as governance processes, outsourcing, supplier relationship management and change management.

		- Explore the possible role of environmental factors in explaining the effects of IT application orchestration capacity, such as market turbulence and uncertainty.
	Panda and Rath (2016) Investigating the structural linkage between IT capability and organizational agility	- Investigate the ability to generalize results from complementary research projects, such as longitudinal or experimental, to further explore the causal relationship between IT capacity and organizational agility. - Analyze the potential of IT capabilities as a facilitator for superior agility and agile ability of companies to build greater IT capacity (enabler for superior agility and agile firms' ability to build greater IT capability). - Investigate the company's effective use of IT to develop resources and increase agility at the business process level, as well as at the corporate level.
	Liang et al. (2017) Unraveling the alignment paradox: How does business-IT alignment shape organizational agility?	- Extend the scope of the investigation to other cultural and economic contexts, beyond the Chinese shipbuilding industry, as well as applying longitudinal approaches, to test the power of generalization of the results found by the researchers. - Deepen the conceptual model presented, including the analysis of the relationship between social alignment and cognitive inertia. Expand the conceptual model presented, making it more comprehensive. For example, examining how inertia is shaped under intellectual alignment is a promising line of research.
NEW PRODUCTS DEVELOPMENT	**Kawakami et al. (2015)** Information technology tools in new product development: The impact of complementary resources	- Evaluate the ability to generalize the results, based on replication of the study in diverse cultural and economic environments in Japan, with emphasis on Latin America, as well as applying longitudinal research approaches. - Expansion of the model proposed by the authors, testing contingent relationships. For example, asset specificity is a potential moderator. In addition, future research can capture several other constructs related to IT tools and investigate whether there is a second order construct that can be labeled "IT tool competence for NPD", which is a source of sustained competitive advantage. - Examine whether different contexts (for example, product innovation, nature of global partners) can alter this relationship

	between global engagement and the frequency of IT tool replacement.
Reid et al. (2016) The impact of the frequency of usage of IT artifacts on predevelopment performance in the NPD process	- Examine the conceptual structure in specific sectors to determine the importance of these relationships in the model proposed by the authors. - Expansion of the scope of the research to other environments, cultural, economic and technological, in addition to the one used (Australian companies). - Examine the frequency of use and the importance of specific IT artifacts and their influence at any stage of the NPD process, for example, how ideation software applications are used inter-organizationally to promote the co-creation of ideas in the pre-development stage.
Addas and Pinsonneault (2016) IT capabilities and NPD performance: Examining the mediating role of team knowledge processes	- Deepen research into the consequences of using IT to enable external knowledge processes, either vertically (for example, co-developing products with customers or suppliers) or horizontally (for example, product co-development with alliance members), and how it all influences the efficiency and effectiveness of the NPD. - Apply the conceptual framework to dynamic NPD environments, but with caution, as such environments may require other types of IT resources and KM processes, such as dynamic IT capabilities, absorption capacity and reconfiguration of knowledge. - Investigate the role of NPD team leaders in the proposed conceptual model. Specifically, it can be suggested that the characteristics of the NPD team leader can influence the types of IT used in the NPD teams and also have a direct effect on the team's knowledge processes.
Mauerhoefer et al. (2017) The Impact of Information Technology on New Product	- Include in the model the potential dynamic effects of IT resource development and IT leverage competency, for example, examining the time patterns of changes in NPD IT capabilities and competencies resulting from investments in new IT tools, from the introduction of a formal executive champion role or other non-IT background. - Expand the conceptual model by examining contingencies and

	Development Performance	other antecedents and results of NPD's IT capabilities and competencies. For example, investigating IT spending (for example, on hardware, software or training) as a moderator of the relationships between company-level IT resources or executive champion and NPD IT resources can help identify the appropriate level of NPD IT investments. - Extend the scope of the research to other cultural and economic environments, in addition to the German business. - Explore the existence of certain IT tools or IT functionality that are important to NPD managers who conduct one or more NPD projects (that is, IT features that support management tasks), instead of members of the NPD team (i.e. IT features that facilitate operational tasks). - Analyze how NPD IT capabilities and competencies affect other capabilities (for example, technological or marketing capabilities) or other performance metrics (for example, product quality, degree of innovation). In this sense, it is suggested to use the updated concept of IT leverage competence in NPD.
IT SUPPLY	**Tebboune and Urquhart (2016)** Netsourcing strategies for vendors: A resource-based and transaction cost economics perspective	- Expand the sample size in future research, as well as the inclusion of other theoretical lenses, such as agency theory and resource dependency theory.
	Schneider and Sunyaev (2016) Determinant factors of cloud-sourcing decisions: Reflecting on the IT outsourcing literature in the era of cloud computing	- Direct attention to factors other than technology characteristics, such as organizational, individual and environmental characteristics, in the context of cloud outsourcing decisions - Distinguish environmental uncertainty from demand uncertainty and product uncertainty to clarify inconsistent findings in the context of cloud computing. - Extend research on IT outsourcing by including technological aspects, such as security risks, availability risks, perceived complexity of innovation, reduced time to market and supplier service resources. - Apply a micro-level perspective to investigate cloud outsourcing decisions, as well as combine factors from strategic and economic theories with factors from social or organizational theories,

	particularly determining factors of the categories individual characteristics and environmental characteristics.
Tiwana and Kim (2016) Concurrent IT Sourcing: Mechanisms and Contingent Advantages	- Explore the possible effects of other factors that affect the simultaneous benefits of IT outsourcing, as well as other consequences, such as IT ambidexterity. Examples of factors include whether the client outsources primarily to access experience or to reduce costs, inter-firm asymmetries in the maturity of IT capacity, formal control mechanisms used and interfirm energy asymmetry. - Conceptualize IT Capabilities at the company level in a multidimensional way that include IT infrastructure assets and cultural elements of the company's capabilities
Hanafizadeh and Zare Ravasan (2018) An empirical analysis on outsourcing decision: the case of e-banking services	- Use user-centered theories to analyze the IT outsourcing process, especially the theory of planned behavior (TPB), focusing on user adoption and acceptance. - Test the power of generalization of the results presented, based on longitudinal strategies and comparisons of results obtained in contexts of greater or lesser economic development. In addition, differences in context, client size or even selected outsourcing strategy can be analyzed. - Analyze the effect of the outsourcing strategy, as well as the public or private type of the client organization, as well as studying the IT outsourcing process from the perspective of different stakeholders from IT executives, as business owners, CEOs and people whose careers are influenced and even threatened by outsourcing initiatives. - Consider the concept of IT portfolio outsourcing, instead of outsourcing IT services and processes in isolation.

Source: Authors own work

5. Conclusions

This study aimed to analyze the scientific literature on IT capabilities, revealing its conceptual and intellectual structures and presenting the state of the art of research in the field. We analyzed 219 studies through the innovative use of three complementary software and the application of several bibliometric techniques. As a result, we provide a consistent and harmonious narrative about the origin, evolution, and future of IT capabilities research for the

academic community. The fundamental themes for structuring the scientific production on IT capabilities, which had a higher level of development and connection with external research flows, include organizational performance, strategic management, resource, and value-based views. Future researchers will find a rich and varied literature involving these major themes and various sub-themes associated with each driving theme, as presented in the article.

Another contribution of this study is the presentation of the main intellectual structure of the field to the academic community, i.e., studies with high levels of co-citation that can be grouped into relatively cohesive thematic blocks. These study clusters explore topics such as organizational performance, competitive advantage, organizational agility, leadership, organizational learning, knowledge management, IT use and value, and supply chain management. Another significant contribution of the study was the identification of the main paths that researchers have taken in recent years, representing the state-of-the-art literature on IT capabilities. In this sense, we highlight recent research on business analytics, ambidexterity, organizational agility, new product development, and IT supply. These five themes represent the main working fronts in the field.

5.1 Implications

Our findings have several implications for both academics and practitioners. The identification of key themes and intellectual structures provides a foundation for future research and offers a roadmap for exploring new areas within IT capabilities. The highlighted themes of organizational performance, strategic management, and resource-based views suggest that IT capabilities are integral to achieving competitive advantage and improved performance.

Additionally, the exploration of business analytics reveals how data-driven decision-making processes can significantly enhance organizational efficiency and innovation. The integration of IT capabilities with strategic management practices highlights the importance of aligning IT initiatives with business goals to maximize performance outcomes. The study also underscores the role of IT capabilities in fostering organizational agility, enabling firms to respond swiftly to market changes and technological advancements.

For practitioners, insights into emerging research fronts such as IT ambidexterity and new product development can inform strategies to leverage IT for innovation and agility. The findings suggest that companies should invest in developing IT capabilities that support both exploitation and exploration processes to maintain a competitive edge. Moreover, understanding the role of IT in supply chain management can help organizations optimize their logistics and improve overall supply chain performance.

The study also emphasizes the importance of human factors in IT capability development. The role of IT human capital, including technical skills and attitudes towards technology, is crucial in driving IT-enabled innovation and organizational performance. Therefore, practitioners should focus on enhancing IT-related competencies and fostering a culture that supports continuous learning and adaptation.

5.2 Limitations and Future Research

Like all scientific research, this study has limitations, including those resulting from the choice of keywords and the use of only one database. Future studies can broaden the scope by including studies published in the Scopus database, which is considered more comprehensive. This would be especially useful for mapping smaller, non-WoS-covered research areas. Researchers should also be aware of the differences between databases, such as Scopus containing data for all authors of cited references, unlike WoS, which only includes the first author, potentially causing distortions in citation and co-citation analysis.

Further advancements in bibliometric approaches could involve developing software that integrates databases and allows the transfer of pre-processed data between various bibliometric software in a more intuitive manner. This would enable researchers, even those not proficient in database usage and programming languages, to perform comprehensive bibliometric analyses of the literature. Additionally, future research could investigate the impact of IT capabilities on other organizational outcomes, explore the role of IT in different cultural and economic contexts, and validate the findings using longitudinal data and objective performance measures.

Future studies could also delve into the dynamic effects of IT resource development and IT leverage competency. For instance, examining the time patterns of changes in IT capabilities resulting from investments in new IT tools or the introduction of executive champion roles could provide deeper insights into the evolution of IT capabilities. Expanding the conceptual model to include contingencies and other antecedents of IT capabilities, such as IT spending and its impact on performance, would enhance our understanding of the factors that drive IT capability development.

Another area for future research is the exploration of specific IT tools or functionalities that are critical for different organizational processes, such as new product development (NPD) management. Investigating how NPD-related IT capabilities affect other organizational capabilities, such as marketing or technological capabilities, and their impact on various

performance metrics, such as product quality and innovation, would provide valuable insights for both researchers and practitioners.

Finally, based on the analysis presented in this article, which aimed to identify the theoretical foundations and underpinnings of the literature on IT capabilities, we highlight that the studies analyzed up to 2019 remain highly cited and influential in the field of IT management. Therefore, future research can benefit from investigating how the COVID-19 pandemic impacted IT capabilities in organizations, comparing the strategies and adaptations adopted during the pandemic with previous practices to identify significant changes and their long-term implications. Additionally, with the rapid advancement of emerging technologies such as artificial intelligence, blockchain, and the Internet of Things (IoT), future studies can focus on how these new technologies are being integrated into IT capabilities and their impacts on organizational performance and innovation. The analysis of data up to 2019, the pre-COVID-19 period, creates a clear and well-defined starting point for subsequent longitudinal studies, allowing future researchers to track the evolution of IT capabilities and analyze trends and changes over time more deeply.

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