Digitalization and business models: where are we going? A science map of the field

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Abstract

Scientific research on digitalization and its impact on business models has been growing exponentially in recent years. This has been particularly evident from 2010 onwards, following a landmark special issue published in *Long Range Planning*. This article offers an overview of the development of academic literature published between 2010 and 2019 with regards to the relationship between digitalization and business models in 198 peer-reviewed articles. By applying a novel methodological approach to compare results from different bibliometric analyses, such as the analysis of citations, co-citations, bibliographic coupling, and co-occurrences of keywords, we have identified the most influential journals, authors, and articles, as well as three thematic clusters (technological

innovation, strategic management, and digital transformation). For each cluster, the most relevant contributions are presented. Promising research areas and future research directions are identified to address the existing gaps in knowledge.

Keywords: Business models; digitalization; bibliometric; co-citation; keywords analysis; bibliographic coupling; VOSViewer.

1. Introduction

Organizations across the world are paying more and more attention to the development of new technologies in order to adequately adapt their strategies to new market needs and stimuli. In recent years, the trend has been spurred on by the introduction of new innovations, such as the Internet of Things (IoTs) and Artificial Intelligence (AI) (Bresciani, Ferraris, & Del Giudice, 2018; Caputo, Marzi, & Pellegrini, 2016; Snabe Hagemann & Weinelt, 2016). Digitalization trends are disrupting the ways in which firms do business (Fakhar Manesh, Pellegrini, Marzi, & Dabić, 2020). Crises and collapses that have affected firms such as Blockbuster and Kodak. These firms were not able to innovate their business models to survive digital technological shifts and new economic paradigms (Chesbrough, 2010; Wirtz, Schilke, & Ullrich, 2010). This could be considered an effective representation of the impact generated by the development of new forms of technology characterized by a high degree of digitalization (Raffaelli, Glynn, & Tushman, 2019). Similarly, the digitalization of markets, services, and products has also triggered the quick development of more agile firms, such as Airbnb, Uber, Facebook, and many others. These companies are able to innovate their business models to ride technological waves and exploit the opportunities offered by hyper competitive markets (Ritter & Lettl, 2018; Teece, 2018).

The relationship between trends triggered by technological innovation (such as digitalization) and business model innovation is characterized by different theoretical levels of analysis (Baden-Fuller, Demil, Lecoq, & MacMillan, 2010; Christoph Zott & Amit, 2010). The relevance of the topic is connected to the strategic relevance of the business model. According to Teece (2010, p.1), business

models represent “the manner by which the enterprise delivers value to customers, entices customers to pay for value, and converts those payments to profit”. Thus, the digitalization of processes and societies could impact upon business models on several levels. Specifically, prior studies have highlighted the difference between “disruptive technologies” and “disruptive business models” (Cozzolino, Verona, & Rothaermel, 2018), wherein “disruptive technologies” and “disruptive business models” create “different kinds of markets, pose radically different challenges for established firms, and have radically different implications for managers” (Markides, 2006, p. 19). Our research concurs with Cozzolino and colleagues (2018) by theoretically distinguishing between the development and introduction of disruptive technologies and the exploitation of new technologies through business model innovation. Indeed, a large number of innovative firms have based their competitive advantage on technological innovations, such as additive manufacturing (Caputo et al., 2016; Fakhar Manesh et al., 2020), rather than on effective business model innovation. Conversely, others have successfully innovated business models that rely on or rejuvenate existing technologies, such as the adoption of an agile or just-in-time approach (Baden-Fuller & Haefliger, 2013).

Despite the importance of the topic with regards to both scholarly research and managerial practices, along with the increased attention paid to business models in academic literature pertaining to strategy, we still have a limited understanding of the ways in which business models are innovated in the wake of technological changes and disruptive innovations (Cozzolino et al., 2018; Foss & Saebi, 2018; Wirtz, Pistoia, Ullrich, & Göttel, 2016; C Zott, Amit, & Massa, 2011). Thus, in this paper, we focus our attention on the relationship between digitalization - a specific form of disruptive technological change - and business model innovation, with particular reference to the developments that have occurred over the last decade.

In the academic panorama, a special issue on business models by *Long Range Planning* (Baden-Fuller et al., 2010) is particularly significant in this shift. Shedding light on the evolution of business models ignited by the digitalization process, a bibliometric analysis of 198 articles published in peer-reviewed scientific journals has been performed in order to systematize academic contributions and knowledge regarding the digitalization of business models after 2010. Specifically, an innovative

approach has been deployed in comparing and contrasting results from alternative bibliometric tools (i.e. citations, normalized citations, and bibliographic coupling) in order to identify the most influential articles in the field. This study provides several contributions: both theoretically, by identifying the most influential articles in the field, clustering the research themes (technological innovation, strategic management, and digital transformation), and drawing a research agenda for future research; and methodologically, by adopting an innovative and comparative approach to bibliometric analysis that lessens the inherent biases of each form of bibliometric analysis.

2. Business models and digitalization: an overview

Although digital changes have been thoroughly investigated by academics, digital transformation, digitalization, and digitization are terms that are often used interchangeably by management scholars. For the purpose of this study, which is the investigation of digitalization and business model research, clarification is thus needed. Digital transformation, often used in broad terms, refers to strategic transformations targeting organizational changes implemented through digitalization projects, with the goal of enabling major business improvements (Warner & Wäger, 2019). Digitization, however, is the transition from analog information to a digital format, such as converting a book from typewritten text into a digital form (Brennen & Kreiss, 2016). Finally, digitalization represents a wide sociotechnical process and implies the integration of multiple technologies into aspects of daily social life, examples of which can be smart homes, e-healthcare, smart mobility, and smart cities (Brennen & Kreiss, 2016). Despite these differing definitions, all of these trends instigate new competitive contexts and increase the need for new managerial capabilities, expanding the boundaries of the firm (Caputo, Fiorentino, & Garzella, 2019). This is why Autio et al. (2018) have posited that "digitalization creates potent digital affordances that likely have a transformative effect upon the organization of economic activity by supporting radical business model innovation".

For all of these reasons, the last decade has been preoccupied with the speedy development of new business models characterized by a high degree of digital innovation (Ferraris, Mazzoleni, Devalle, & Couturier, 2019). Contrary to prior technological innovations, this digitalization has concerned both

innovative and traditional sectors, which typically are not characterized by high degrees of technological investment (Teece, 2010; Warner & Wäger, 2019). Furthermore, digitalization has stimulated and favored competition in markets characterized by several legal and financial barriers related to licenses or financial investment, offering a competitive advantage to firms such as Uber, Spotify, and Airbnb over incumbents (Ritter & Lettl, 2018). Moreover, this digitalization has reduced the resource gap between large and small/medium enterprises, which typically affects market dynamics, as lots of resources are now virtually accessible with limited costs and effort (Scuotto, Santoro, Bresciani, & Del Giudice, 2017).

In terms of business model impact, one of the main innovations introduced by digitalization is the development of new forms of business models characterized by decreased reliance on physical elements (Erevelles, Fukawa, & Swayne, 2016). While initial studies of business models explicitly recognize the central role of physical elements (Dasilva & Trkman, 2014; Demil & Lecocq, 2010), current and emerging forms of business models are prominently based on the adoption of digital infrastructures (Warner & Wäger, 2019), with the creation of new business model archetypes characterized by the dematerialization of processes (Snabe Hagemann & Weinelt, 2016). The development of these new archetypes requires the adoption of digital strategies in order to achieve the highest degree of resource effectiveness (Wirtz et al., 2010). A typical example is represented by the development of new forms of enterprises, i.e. platforms that serve as a hub between buyers and sellers in the exchange of goods and services (Velu, 2015).

However, although positive externalities are related to higher degrees of competitive advantage, the process of a firm's digitalization could also be influenced by factors not directly linked to economic reasons. Indeed, the age of the firm, the presence of women in strategic decisions, and the firm's sector of origin can favor digitalization (Ferreira, Fernandes, & Ferreira, 2019; Warner & Wäger, 2019). Conversely, digitalization can be hindered by rigidities caused by both external and internal systems (Doz & Kosonen, 2010). Prior studies have highlighted the ways in which the transition to new business models is characterized by a high degree of complexity. This is caused by the obvious existence of threats and opportunities related to the introduction of a new technology within the specific processes

of an enterprise (Saebi, Lien, & Foss, 2017). In particular, Chesbrough (2010) suggested that the effects related to the introduction of new technological devices are influenced by the overall quality of business models. Furthermore, some business models are intrinsically characterized by their resistance to change, based both on prior experience and the traits of the company (Maslach, 2016). According to this evidence, a mediocre technology applied to a great business model might be more valuable than a great technology exploited by a mediocre business model (Chesbrough, 2010).

3. Methodology

To provide a comprehensive map of the knowledge structure of the relationship between digitalization and business models, consistent with recent trends in bibliometric research (Caputo, Marzi, Maley, & Silic, 2019; Dabić et al., 2019), we used several complementary bibliometric analyses (Ferreira, 2018) based on a database search that followed the systematic review protocol (Tranfield, Denyer, & Smart, 2003). Results from the different analyses were then compared in order to identify most influential journals, authors, articles, and research themes.

3.1. Database and search protocol

A systematic search was performed using the Web of Science Core Collection (WOS) database during October 2019. This was cross-validated using other databases (Scopus and EBSCO). Considering the results of the cross-validation and the maturity of the business model field, WOS was chosen as it yielded the highest quality of publications and was reliable in its indexing of highly ranked journals (Caputo, Marzi, et al., 2019; Raghuram, Hill, Gibbs, & Maruping, 2019). Using the WOS database (Business and Economics), as opposed to using a selection of relevant journals, was preferred as this avoided potential biases and/or omissions that could have occurred in the final set of selected articles. This also allowed for the future replication of our study (van Eck & Waltman, 2014). To limit the risk of researcher bias, a panel of external experts was formed to outline the protocol and thus set the boundaries of the field of research, choose the keywords and the database, and establish a set of

inclusion criteria based on the most generally accepted definitions of 'business model' (Teece, 2010) and 'digitalization' (Brennen & Kreiss, 2016). Consistent with the purpose of this research, the time limit allowed for this search was from 2010 - the year of publication of the *Long Range Planning* Special Issue on business models - until 2019.

The search for data in WOS was done according to following search string. The keywords: "*digital**" and "*Business model**" needed to be present in the title, abstract, or keywords of the articles in order to ensure the comprehensive nature of our search. With regards to the publication language, consistent with both the best practices in systematic review studies and the nature of our research, English was chosen as the search language. When it came to the document type, only articles published in peer-reviewed journals were selected, as these contained the most reliable knowledge. Through these search criteria, we retrieved an initial sample of 241 documents.

Given the broad scope of our search strings and the fact that many of the retrieved publications were multidisciplinary, a filtering process - which required the independent reading of abstracts by two of the authors - was carried out. To ensure inclusiveness and limit human errors, all of the resulting records were then matched and disagreements were solved through a panel discussion involving all of the authors and the external panel of experts. Forty-three articles were excluded from the analysis, either because they were out of the scope of the present study (e.g. information systems studies about technical issues) or simply because they addressed other research topics not directly related to digitalization and business models (e.g. leadership skills in the digital era). This procedure was fundamental to obtaining an appropriate sample because, despite mentioning 'digital' and 'business model' in their keywords, some articles dealt with different topics, such as the inclusion of digital business models in information systems education curricula (Fichman, Dos Santos, & Zheng, 2014). The result was a final sample of 198 articles that formed the basis of the bibliometric analyses. This size is consistent with other bibliometric studies (Caputo, Marzi, Pellegrini, & Rialti, 2018; Ferreira, 2018), confirming the appropriateness of the research design and protocol. As a measure of the reliability of the selection process, out of the top 50 most cited articles from the first sample, only 4 (8%) were excluded from the final dataset.

3.2. Bibliometric analysis

Bibliometrics analysis, in scientometric disciplines, applies statistical methods to the study of scientific activities in a field of research (Broadus, 1987). Bibliometrics combines two main procedures: performance analysis and science mapping (Aria & Cuccurullo, 2017). Performance analysis is based on *activity indicators* (Mingers & Leydesdorff, 2015), which provide data pertaining to the volume and impact of research through the use of a wide range of techniques, including word frequency analysis, citation analysis, and publications counted by a unit of analysis (e.g., authorship, country, affiliation, etc.). Science Mapping is based on *first and second generation relation indicators*, which provide a spatial depiction of the ways in which different scientific elements are related to one another (Caputo, Marzi, et al., 2019; McCain, 1990). The objective of science mapping is to show the structural and dynamic organization of knowledge for the field of research under investigation (Iwami, Ojala, Watanabe, & Neittaanmäki, 2020). To overcome the limitations pertaining to every synthetic indicator, prior studies advocate the use of more than one indicator (Marzi, Dabić, Daim, & Garces, 2017). In this study, we therefore innovatively adopt a comparative approach to bibliometrics by integrating the results of different bibliometric analyses, namely co-citation, bibliographic coupling, and the co-occurrence of keywords.

Co-citation analysis measures the similarity between articles, authors, or journals through the frequency by which two items are independently cited by one or more items (Dabić, González-Loureiro, & Harvey, 2015; McCain, 1990). This analysis relies on the assumption that, when items are cited together, they are more likely to be related. Due to the time necessary for publications to be produced and citations accumulated, co-citation analysis offers a dynamic representation of a topic from the past, rather than the present or the future (Caputo, Marzi, et al., 2019). Bibliographic coupling analysis shows when two articles cite a common third article, suggesting that the two articles potentially discuss a common topic (Kessler, 1963). This analysis relies on the assumption that, the more the references of two articles overlap, the stronger their connection is. As the number of cited documents in a source does not change over time, bibliographic coupling is considered to be a static form of analysis that does not suffer from a time bias (Caputo, Marzi, et al., 2019). The co-occurrence of keywords is a form of content

analysis which uses the keywords provided by authors to investigate the conceptual structure of the field (Callon, Courtial, Turner, & Bauin, 1983). This analysis relies on the assumption that, when words co-occur in a document, the concepts related to those words should be closely related. As this form of analysis uses the actual content of a document, it is particularly powerful and appropriate for use when developing a semantic map to assist in understanding the conceptual structure of a field or topic (Caputo, Marzi, et al., 2019).

When considering the tools used for the calculation of the bibliometric indicators, in accordance with the best practices in bibliometrics published in top journals in management (Griffin & Grote, 2020; Raghuram et al., 2019), we adopted the software program VOSViewer (Van Eck & Waltman, 2010). Specifically, we adopted network visualization and density visualization. For network visualization, items were represented by a tag and a circle, the size of which varied according to the importance of the element. The more substantial the weight of an item, the larger the circle. The distance between the two items or the unit of analysis (e.g. journals, authors, articles) in the visualization indicates the approximate relatedness of the items in terms of their adopted metric links (e.g. co-citation, bibliographic coupling, etc.). The closer two items are located to each other, the stronger their relatedness. The different colors and the spatial positioning of the circles are used to cluster the items. In the density visualization, items are represented by their tag and are in the same position as they are in the network visualization. The graph shows the density of the items at each point of the network by color. Colors range from green as the lowest density, to yellow as the medium density, to red as the highest density. The density algorithm is based on the number of items (e.g. journals, authors, articles) in the vicinity of a point and the weight of the neighboring items, according to the chosen metric (e.g. co-citation, bibliographic coupling, etc.). For a detailed explanation of the scripts and the mathematical algorithms adopted in VOSViewer, see van Eck and Waltman (2007; 2010).

To summarize, while citation analysis focuses on the publications included in the dataset, co-citation analysis evaluates the references cited by the publications included within the dataset. Bibliographic coupling analyzes the connections between articles, resulting in insights regarding the importance of the publications in the dataset in terms of their network positioning. The keyword

analysis, instead, focuses on the content investigated by the publications in the dataset, allowing for the identification of thematic clusters. Therefore, the comparative adoption of these analyses allows us to limit the inherent methodological biases of each bibliometric indicator, providing a comprehensive map of the field under investigation.

4. Results

A bibliometric approach provides detailed insights regarding the evolution of scientific fields. However, in order to fully comprehend the evolutionary pathways that have characterized the field and identify the most influential studies, topics, and sources, we have adopted a comparative approach to bibliometrics that compares, contrasts, and integrates the results from different indicators, as discussed in the method section. Results are presented according to the unit of analysis under investigation: journals, authors, articles, and, finally, the identification of conceptual themes and keywords. For each unit of analysis, the results of citations, co-citations, and bibliographic coupling are presented in order to provide a comparative picture that takes into account the past, present, and future of the field through performance and network analysis.

4.1. Analysis of the Journals

The analysis of the journals provides a picture of the outlets that have most contributed to the development of the fields of digitalization and business models from three perspectives of analysis: relevance from 2010 (citation analysis), foundations of the field (co-citation analysis), and network importance (bibliographic coupling). The dataset consisted of publications from 113 journals; the average number of citations per journal was 17.68 (S.D. 50.99). The largest number of citations were from *Technological Forecasting and Social Change* (318), the *Journal of Retailing* (303), the *Journal of Marketing* (255), *Industrial Marketing and Management* (193), and *Business Horizons* (83). These appear to be the most impactful journals since 2010. With regards to co-citation analysis (i.e. analyzing the cited journals by the articles in our dataset), out of the 4470 cited journals, 34 received more than 40 citations. Studies from 2010 have mostly cited articles from the *Strategic Management Journal*

(244), *Long Range Planning* (235), the *Harvard Business Review* (208), *Technological Forecasting and Social Change* (172), and the *Academy of Management Review* (150).

Finally, with regards to the bibliographic coupling analysis of journals, a minimum threshold of two articles per journal was set (Ferreira, 2018), which resulted in 43 journals out of 114 meeting this requirement. The results show the top 5 Journals in terms of link strength are *Technological Forecasting and Social Change* (1462), *Strategic Change* (859), *Industrial Marketing Management* (633), the *Strategic Entrepreneurship Journal* (559), and the *International Journal of Electronic Commerce* (431). In comparing these results, we found that the scientific investigation of digitalization and business models is mostly published in sectorial journals, while its theoretical foundations are found in top generalist and strategic management journals.

Please Insert Table 1 About Here

4.2. Analysis of the Authors

Although the digitalization of business models is a field in its infancy, management scholars' attention in recent years has substantially increased with the development of a substantial stream of research. However, as evidenced by the indicators related to the authors, such a stream is characterized by heterogenous communities of scholars. The dataset included 494 authors for 198 publications. The average number of citations per author was 10.14 (S.D. 29.96). It is interesting to note that the citation analysis reveals that the authors with the highest number of citations (303) published only one article on digital business models. For the results of the co-citation analysis in terms of authorship, i.e. authors cited in the reference list of the articles included in our dataset, out of 6,973 cited authors, only 17 were cited more than 20 times (Ferreira, 2018). This demonstrates a reliance on a small number of individuals, demonstrating the importance of a few key strategy scholars, such as Teece (107), Chesbrough (78), Zott (76), Osterwalder (52), and Porter (51). Finally, the bibliographic coupling showed that the authors with the highest link strength, meaning that they had a higher centrality in the network of citations and were highly embedded in conversations, were: Trabucchi (3050), Buganza (2757), Bustinza (2120), Bogers (2098), and Parida (1966). These results shed some light on future

avenues for the field. Indeed, it is the relatively early career researchers that have published the recent studies that have had a significant impact on contemporary research in this field. The authors' analysis confirms the importance of a continuous knowledge production and its renewal in a highly dynamic field that deeply affects the entirety of society.

Please Insert Table 2 About Here

4.3. Analysis of the Articles

The evolution of the field in terms of the volume of scientific production (Figure 1) shows an exponential growth in the number of articles investigating digitalization and business models since 2010 - the year in which the landmark special issue on business models was published in *Long Range Planning* (Baden-Fuller et al., 2010). For the articles (N=198) included in the dataset, the average number of citations per article was 10.09 (S.D. 31.28), the median was 2, while the mode was 0. These numbers confirm a growing academic interest in this field of research.

Please Insert Figure 1 About Here

The analysis of the references cited by the articles in the dataset (via co-citation analysis) provides a picture of the contributions of the main references - i.e. the theoretical pillars - that have influenced the development of the field in recent years. Considering the 198 articles included in our dataset, and fixing a minimum threshold of 5 citations (Ferreira, 2018) for each reference, the set obtained contains 120 cited references out of the 9,439 total. The five most connected references, which can be considered the main theoretical pillars of the field, are:

- Teece, D. J. (2010). Business models, business strategy and innovation. *Long range planning*, *43*(2-3), 172-194.
- Zott, C., Amit, R., & Massa, L. (2011). The business model: recent developments and future research. *Journal of Management*, *37*(4), 1019-1042.

- Chesbrough, H., & Rosenbloom, R. S. (2002). The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies. *Industrial and Corporate Change*, *11*(3), 529-555.
- Amit, R., & Zott, C. (2001). Value creation in e-business. *Strategic Management Journal*, *22*(6-7), 493-520.
- Chesbrough, H. (2010). Business model innovation: opportunities and barriers. *Long Range Planning*, *43*(2-3), 354-363.

Table 3 provides a list of the top 30 articles within the dataset, ranked according to total citations (TC), normalized citations (NC), and bibliographic coupling (link strength), denoting a comparative approach that constitutes the basis of our study. This analysis shows how the three indicators provide quite different results, confirming the usefulness of a comparative approach to bibliometrics when identifying studies of influence. The citation analysis suggests that the most significant article within this debate was published by Verhoef et al. (2015), while the normalized citation analysis reveals that, despite the novelty of research by Trabucchi and Buganza (2019), it has a high impact. Finally, the bibliographic coupling of the 198 articles in our dataset shows that the largest set of connected documents contains 107 publications (54.04% of the dataset). The five studies with the highest index of bibliographic coupling were Warner and Waeger (2019), Trabucchi, Talenti, and Buganza (2019), Bogers, Hadar, and Bilberg (2016), Cozzolino, Verona, and Rothaermel (2018), and Hanafizadeh, Mehrabioun, Badie, and Soofi (2018).

The reasoning behind these different results pertains to the inherent biases of each indicator, as discussed in the Methodology section. Indeed, total citations favor older articles and, over time, are more likely to accrue citations, while normalized citations favor articles that have had more impact in comparison with others published in the same year, thus citations. Bibliographic coupling, instead, looks at the embeddedness of the articles, focusing on their relevance within the study networks of the field. Assessing the results of these indicators together allows these perspectives to mitigate each other's biases, increasing the validity of the study and reducing the likelihood of omitting significant research.

Please Insert Table 3 About Here

4.4. Analysis of the Keywords

When analyzing the content of the articles, the analysis of the co-occurrence of keywords is based on the idea that a research specialty can be identified by the particular associations established between its keywords (López-Fernández et al., 2016). This analysis is useful when identifying the thematic areas – clusters - that make up the theoretical building blocks or foundational topics for the field under inquiry (Fakhar Manesh et al., 2020).

Keyword analysis was performed using the Keyword Plus tool from the Web of Science. Keyword Plus was chosen in order to ensure consistency when classifying the keywords of articles. Previous studies have considered Keyword Plus to be as effective as the keywords provided by the authors in terms of bibliometric analysis when investigating the knowledge structure of scientific fields (Zhang et al., 2016). The adoption of Keyword Plus allows the researcher to limit the biases and risks associated with the manual tagging of contents. Only keywords that occurred at least 5 times were kept; this resulted in 39 out of 493 keywords, constituting the largest usable set of connected terms (Ferreira, 2018). The five most occurring keywords are: Innovation (40), Technology (23), Strategy (22), Industry (17), and Performance (17). Data provided by WoS Keyword Plus reveals the existence of two different couples of related keywords that, at first sight, could be mistakenly interpreted as the same concept, despite the fact that they are standalone nodes. The first refers to the words "business model" and "business models". The former refers to the practical and managerial aspects of the theme, while the latter concerns the different archetypes of business models identified in scientific literature. Similarly, the keyword "strategy" concerns studies within the strategy field, while "strategies" is concerned with the investigation of specific strategies.

Please Insert Table 4 About Here

To complete the analysis of the co-occurrence of keywords, the network of co-occurring keywords is presented through diagrams displaying the network and the density of keywords (respectively, Figures 2 and 3). From this perspective, the field seems to be primarily composed of three clusters of connected topics: technological innovation (Cluster 1 - Red), strategic management (Cluster 2 - Green), and digital transformation (Cluster 3 - Blue).

Please Insert Figure 2 About Here

Please Insert Figure 3 About Here

Another useful diagram to consider is the overlay visualization, which shows the temporal distribution of the keyword in each cluster (Figure 4). In this diagram, the keywords are colored according to a score. This score is given based on the average year of occurrence of a keyword. Colors range from blue (oldest year) to green and yellow (most recent years). The field of studies regarding the digitalization of business models has evolved from a previous concentration on topics of innovation and technology (oldest keywords), to more specific and strategic topics, such as entrepreneurship, strategy, performance, and the future challenges that digitalization may bring.

Please Insert Figure 4 About Here

5. Discussion of thematic clusters

The digitalization of the business model is a complex subject. Prior evidence has shown a substantial absence of a win-win situation between disruptive innovation and business models (Cozzolino et al., 2018) and, in several cases, disruptive innovation has led business models and companies to crumble. Nevertheless, over the last ten years, the business world has witnessed the rise of innovative firms that built their competitive advantage through the adoption of business models

characterized by a high degree of digitalization (Amit & Zott, 2012). Thus, digitalization, despite being a disruptive innovation and a new social trend, can be integrated into innovative business models (Gozman & Willcocks, 2019; Warner & Wäger, 2019). When studying the overlay visualization of keywords (Figure 5), it is plausible to state that the initial attention paid to technological innovation is related to the possibility of structuring new business models around digital innovation; as seen, for example, when the "dot-com bubble" exploded at the beginning of the century (e.g., Dasilva & Trkman, 2014). Later, attention shifted towards the process of strategically managing the impact of digitalization on companies' business models (e.g., Cozzolino et al., 2018).

The first cluster (Red) reveals the existence of several studies investigating the role of technological innovation in relation to business value creation. The process of value creation has been analyzed from different perspectives. The first debate observes the impact of the digitalization of business models on market competition and dynamics. In particular, scholars have shown that digitalization has led to both coopetition and competition phenomena. Specifically, digitalization can facilitate synergies and knowledge sharing, even between actors in the same market, thus resulting in coopetition (Bogers et al., 2016; Ricciardi, Zardini, & Rossignoli, 2016; Ritala, Golnam, & Wegmann, 2014). Other scholars have instead assessed the effectiveness of the adoption of digital business models when it comes to increasing a firm's competitive advantage purely from a competitive standpoint (Ferreira et al., 2019; Zott, & Amit, 2010). Another stream of research has investigated the relationship between digital innovation and the development of new internal capabilities within firms in order to fully reap its benefits (Scuotto et al., 2017; Urbinati, Chiaroni, Chiesa, & Frattini, 2019). This stream mostly concentrates on specific innovations and the trigger capabilities involved. It is therefore suitably placed within the cluster that takes a central position with regards to technological innovation.

The second cluster (Green) assesses strategic implications in a managerial fashion, related to the digitalization of the business models analyzed at both theoretical and empirical levels. On the one hand, theoretical articles are interested in the definition of analytical frameworks and insights pertaining to the implementation of new forms of business models (Potstada, Parandian, Robinson, & Zybura, 2016; Trabucchi & Buganza, 2019). Some studies focus their attention on the managerial dynamics activated

by digitalization, such as the use of big data analytics and social media (e.g., Muninger, Hammedi, & Mahr, 2019; Warner & Wäger, 2019). On the other hand, empirical articles mainly assess and evaluate the impact of digitalization on competitive advantages. Some of these empirical articles analyze the digitalization of processes, specifically with regards to the supply chain (e.g. Lenka, Parida, & Wincent, 2017; Vendrell-Herrero, Bustinza, Parry, & Georgantzis, 2017). More generally, other papers are interested in the possible implications of digitalization in different industries and contexts (e.g. Benghozi & Salvador, 2016; Vendrell-Herrero, Myrthianos, Parry, & Bustinza, 2017).

The third cluster (Blue) analyzes the impact of digital transformation on entire industries. In this cluster, data management is a prominent topic, both in terms of the internal management of this huge flow of data and the external sources and dynamics needed to acquire such data (Del Giudice & Della Peruta, 2016; Verma, Gustafsson, Gustafsson, Kristensson, & Witell, 2012). Furthermore, the digitalization and data management stemming from this may have different effects on different industries and competitive dynamics (Harrison & Hair, 2017; Mattsson & Andersson, 2019). In fact, several authors have already begun discussing new industries, such as the two-sided market and the platform economy (Harrison & Hair, 2017; Trabucchi & Buganza, 2019). The platform business model perspective demonstrates quick growth and is particularly interested in the use of social media when developing market relationships (Gunawan & Huarng, 2015; Suseno, Laurell, & Sick, 2018). These new forms of communication have had disruptive effects on some business strategies, such as market exchanges and customer relationship management (Harrison & Hair, 2017; Verhoef et al., 2015). Finally, the role of information technology has also been analyzed from a legal perspective, demonstrating the contribution of digitalization to the eradication of illegal phenomena, such as copyright piracy (Moreau, 2013).

6. Conclusions, future directions and limitations

The main insights and contributions provided by this study are both theoretical and methodological in nature. Theoretical contributions pertain to the identification of the knowledge structure of this emerging field of studies with regards to the digitalization of business models (Baden-Fuller & Morgan,

2010; Christoph Zott & Amit, 2010). The relatively innovative methodological approach consists of the comparison of the results of different bibliometric indicators. This favors the emergence of an overall scientific knowledge structure, thanks to the presentation of different perspectives. It also offers a novel approach to the science mapping of dynamic management fields. The analyses performed on journals, authors, and articles provide comprehensive and vital insights that systematize the body of knowledge and build upon research into the academic panorama.

These analyses reveals that the integration of the results from different indicators unveil the past, present, and future of research into the digitalization of business models. This evidence is related to the divergences between citation analysis, co-citation analysis, and bibliographic coupling, which is not an obvious or trivial consideration. On the one hand, when considering the analysis of authors, co-citation analysis reveals that the roots of the field are based on prior contributions that are not directly related to the digitalization of business models. In particular, the analysis reveals a wide diffusion of contributions provided by authors such as Osterwalder and Porter. On the other hand, the bibliographic coupling shows that the authors with the highest link strengths published their articles during the second half of the time span under investigation.

Similar results have been collected with regards to journals and articles. For the first indicator, the analysis shows that the debate has been examined in only a few journals. This was confirmed throughout all analyses. In addition to this, bibliographic coupling shows that some of the journals with the highest link strengths, such as *Strategic Change and Creativity* and *Innovation Management*, although prominent, are not necessarily considered as top journals in the majority of international journal rankings. Thus, the concentration of the articles within a limited number of top journals negatively impacts upon the diffusion of a topic within wider scientific discourse. For the analysis of the articles, those published in recent years appear to have more relevance. The normalized citation analysis shows that the diffusion of contributions published during the last 3 years have been higher than the those published in the past. Even though the first special issue on this topic was launched in 2010, the most significant contributions to the field in terms of normalized citations were published after 2015. Thus,

the bulk of literature on digital business models is built on contributions published five years after the preliminary contributions of Baden-Fuller et al. (2010b).

The main methodological contribution of this paper is the presentation of a methodology that allows for the identification of a comprehensive, yet succinct, list of the most influential articles in the field, considering total citations, normalized citations, and network link strength. Our methodology is consistent and respectful of the endless debates in academia on the ways in which a study should be considered influential. Without entering into such a debate, our approach is particularly useful for scholars seeking to further integrate systematic literature reviews with bibliometric analysis (Dabić et al., 2019). Our evidence confirms the potential benefits of adopting a comparative approach to bibliometric studies. This type of study often only maps the field using the most cited articles, risking the neglect of newer and more prominent trends. In using a comparative approach and selecting the most influential articles according to multiple indicators, this research allows us to include and integrate different perspectives in order to reach significant results. This approach is valid in both established and emerging fields of study, particularly those that are dynamic or nascent.

Finally, our analyses have also revealed a number of future research directions through which our knowledge of digitalization and business models could be advanced in line with the three thematic clusters identified (Table 5). In particular, future research could expand upon existing research areas and identify new topics related to the different forms and archetypes of business models developed in recent years. Testing the many theoretical and conceptual frameworks proposed is also an important future avenue of research. Furthermore, future research could assess the impact of digitalization in terms of non-financial outcomes, such as the creation of shared value for stakeholders interested in the firm's activities. Finally, future studies could also move on from our bibliometric investigation of the field and extend our work by systematically reviewing the three identified clusters in more depth, taking into consideration those identified as the most influential articles.

Please Insert Table 5 About Here

Despite the adoption of this relatively innovative comparative bibliometric approach, some limitations still remain. In particular, one limitation may lie in the focus on the Business and Economics studies in the Web of Science database. This, while naturally facilitating a more focused overview of several well-established topics, is problematic to younger fields of inquiry that are not completely focused on specific research streams. Moreover, in order to guarantee homogeneity, our analysis has not considered books, conference proceedings, and reports. Future studies could examine these other publications and scientific subjects in order to complement our results, such as Information Systems (e.g., Al-Debei & Avison, 2010). As in previous bibliometric studies (e.g., Ferreira, 2018), one of the main limitations of this research is the prevalent approach adopted throughout the paper. The authors prioritized a wider panoramic view of the field, rather than a detail-oriented and in-depth analysis of content. This is a tradeoff and, as aforementioned, future studies should build upon these findings in order to expand upon this investigation. We have rigorously identified and unveiled the most relevant and impactful areas in terms of research, studies, journals, and authors and, in doing so, have highlighted major unresolved issues which offer future research directions. Our objective was to compile a science map of the field of study investigating digitalization and business models. Like every map, our study makes an abstraction derived from reality and, as such, it cannot be as complex as reality itself: the map is not the territory (Korzybski, 1998).

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Figure 1 - Articles per year

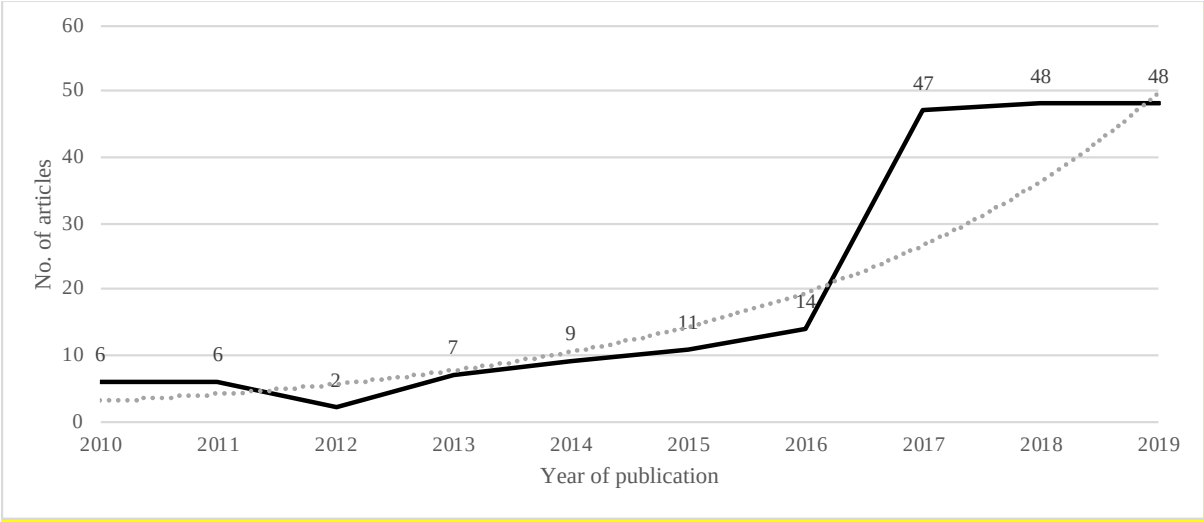

Figure 2 - Network diagram of the co-occurrence of keywords

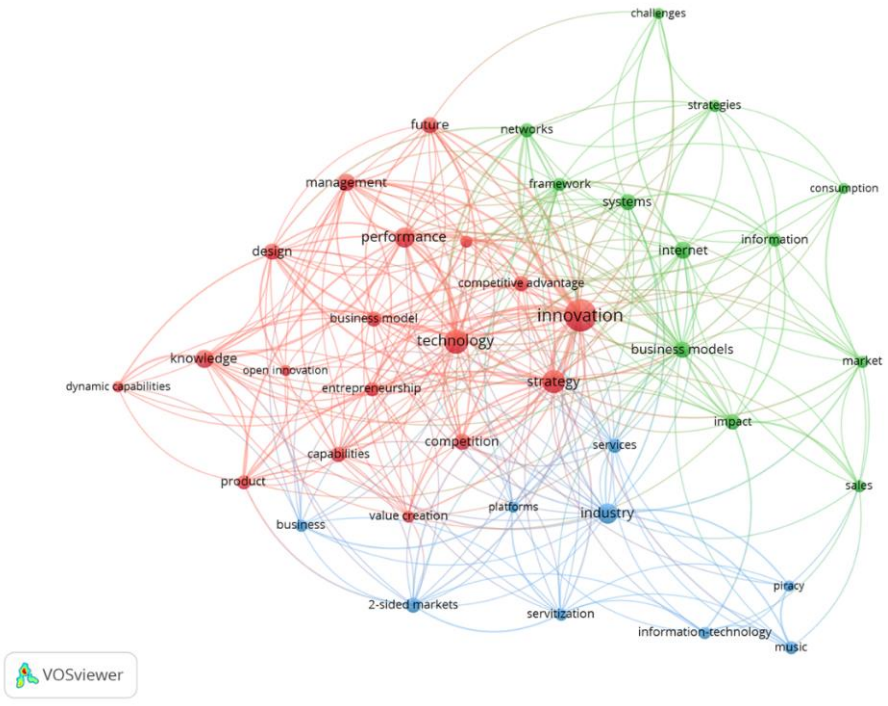

Figure 3 – Density diagram of the co-occurrence of keywords

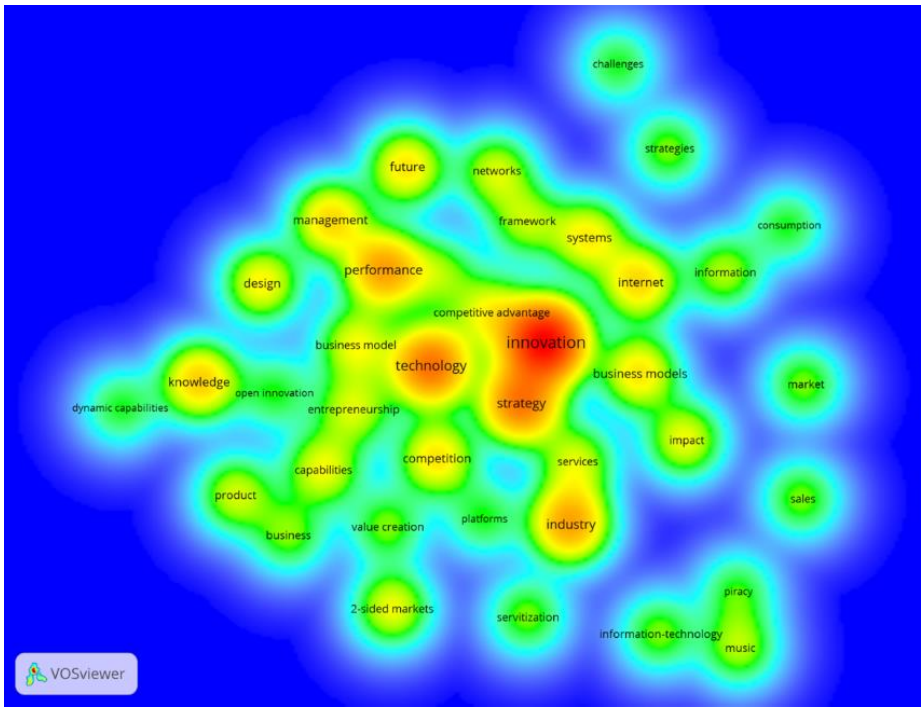

Figure 4 – Overlay diagram of the co-occurrence of keywords

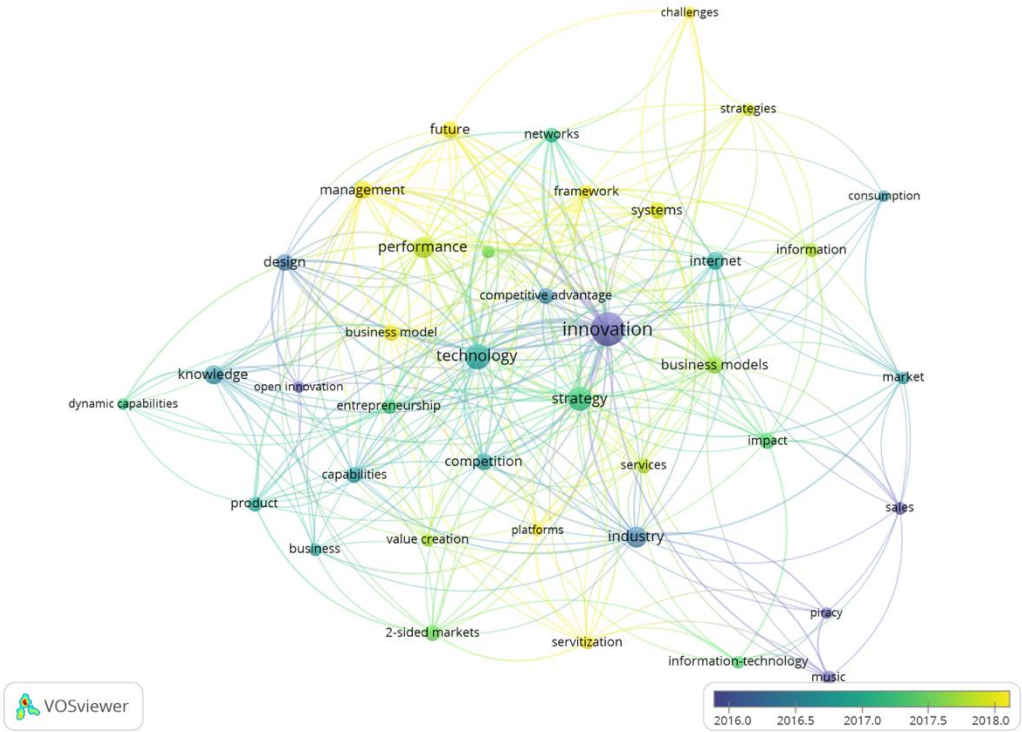

Table 1 - Comparison of citation, co-citation and bibliographic coupling of Journals

Citation analysis				Co-citation analysis			Bibliographic coupling		
	Source	**Papers**	**TC**		**Source**	**TC**		**Source**	**Link Strength**
1	Technological forecasting and social change	16	318	1	Strategic management journal	244	1	Technological forecasting and social change	1462
2	Journal of retailing	1	303	2	Long range planning	235	2	Strategic Change	859
3	Journal of marketing	2	255	3	Harvard business review	208	3	Industrial marketing management	633
4	Industrial marketing management	4	193	4	Technological forecasting and social change	172	4	Strategic entrepreneurship journal	559
5	Business horizons	9	83	5	Academy of management review	150	5	International journal of electronic commerce	431
6	Mis quarterly	2	81	6	Research policy	149	6	Creativity and innovation management	422
7	Strategic entrepreneurship journal	4	66	7	Management Science	147	7	Review of managerial science	408
8	Research-technology management	2	47	8	Journal of marketing	133	8	Long range planning	395
9	Journal of technology transfer	1	34	9	Industrial marketing management	132	9	Journal of business research	383
10	International journal of arts management	2	27	10	Mis quarterly	123	10	European management journal	359
11	Journal of the academy of marketing science	1	26		Organization Science	123	11	Business horizons	356
	Journal of business ethics	2	26	12	J prod innovat manag	104		Journal of management studies	316
	Journal of management information systems	2	26	13	Academy of management journal	100		California management review	307
14	Journal of business research	5	25	14	Journal of business research	89	14	Systemic practice and action research	306
	Internet research	2	25		Journal of Management	89		Industry and innovation	296
16	Creativity and innovation management	3	24	16	Mit sloan management review	85	16	Business models and modelling	279
	Economic and labour relations review	2	24	17	Journal of marketing research	77		International journal of entrepreneurial venturing	273
18	Research policy	2	23	18	California management review	66	18	Research policy	256
19	Mit sloan management review	2	21	19	Information Systems Research	62	19	International journal of innovation and technology management	245
20	Psychology & marketing	3	19		Journal of cleaner production	62	20	Baltic journal of management	221
	Management decision	1	19	21	Administrative sciences quarterly	59		Journal of strategic marketing	212
	Information economics and policy	1	19		Industrial and Corporate Change	59		Technovation	207
23	Industry and innovation	2	16	23	Journal of Management Studies	58	23	Industrial and corporate change	201
	Mis quarterly executive	2	16	24	Business horizons	55		Service industries journal	187
25	Journal of media business studies	3	15		Marketing Science	55	25	Management & marketing	177
	Electronic commerce research and applications	3	15	26	Journal of business venturing	50		Service business	169
27	European management journal	2	14	27	Technovation	49	27	Technology analysis & strategic management	169
28	Journal of strategic information systems	2	13	28	Journal of the Academy of Marketing Science	47	28	International journal of business	166

29	California management review	3	12	29	R&D Management	46	29	Futures	161
	Energy policy	2	12	30	Journal of management information systems	45		Research-technology management	159

Table 2 - Comparison of citation, co-citation and bibliographic coupling of Authors

Citation analysis			Co-Citation analysis			Bibliographic coupling		
Rank	**Author**	**TC**	**Rank**	**Author**	**TC**	**Rank**	**Author**	**Link strength**
1	Inman, J. J	303	1	Teece, Dj	107	1	Trabucchi, D	3050
	Kannan, P. K.	303	2	Chesbrough, H	78	2	Buganza, T	2757
	Verhoef, P. C.	303	3	Zott, C	76	3	Bustinza, O	2120
4	Day, G. S.	249	4	Osterwalder, A	52	4	Bogers, M	2098
5	Rayna, T	141	5	Porter, Me	51	5	Parida, V	1966
	Striukova, L	141	6	Amit, R	44	6	Parry, G	1575
7	Golnam, A	92		Gawer, A	44		Vendrell-Herrero, F	1575
	Ritala, P	92	8	Eisenhardt, Km	41	8	Chiesa, V	1533
	Wegmann, A	92		Yin, Rk	41		Frattini, F	1533
10	Oestreicher-Singer, G	81	9	Christensen, Cm	38		Oghazi, P	1533
	Zalmanson, L	81	10	Baden-Fuller, C	30		Urbinati, A	1533
12	Bilberg, A	66	11	Casadesus-Masanell, R	29	12	Laudien, S.	1463
	Bogers, M	66	12	Clemons, Ek	25	13	Li, F	1312
	Hadar, R	66	13	Prahalad, Ck	24	14	Ghezzi, A	1276
15	Bustinza, O. F.	60		Von Hippel, E	24	15	Pellizzoni, E	1253
16	Parry, G	59	15	Belk, R	20	16	Talenti, L	1250
	Vendrell-Herrero, F	59		Eisenmann, T	20	17	Waeger, M	1216
18	Georgantzis, N	52	17	Helfat, Ce	19		Warner, K	1216
19	Kathan, W	48		Parker, Gg	19	19	Cabras, I	1168
	Matzler, K	48		Vargo, Sl	19		Cowling, P	1168
	Veider, V	48	20	Adner, R	18		Devlin, S	1168
22	Autio, E	47		Brynjolfsson, E	18		Fernandes, K	1168

22	Bertels, H. M. J.	38		European, Commission	18		Goumagias, N	1168
	Elsum, I. R.	38		Hagiu, A	18		Kudenko, D	1168
	Koen, P. A	38		Mcgrath, Rg	18		Nucciarelli, A	1168
26	Moreau, F.	37		Rochet, Jc	18	26	Bilberg, A	1151
27	Carayannis, E.G	34	26	Zahra, Sa	17		Hadar, R	1151
	Del Giudice, M	34	27	Afuah, A	16	28	Badie, K	1071
	Schuessler, E	34		Autio, E	16		Hanafizadeh, P	1071
	Scuotto, V	34		Iansiti, M	16		Mehrabioun, M	1071
				Katz, Ml	16		Soofi, J	1071

Table 3 – Identification of most influential papers according to Citations, Normalized Citations and Bibliographic Coupling

Citations			Normalized citation			Bibliographic coupling		
Rank	**Articles**	**TC**	**Rank**	**Articles**	**NC**	**Rank**	**Articles**	**Link Strength**
1	Verhoef, PC; Kannan, PK; Inman, JJ (2015)	303	1	Trabucchi, D; Buganza, T (2019)	10,286	1	Warner, KSR; Wager, M (2019)	395
2	Day, GS (2011)	249	2	Autio, E; Nambisan, S; Thomas, LDW; Wright, M (2018)	9,900	2	Trabucchi, D; Buganza, T (2019)	357
3	Rayna, T; Striukova, L (2016)	141	3	Verhoef, PC; Kannan, PK; Inman, JJ (2015)	8,524	3	Bogers, M; Hadar, R; Bilberg, A (2016)	343
4	Ritala, P; Golnam, A; Wegmann, A (2014)	92	4	Vendrell-Herrero, F; Bustinza, OF; Parry, G; Georgantzis, N (2017)	7,614	4	Cozzolino, A; Verona, G; Rothaermel, FT (2018)	316
5	Oestreicher-Singer, G; Zalmanson, L (2013)	81	5	Browder, RE; Aldrich, HE; Bradley, SW (2019)	6,857	5	Hanafizadeh, P; Mehrabioun, M; Badie, K; Soofi, JB. (2018)	306
6	Bogers, M; Hadar, R; Bilberg, A (2016)	66	6	Frishammar, J; Richtner, A; Brattstrom, A; Magnusson, M; Bjork, J (2019)	6,857	6	Laudien, SM; Pesch, R (2019)	280
7	Vendrell-Herrero, F; Bustinza, OF; Parry, G; Georgantzis, N (2017)	52	7	Rayna, T; Striukova, L (2016)	6,388	7	Zhang, JJ; Lichtenstein, Y; Gander, J (2015)	279
8	Kathan, W; Matzler, K; Veider, V (2016)	48	8	Scuotto, V; Del Giudice, M; Carayannis, EG (2017)	4,978	8	Anagnou, M; Handrich, M; Schnellbacher, B; Heidenreich, S (2019)	273
9	Koen, PA; Bertels, HMJ; Elsum, IR (2011)	38	9	Gomber, P; Kauffman, RJ; Parker, C; Weber, BW (2018)	4,800	9	Rietveld, J (2018)	261
10	Scuotto, V; Del Giudice, M; Carayannis, EG (2017)	34	10	Day, GS (2011)	4,486	10	Sanchez-Montesinos, F; Basaez, MO; Aranda, DA; Bustinza, OF (2018)	249

11	Autio, E; Nambisan, S; Thomas, LDW; Wright, M (2018)	33	11	Coreynen, W; Matthyssens, P; Van Bockhaven, W (2017)	3,953	11	Beynon-Davies, P (2018)	242
12	Coreynen, W; Matthyssens, P; Van Bockhaven, W (2017)	27	12	Ritala, P; Golnam, A; Wegmann, A (2014)	3,943	12	Hanninen, M; Smedlund, A; Mitronen, L (2018)	221
13	Papies, D; Eggers, F; Wlomert, N (2011)	26	13	Teece, DJ (2018)	3,900	13	Aversa, P; Hervas-Drane, A; Evenou, M (2019)	213
14	Martinez-Torres, MR; Toral, SL; Barrero, F; Cortes, F (2010)	25	14	Tauscher, K; Laudien, SM (2018)	3,600	14	Standing, C; Mattsson, J (2018)	212
15	Simmons, G; Palmer, M; Truong, Y (2013)	22	15	Dey, BL; Babu, MM; Rahman, M; Dora, M; Mishra, N (2019)	3,429	15	Urbinati, A; Bogers, M; Chiesa, V; Frattini, F (2019)	207
16	Weijters, B; Goedertier, F; Verstreken, S (2014)	21	16	Warner, KSR; Wager, M (2019)	3,429	16	Holland, CP; Gutierrez-Leefmans, M (2018)	205
17	Moreau, F (2013)	21	17	Jocevski, M; Arvidsson, N; Miragliotta, G; Ghezzi, A; Mangiaracina, R (2019)	3,429	17	Bjorkdahl, J; Holmen, M (2019)	201
18	Mangematin, V; Sapsed, J; Schussler, E (2014)	19	18	Frank, AG; Mendes, GHS; Ayala, NF; Ghezzi, A (2019)	3,429	18	Simmons, G; Palmer, M; Truong, Y (2013)	195
19	Rothmann, W; Koch, J (2014)	19	19	Urbinati, A; Chiaroni, D; Chiesa, V; Frattini, F (2019)	3,429	19	Tauscher, K; Laudien, SM (2018)	195
20	Corciolani, M; Dalli, D (2014)	19	20	Aversa, P; Hervas-Drane, A; Evenou, M (2019)	3,429	20	Amit, R; Han, X (2017)	193
21	Thomes, TP (2013)	19	21	Wang, HH; Hao, N; Zhou, QJ; Wetzstein, ME; Wang, Y (2019)	3,429	21	Muller, CN; Kijl, B; Visnjic, I (2018)	191
22	Weill, P; Woerner, SL (2013)	19	22	Oestreicher-Singer, G; Zalmanson, L (2013)	3,082	22	Eiriz, V; Leite, FP (2017)	187
23	Oiestad, S; Bugge, MM (2014)	17	23	Martinez-Torres, MR; Toral, SL; Barrero, F; Cortes, F (2010)	3,061	23	Bourreau, M; Gensollen, M; Moreau, F (2012)	185
24	Gomber, P; Kauffman, RJ; Parker, C; Weber, BW (2018)	16	24	Helfat, CE; Raubitschek, RS (2018)	3,000	24	Ruggieri, R; Savastano, M; Scalingi, A; Bala, D; D'Ascenzo, F (2018)	177
25	Amit, R; Han, X (2017)	16	25	Bogers, M; Hadar, R; Bilberg, A (2016)	2,990	25	Ritala, P; Golnam, A; Wegmann, A (2014)	174
26	Richter, C; Kraus, S; Brem, A; Durst, S; Giselbrecht, C (2017)	16	26	Santos, G; Murmura, F; Bravi, L (2018)	2,400	26	Gandia, R; Parmentier, G (2017)	174
27	Lenka, S; Parida, V; Wincent, J (2017)	16	27	Amit, R; Han, X (2017)	2,343	27	Kohtamaki, M; Parida, V; Oghazi, P; Gebauer, H; Baines, T (2019)	173
28	Bourreau, M; Gensollen, M; Moreau, F (2012)	16	28	Richter, C; Kraus, S; Brem, A; Durst, S; Giselbrecht, C (2017)	2,343	28	Vendrell-Herrero, F; Bustinza, OF; Parry, G; Georgantzis, N (2017)	170
29	Nucciarelli, A; Li, F; Fernandes, KJ; Goumagias, N; Cabras, I; Devlin, S; Kudenko, D; Cowling, P (2017)	15	29	Lenka, S; Parida, V; Wincent, J (2017)	2,343	29	Frishammar, J; Richtner, A; Brattstrom, A; Magnusson, M; Bjork, J (2019)	166
30	El Sawy, OA; Kraemmergaard, P; Amsinck, H; Vinther, AL (2016)	15	30	Nucciarelli, A; Li, F; Fernandes, KJ; Goumagias, N; Cabras, I; Devlin, S; Kudenko, D; Cowling, P (2017)	2,196	30	Santoso, AS; Prijadi, R; Balqiah, TE (2019)	166

Table 4 – Results of keyword analysis

Cluster 1: Technological Innovation (Red)			Cluster 2: Strategic Management (Green)			Cluster 3: Digital Transformation (Blue)		
Keyword	**Occurrences**	**Link strenght**	**Keyword**	**Occurrences**	**Link strenght**	**Keyword**	**Occurrences**	**Link strenght**
Innovation	40	92	Internet	12	23	Industry	17	32
Technology	23	59	Business models	11	32	2-sided markets	9	20
Strategy	22	64	Systems	10	21	Services	8	18
Performance	17	56	Impact	9	22	Music	7	11
Knowledge	13	30	Networks	8	25	Business	6	14
Management	12	34	Framework	7	22	Information-technology	6	10
Competition	11	27	Information	7	15	Servitization	6	17
Future	11	25	Market	6	15	Platforms	5	17
Design	10	28	Sales	6	11	Piracy	5	9
Business model	9	25	Strategies	6	13			
Capabilities	9	22	Challenges	5	9			
Competitive advantage	9	21	Consumption	5	9			
Entrepreneurship	8	19						
Product	8	20						
Value creation	6	17						
Product-service systems	6	16						
Dynamic capabilities	5	11						
Open innovation	5	11						

Table 5 – Future research agenda

Cluster	Theme	Future Research Area	Main sources
Cluster 1 (Red)	Technological innovation	• Evaluation of app's industry performance • The effects of Industry 4.0 on business model • Business model innovation in Unicorn-tech • Inter-technology relationship networks	(Frank, Mendes, Ayala, & Ghezzi, 2019; Hofmann, Keller, & Urbach, 2019; Trabucchi & Buganza, 2019; Urbinati, Chiaroni, Chiesa, & Frattini, 2019)
Cluster 2 (Green)	Strategic management	• Entrepreneurial team formation in Maker industry • Evaluation of the effects related to the adoption of Fintech systems • Digital piracy • Consumer engagement in freemium business model	(Aversa, Hervas-Drane, & Evenou, 2019; Browder, Aldrich, & Bradley, 2019; Jocevski, Arvidsson, Miragliotta, Ghezzi, & Mangiaracina, 2019; Niemand, Mai, & Kraus, 2019)
Cluster 3 (Blue)	Digital transformation	• Innovation in auditing services • Technology upgrading through co-creation of value • Evaluation of the temporal effects related to the digital transformation • Digitalization of the public sector	(Dey, Babu, Rahman, Dora, & Mishra, 2019; Frishammar, Richtnér, Brattström, Magnusson, & Björk, 2019; Mattsson & Andersson, 2019; Warner & Wäger, 2019)