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Department of Marketing, Operations and Management

Digital Business Model: A State of Art

João Paulo Quaresma Rangel

Thesis specially presented for the fulfilment of the degree of Master's in Business Administration

Supervisor:
Prof. Dr. Leandro Pereira, ISCTE Business School, Department of Marketing, Operations and General Management

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BUSINESS
SCHOOL

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Acknowledgements

This dissertation was written in period of my life, where I had to balance work with the writing of this academic work, it wasn't easy to be honest, I had to spend many hours of sleep to carry out this dissertation. However, I think that, if we want something in life, we have to lose something, and that's life, and to go through these moments of struggle, it's important to choose well the ones to walk by our side along our journey. For that reason, I would like to thank and refer these same people:

- To my supervisor, because despite having established deadlines, he was always understanding with my situation and helped me in everything I needed, and always with words of motivation to end in those deadlines. For the availability that he has always shown, and for the challenges he has given me, that helped me to grow even more in terms of skills and person, a special thank you.

- To my family and friends who are one of the most important things in my life, who were always there for me when I needed, and it's because of them that I'm here finishing a master's degree. I have no words to express my gratitude as it is a quite large one.

Thanks for all you have done for me so far, it was a real pleasure for me to get you at by my side in my journey, and now it's time to finish this chapter, and embrace once again more challenges in my life, hope to work with you once again, and receive the same support.

Resumo

Nos dias de hoje, os líderes empresariais têm uma preocupação permanente com a necessidade de prever e responder ao desconhecido. Tendo como por exemplo de excelência a situação vigente, relacionada com a COVID-19, onde é sentida a pressão para antecipar novos Modelos de Negócios capazes de introduzir inovação juntamente com a procura de implementação de novas tecnologias para lidar com este tipo de adversidade. Uma alternativa para as empresas se manterem competitivas e preparadas para lidar com a disrupção é, por exemplo, a implementação de um DBM (Digital Business Model), sendo o processo de digitalização de BMs um processo crucial para auxiliar as soluções de negócio tradicionais e aumentar a sua gama de funcionalidades. O objetivo desta investigação é estudar o progresso dos BMs ao longo dos anos, fornecendo uma ideia dos elementos relevantes na adoção do DBM, e o conhecimento necessário entre os drivers do DBM. Para realizar esta investigação, foi feita uma revisão sistemática utilizando a base de dados Scopus para artigos científicos recuperados, por meio de uma amostra representativa entre o período de 2016-2021. Utilizando o VOSviewer para visualizar o processo de desenvolvimento e as relações estruturais em diversas áreas do campo com base em literaturas da base de dados Scopus. Contribuindo para uma melhor compreensão dos DBMs, e como funciona o processo de digitalização nos BMs, técnicas para passar por uma viagem digital e, por fim, o papel da inovação para alcançar a EC (Economia Circular).

Palavras-Chave: Adoção de tecnologia, Análise bibliométrica, Digitalização, Modelo de negócio, Revisão sistemática da literatura, Transformação digital

Classificação JEL:

   L21 – Objetivos de negócio da empresa

   M21 – Economia empresarial

   O33 – Mudança tecnológica: escolhas e consequências – Processos de difusão

Abstract

Nowadays, business leaders are always worried about disruption, the necessity of predict and respond to the unknown. For example, the current situation that we all faced COVID-19, the pressure felt, to anticipate new innovative BMs (Business Models) and new technology adoption to deal with this kind of disruption. An alternative to companies staying competitive and prepared to deal with the disruption, it's for example the implementation of a DBM (Digital Business Model), the process of digitalization of BMs being a crucial process to help traditional business solutions and increasing their scop of functionalities. The aim of this investigation is to study the progress of the BMs all over the years, giving an idea of the relevant elements in the adoption of DBM, and the knowledge needed between the DBM drivers. To conduct this investigation, a systematic review was made using the Scopus database to retrieved scientific articles, through a representative sample between 2016–2021-time range. Using VOSviewer to visualize the development process and structural relations in several fields areas based on literatures from Scopus database. Contributing to a better understanding of the DBMs, and how the process of digitalization in BMs works, techniques to get through a digital journey and finally the role of innovation to achieve CE (Circular Economy).

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Glossary of Acronyms

AM – Additive Manufacturing

BMI – Business Model Innovation

CE – Circular Economy

DBM – Digital Business Model

DC – Dynamic Capabilities

IoT – Internet of Things

LSAs – Lean Startup Approaches

PRISMA – Preferred Reporting Items for Systematic Reviews and Meta-Analyses

SE – Sharing Economy

SLR – Systematic Literature Review

Chapter 1. Introduction

1.1 Framework

The BM (Business Model) concept is an abstract representation of the flow value and relations between various elements of an organization unit, where the main elements to consider are proposition, building, providing, and capturing value. The way these elements are connected is vital to the success of any business. And therefore, the BM concept it's in a way to facilitate the explanation of complex business ideas in a more efficient way.

Currently companies are extremely searching for new paths to get closer to their customers and exerting influence over them (Jafari Navimipour & Soltani, 2016). In this way, one of the challenges that companies face in the current century, is the difficulty on keeping up with the high number of disruptive innovations. Which leads to companies and industries being disrupted in a short period of time. Where the challenge has now shifted from predicting the unknown to agile and sustainable solutions (Xu & Koivumäki, 2019). Therefore, BM plays an importance role to the effectiveness of the representation of analysing, communication, and implementation of complex units of performance within an organization, to deal with the unknown, and to ensure the sustainable development and customer's needs (Xu & Koivumäki, 2019).

This research was focused on understand the field's nature of the implementation of DBMs, and the evolution of its utilization over time and the historical development of past five years key conceptual elements are traced.

To accomplish these objectives, a bibliometric mapping analysis of articles published between 2016 and 2021 on prestigious academic journals in the fields of DBMs and digitalization – ensured by the Elsevier Scopus database, was made. Thus, in order to accomplish these intents a bibliometric mapping software VOSviewer is used, which is a framework for the construction and visualization of bibliometric networks (Liu, 2013).

1.2 Investigation Problem

The major focus of this thesis is to study the impact of the implementation of Digital Business Models in organizations, and consequently what are the most relevant factors to their implementation. The importance of the adoption of digital technologies to help these models' implementation, and to achieve both sustainability and competitiveness.

In recent years, with technology advancement a lag has been created between the discovery of a new technology and its adoption (Doraszelski, 2004). While technology continues to advance, and suffering changes, a conflict between the positive aspects of increasing benefits and the negative aspect of the need to learn new ways of doing business and to develop new innovative approaches has been created (Sunny et al., 2019).

Moreover, organizations that already have controlled the market on their area are confronted all the time by new competitors that redefine the standard industries (Rachinger et al., 2019). Thus, business leaders are always worried about disruption, to have a better response companies are start to feeling a necessity to innovate their business models to be successful in the digital world (Rachinger et al., 2019).

1.3 Theoretical and Empirical Objectives

Relatively to objectives of this investigation and thesis, should be considered the theoretical and empirical objectives. The aim of this investigation, namely the theoretical objectives, is to present the state of art of DBMs in research areas, using 2016 to 2021 as time range, contributing to research and scientific knowledge in the Digital Business Model field, innovation, and technological changes. In order to give a better understanding of the implementation of Digital Business Models and in this way, provide further research on how Digital Business Models can affect an organization, their sustainability and why they needed.

Empirically speaking, as the main objective of this investigation is to study the implementation of Digital Business Models and field's nature, the evolution of its utilization over time and the historical development of past five years, having three research questions in total,

Q1: Which are the most relevant elements in the adoption of DBM?

Q2: How has it evolved over the past years, with the adoption of new technologies?

Q3: Which are the most influential contributions and who are the most influential authors of DBMs research published between 2016 and 2021?

1.4 Thesis Structure

This dissertation is constituted by an introduction, five main chapters and a conclusion. It starts with a brief introduction where it's explained my thesis theme and a little literature about him. The first chapter (Chapter 1) presents the methodology of the systematic literature review. The second chapter (Chapter 2) it's about the research techniques used to retrieve the information needed to this investigation work.

The third chapter (Chapter 3) is where the type of analysis is selected for the following chapters. The fourth chapter (Chapter 4) focus on the treatment of the results, and their presentation, through the analysis selected on third chapter.

Finally, fifth chapter (Chapter 5) summarizes the theoretical and practical conclusions, and contributions of the investigation, describes the limitations of the study and suggests some lines of research for future work on the topic.

Chapter 2. Methodology

To answer this thesis research questions, a systematic literature review (SLR) and meta-analyses was done. A SLR has been developed to identify, classify and generalized truths or generate opportunities for upcoming papers. Joining, combining, and evaluating all documents within a fixed set of constraints. Thus, in this thesis the documents were articles and journals, where the implementation of DBM was used, specifically in top-level research fields. Systematic reviews and meta-analyses are seen as vital tools in summarising information with precision and reliability (Liberati et al., 2009).

2.1 Bibliometric analysis

The concept "bibliometrics" was invented by Alan Pritchard in 1969, with the purpose of explain the implementation of mathematical and statistical methods to study books and other media (Ahmad et al., 2020).

Bibliometric analysis is now recognized as a scientific specialty and is part of the evaluation research within scientific and applied areas (Ellegaard & Wallin, 2015). As an important area of library and scientific information research that studies bibliographic information using quantitative approach (Martínez-López et al., 2018; Ye, 2018). The process aims to evaluate the production and impact of academic research, based on the analyse of the compiled literature (Ellegaard & Wallin, 2015).

2.2 VOSviewer

According to Orduña-Malea and Costas (2021), scientific software plays a vital role on the ecosystem of modern science, especially in processes related to retrieving, analysing, visualization and management of data, making possible scientific discoveries.

VOSviewer is a framework developed by Nees Jan van Eck and Ludo Waltman, used to the construction of bibliographic maps generated on network data and their visualization and exploration (van Eck & Waltman, 2010).

2.2.1. VOSviewer Features

The following Tables (Table 1 and Table 2), show some of the features that VOSviewer turns possible to be done. Being a tool that makes possible building maps based on network data, as a visual tool that enables the exploration of these maps.

Table 1: VOSviewer features

Creation of	Based on
Journal maps	Network (co-citation) (Effendi et al., 2021)
Country maps	---
Publication maps	---
Keyword maps	Shared networks (Effendi et al., 2021)

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In addition, the software provides the possibility to limit the number of keywords, but also the ones who are less relevant can be removed (Effendi et al., 2021).

Table 2: VOSviewer features related to data

Data mining
Data mapping
Data grouping of articles

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The aim of this features is to provide support for creating term maps based on a corpus of documents. Nowadays, the latest version of VOSviewer is 1.6. 18, and can be found here: https://www.vosviewer.com/.

2.2.2. VOSviewer types of analysis and visualization available

According to van Eck and Waltman (2013) and Eck and Waltman (2014), this software enables several types of analysis, that are presented in Table 3 but also three visualization approaches, presented in Table 4.

Table 3: VOSviewer types of analysis (Adapted from van Eck & Waltman, 2013)

Type of data	Type of analysis	Item of analysis	Content
Bibliographic data	Citation	Documents	Link between two items where one item cites the other.
		Sources	
		Authors	
		Organizations	
		Countries	
	Co-citation	Cited References	Link between two items that are both cited by the same document.
		Cited Sources	
		Cited Authors	
	Co-authorship	Authors	Number of publications two researchers have co-authored.
		Organizations	
		Countries	
	Co-occurrence	Keywords	Link between keywords.
	Bibliographic coupling	Documents	Number of cited references two publications have in common.
		Sources	
		Authors	
		Organizations	
		Countries	

These bibliographic data are used to construct a network of citation, co-citation, co-authorship, co-occurrence, and bibliographic coupling links (type of analysis) depending always on the type selected.

Table 4: Visualization approaches

Visualization approaches	Concept	Difference
Distanced-based	The nodes in a bibliometric network are positioned in such a way that the distance between two nodes indicates the relatedness of the nodes.	(Distanced-based and Graph-based)
Graph-based	The nodes are positioned in a two-dimensional space.	Graph-based approach edges are displayed to indicate the relatedness of nodes.
Timeline-based	Each node in a bibliometric network can be linked to a specific pint in time	

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A bibliometric network is constituted by nodes (publications, journals, researchers, or keywords) and edges (relations between Pair <Node,Node>).

2.3 Data Collection

The procedure of data collection intended to provide comprehensive research in the field of DBM. To ensure a solid literature review, information was obtained from the source: Elsevier Scopus database.

According to Knobloch et al. (2011), the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement should be used for systematic reviews and meta-analyses, so based on that, the present literature review was done according with that, once it gives a better understanding about the selection process (Moher et al., 2009).

Following the PRISMA methodology, Figure 1 shows all the steps according with that methodology, a selection process followed carefully, to ensure the reduction of bias and misleading results (Knobloch et al., 2011; Moher et al., 2009), increasing the worth of this study.

Figure 1: Selection Process based on PRISMA methodology (Adapted from Moher et al., 2009)
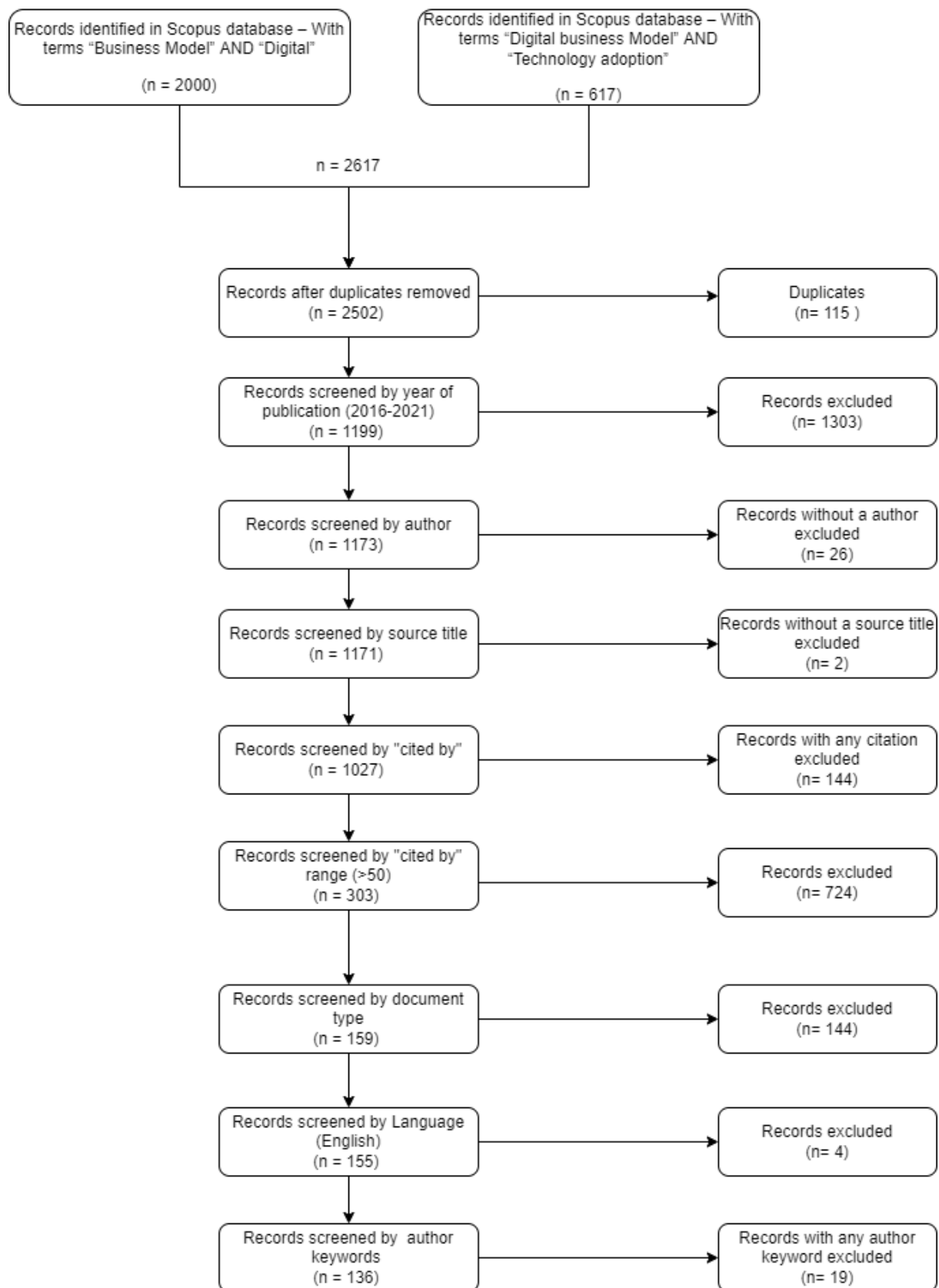
The documents obtained were retrieve from Scopus database searched with the following queries ("Business Model" AND "Digital"), merged with the documents achieved by the terms ("Digital Business Model" AND "Technology adoption"), both in the title, abstract or keywords. Thus, in the initial search, 2617 scientific literacy articles had been found, once the same database was used, and because of the similarity from both queries, the records were all analysed, and the duplicates were removed. Then, all outsider records between the range 2016 and 2021 were removed. Afterwards, all records without an author, source title and citation were eliminated. Then, the remaining records were filtered by citations and the ones with less than 50 citations were removed, posteriorly a filtering by document type was performed were the ones selected were just "articles". Finally, the records that were not originally published in English and didn't had any author keyword were removed. This selection process doesn't include a filtering by field or subject area, once a DBM and technology adoption doesn't have a specific subject, their implementation can occur in any subject. The obtained 136 records were all analysed and read.

2.3.1   Type of analysis selected

The analysed articles were retrieved from the Elsevier Scopus database and downloaded in "CSV" format to be processed by VOSviewer to visualize the development process and structural relations in several fields areas based on literatures from Scopus database. However, only the 20 most cited papers will be discussed graphically on VOSviewer.

Despite the fact of having several options available, in this thesis it has been selected 2 options from Table 3: VOSviewer types of analysis, and 4 items of analysis. For the options selected, the counting method chosen was the "full counting" that means that each co-authorship, co-occurrence, bibliographic coupling, or co-citation link has the same weight. The types of analysis chosen are presented in Table 5.

Table 5: Types of Analysis Chosen (Adapted from van Eck & Waltman, 2013)

Type of Analysis	Item of analysis
Co-authorship	Authors
	Organizations
	Countries
Co-occurrence	Keywords

Chapter 3. Data analysis

3.1 Bibliometric analysis

The systematic literature review performed was planned to identify DBM's, also study their implications and uncover enablers and barriers for the successful implementation of them.

As it is delineated in Figure 2: The number of publications on digital business models from 2016-2021, the number of publications about DBMs decreased since 2017. This can be explained through the fact that we live in a globalization era where is imperative to organizations reinvent continually their business, once business world is a market that expands really fast, and organizations that already have controlled the market on their area are confronted all the time by new competitors that redefine the standard industries (Rachinger et al., 2019), so companies in the current times already have implemented this model on their structures. However, until 2020 one of the major solutions for the continuously innovation of the BMs of companies was the implementation of a digital one, once according to Tesch and Brillinger (2017) the biggest technological challenge that organizations face is digitalization. The organizations have utilized these models to grow faster and become more agile, but also, to capture value over the time.

Figure 2: The number of publications on digital business models from 2016-2021(Scopus)
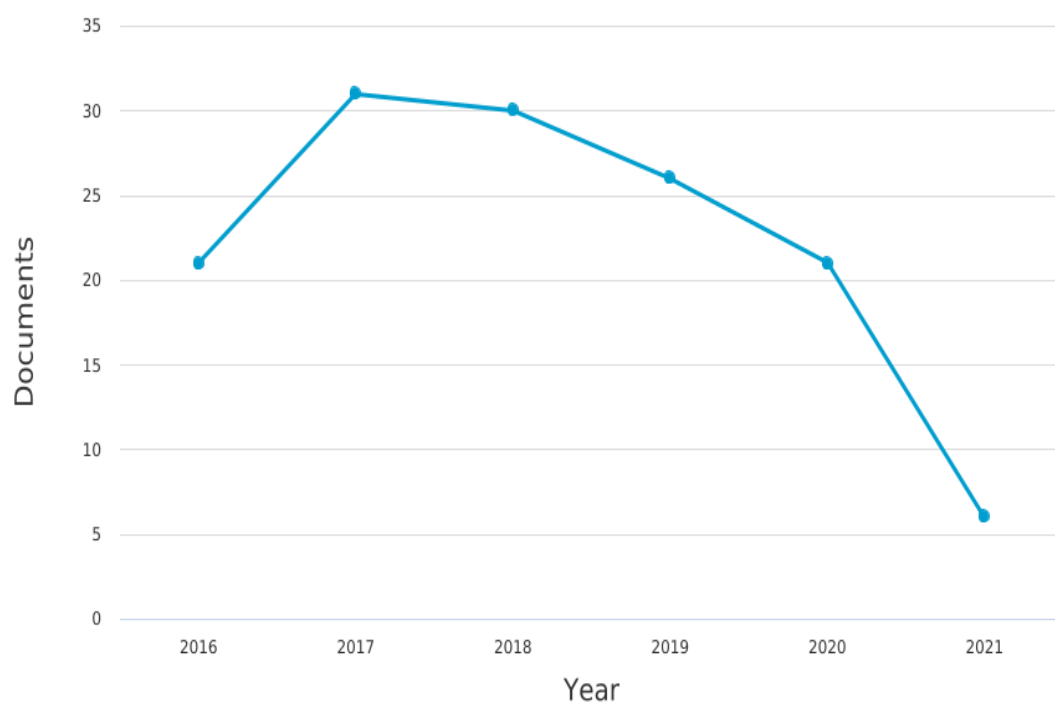
Furthermore, the implementation of DBMs implies news challenges, and considering the lag between the discovery of a new technology and its adoption (Doraszelski, 2004). Notwithstanding, the impacts of culture values on technology usage and acceptance can't be ignored, according to Sunny et al., (2019) studies have shown distinct customer experiences about the successful acceptance of new technologies, considering different cultural values, as a factor determinant in the users' introduction and response to new technologies.

The present SLR provides insights into the research path of the DBM, but also the knowledge of how such different research areas, sectors or even industries apply DBM in order to increase their organizational effectiveness or competitiveness, cost saving, enhance better revenue, simplifying processes, and driving innovation (Mao et al., 2016).

Thus, through a depth analysing, the papers selected came from 93 different sources, and the most come from the Journal of Business Research publications, represented on Table 6: Publications Overview and Figure 3: The number of publications on the digital business model in different journals.

Table 6: Publications Overview

Source Title	Papers
Journal of Business Research	6
Industrial Marketing Management	5
Sustainability (Switzerland)	5
Technological Forecasting and Social Change	5
Applied Energy	4
International Journal of Information Management	4
Other Journals	40
Others	67

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As shown by Figure 3 the overview of publications in different journals, where the journal of business research (with 6 documents), industrial marketing management (with 5 documents), sustainability (Switzerland) (with 5 documents) and technological forecasting and social change (with 5 documents) are the major journals that have published the results and findings of research on DBMs.

Figure 2 and Figure 3 also elucidates about the number of documents published in these journals has been decreased or increased from 2016 onward.

In Figure 4, are represented the data regarding to the different subject areas that have utilized DBMs in either their keywords, abstract, or title. According to the Figure 4, 'Business, Management and Accounting (with 27.5%)', 'Computer Science (with 17.4%),', 'Engineering with (12.7%)' and 'Social Sciences (with 12.0%)', are the major subject's areas that have lend the concept of DBMs, moreover together they have published more than half (i.e., 69.9%) of the documents.

Through the analysis made in Figure 5, it was possible to distinguish 10 different countries on the studied paper. Where, most of the studies focus on United Kingdom and United States both with 29 documents, as can be seen in Figure 5.

Figure 4: Implementation of digital business model in different subject areas (Scopus)
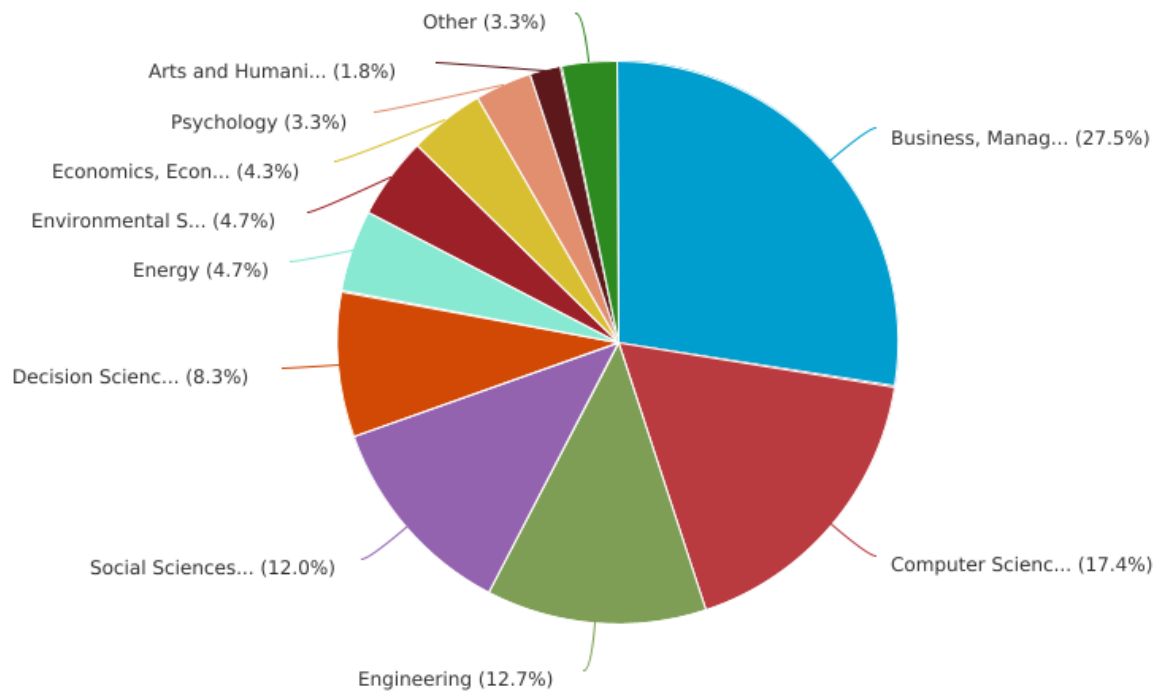
Figure 5: Research on digital business models in different countries from 2016 to 2021 (Scopus)
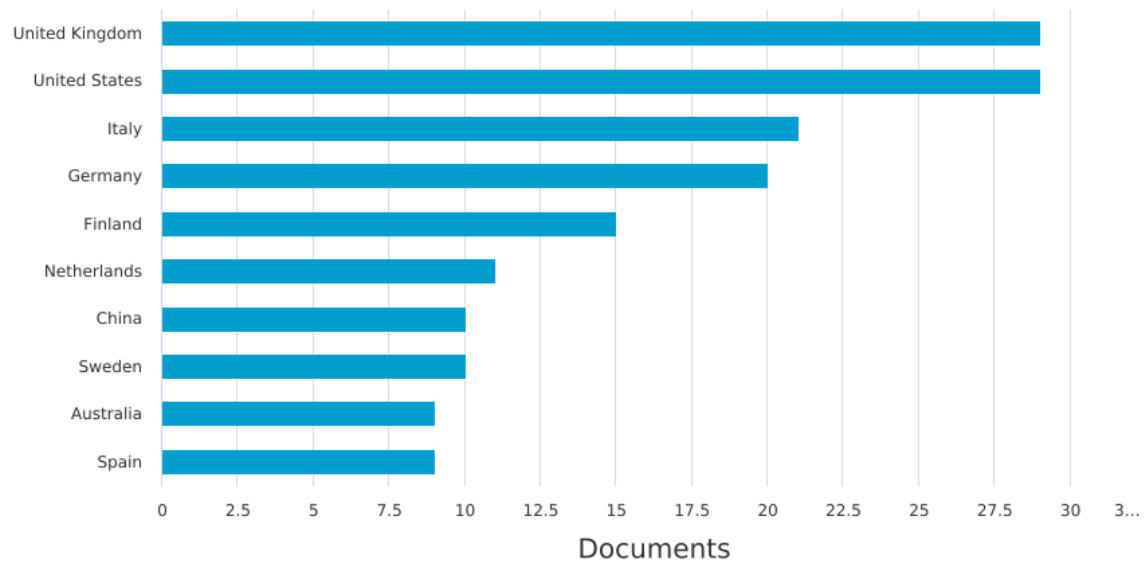
3.2 VOSviewer analysis

3.2.1 Co-occurrence – keyword analysis

In order to identify the main key concepts and findings over the period of time stablish above, was performed a map of the keywords that were applied on the 20 most cited papers of our filtered research (136 papers). Considering the option keyword co-occurrence of Table 5, through VOSviewer that analysis was made, returning as the output a comprehensive network visualisation of the top keywords, that means the ones that usually co-occur together.

According to the van Eck & Waltman (2013), the distance between two items identify the strength of the relation between them, a smaller one indicates a stronger relationship. Thus, Figure 6: Network Visualization of co-occurrence - keyword analysis, represents the main key concepts and findings over the range of 2016 to 2021 of the research on the topic of DBMs.

Figure 6: Network Visualization of co-occurrence - keyword analysis (VOSviewer Software)
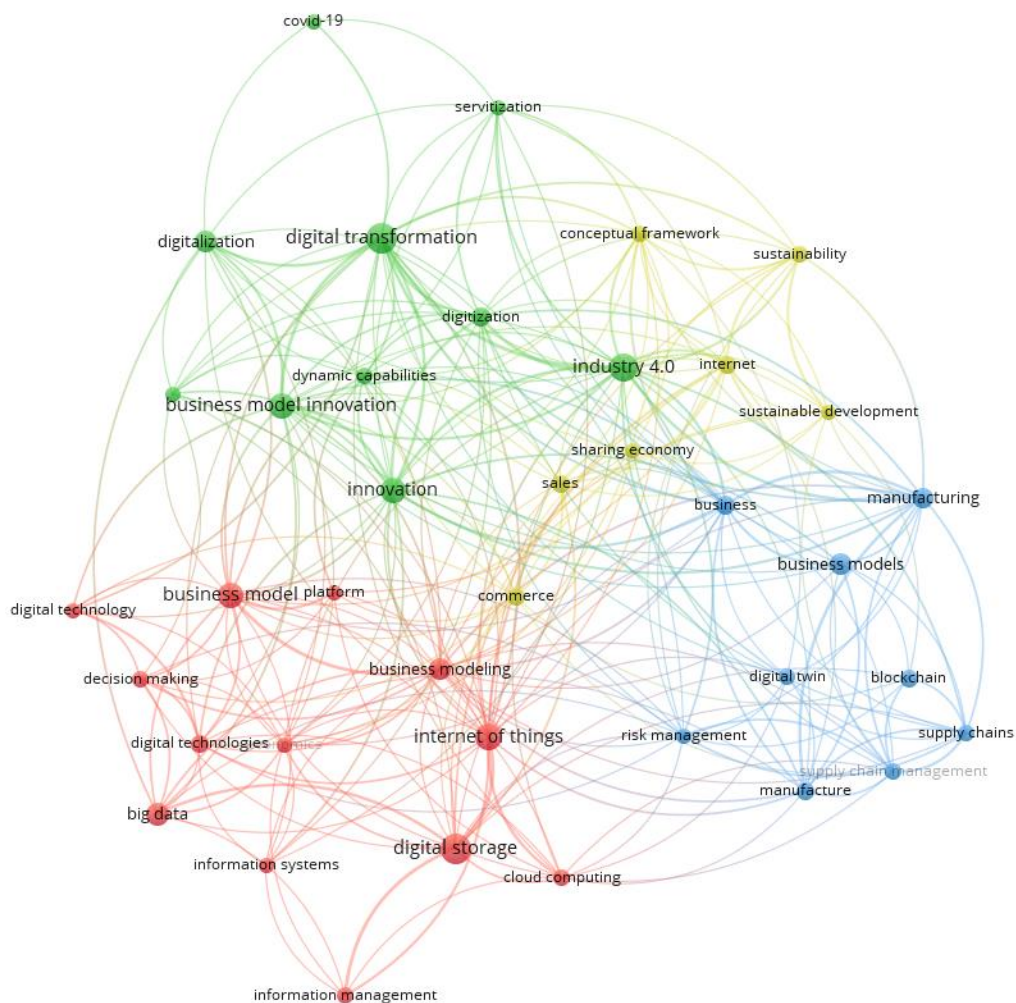
Through a deep analysis of the map, and interpreting the results generated, immediately enhance the view, 4 main clusters, as represented on Table 7 . Cluster is a set of closely related nodes.

Table 7: Clusters of key concepts

Cluster 1: **Business modelling**	Cluster 2: **Digitalization**
Internet of things; Digital technologies; Decision making; Business modelling; Business model; Information systems; Information management; Big data;	Digitalization; Digital transformation; Technological development; Business model innovation; Innovation; Dynamic Capabilities
Cluster 3: **Management**	Cluster 4: **Sustainability**
Blockchain; Business; Business models; Manufacturing; Supply chain; Risk management	Sustainability; sharing economy; Sustainable development; commerce

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3.2.1.1 Business modelling and Digitalization Cluster

According to Velu & Stiles (2013) the BM outlines the architecture and sense of the business. Recently, merging distinct technologies as Big Data, opens forward potentialities to create new BMs (Rachinger et al., 2019). According to Bouwman et al., (2018) big data plays an important role because, can affect companies in all their core logistic activities and their principal partners. As Big Data, IoT (Internet of Things) increase the possibility to power up the technology in order to innovate the companies strategies , creating hypothesis to implement new service-oriented BM (Paiola & Gebauer, 2020).

Moreover, the innovation of BMs is fundamental to the adaptation of new resources and technologies, providing a bigger change for companies to have better performance than its competitors, becoming one of the priorities of CEO's (Velu & Stiles, 2013; Dhir et al., 2020).

Thus, according to Reymen et al., (2017) the importance of decision-making and innovation is indisputable when business modelling plays a key role in preventing unexpected events, and to prepare the BM to work with certain technologies (Bouwman et al., 2018). In fact, business leaders are always worried about disruption, to have a better response companies are start to feeling a necessity to innovate their BMs to be successful in the digital world (Rachinger et al., 2019).

The ability to react, respond, and differentiate is crucial for any business to prosper, however, industries due to the constants changing environments have been facing many transformations over the past century (Frank et al., 2019a), how can organizations innovate and meet their customers' and users' expectations in the right time-to-market?

Recent evidence suggest that LSAs (Lean Startup Approaches) are agile methods for BMI (Business Model Innovation) (Ghezzi & Cavallo, 2020a).

For that reason, the BM itself has progressively starting to be a source of innovation and competitiveness (Hossain, 2017; Rachinger et al., 2019), according to Frank et al., (2019) associated with servitization strategy of firm products, across their digital transformation journey. Studies of servitization strategies show the importance of digital technologies on supporting their implementation, that are required to successfully guarantee each service transformation path (M. Ardolino et al., 2018).

Existing research recognises the critical role played by DC (Dynamic Capabilities) for digital transformation path, viewed as the use of new digital technologies. DC turns possible to create, extend and change an organization resource base, building strong DC is imperative to companies be prepared to deal with disruption innovations, a fundamental key to digital transformation and therefore to the implementation of DBM (Warner & Wäger, 2019a). The top 5 papers identified on this cluster are described on Table 8.

Table 8: Business modelling and Digitalization Cluster

Title	Authors	Year	Source	Cited
Servitization and Industry 4.0 convergence in the digital transformation of product firms: A business model innovation perspective	Frank, A.G., Mendes, G.H.S., Ayala, N.F., Ghezzi, A.	2019	Technological Forecasting and Social Change 141, pp. 341-351	290
The role of digital technologies for the service transformation of industrial companies	Ardolino, M., Rapaccini, M., Saccani, N., (...), Crespi,	2018	International Journal of Production Research	249

	G., Ruggeri, C.		56(6), pp. 2116-2132	
Agile Business Model Innovation in Digital Entrepreneurship: Lean Startup Approaches	Ghezzi, A., Cavallo, A.	2020	Journal of Business Research 110, pp. 519-537	177
The impact of digitalization on business models	Bouwman, H., Nikou, S., Molina-Castillo, F.J., de Reuver, M.	2018	Digital Policy, Regulation and Governance 20(2), pp. 105-124	108
Internet of things technologies, digital servitization and business model innovation in BtoB manufacturing firms	Paiola, M., Gebauer, H.	2020	Industrial Marketing Management 89, pp. 245-264	103

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3.2.1.2 Management Cluster

According to Vendrell-Herrero et al., (2017) companies work together in supply chains, but they all try to maximize their individual power to engage greater value for themselves. Once, servitization can transformed the structure of the supply chain, and for that reason both are linked. However, there is conflicting evidence on the relationship between considering servitization a risky strategy (Vendrell-Herrero et al., 2017) and the importance of the implementation of a servitization strategy (M. Ardolino et al., 2018), moreover, according to Kohtamäki et al., (2019) BMs in digital servitization should be seen through an ecosystem perspective.

Studies of BMI show the importance of companies continuously innovates their supply chains and complementary BMs to increase their business ecosystems (Wang et al., 2018), but also servitization and digitalization (Kohtamäki et al., 2019).

Debate continues about the best strategies for the management of the implementation of BMs and sustainable supply chains, and according to Bogers et al., (2016) utilizing AM (Additive Manufacturing) technologies on the supply chain will reduce the inventory levels, that will allow companies to increase the delay differentiation, providing a better supply correspondence to real demand. One major issue in early Linde et al., (2020) research concerned about how to manage the risk of dealing with the unknown. Thus, it's fundamental to managers focus on selecting the right approach to risk management, and according to (Linde et al., 2020), there is four approach's.

1. Avoiding the risk.
2. Mitigating the risk.
3. Transferring the risk.
4. Leveraging the risk.

According to Sunny et al. (2019) one of the major challenges that managers face, is providing an innovative service experiences to customers, and, at the same time, minimize the risks of applying a new delivery process to employees. Moreover, they have also to guarantee that their employees are capable with the implementation of new technologies-based services if the company choose to adopt new technologies. The top 5 papers identified on this cluster are described on Table 9.

Table 9: Management Cluster

Title	Authors	Year	Source	Cited
Blockchain	Nofer, M., Gomber, P., Hinz, O., Schiereck, D.	2017	Business and Information Systems Engineering 59(3), pp. 183-187	457
Servitization, digitization and supply chain interdependency	Vendrell-Herrero, F., Bustinza,	2017	Industrial Marketing Management 60, pp. 69-81	296

	O.F., Parry, G., Georgantzis, N.			
Additive manufacturing for consumer-centric business models: Implications for supply chains in consumer goods manufacturing	Bogers, M., Hadar, R., Bilberg, A.	2016	Technological Forecasting and Social Change 102, pp. 225-239	223
Understanding platform business models: A mixed methods study of market-places	Täuscher, K., Laudien, S.M.	2018	European Management Journal 36(3), pp. 319-329	212
Digital servitization business models in ecosystems: A theory of the firm	Kohtamäki, M., Parida, V., Oghazi, P., Gebauer, H., Baines, T.	2019	Journal of Business Research 104, pp. 380-392	197

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3.2.1.3 Sustainability Cluster

Existing research recognises the critical role played by optimizing continuously the business processes to enhance CE (Circular Economy) (Bag et al., 2020).

A considerable amount of literature has been published on CE, and several cross-sectional studies suggest common definition of CE is the attempt to make better use of resources (Velenturf & Purnell, 2021). However, so far there has been little agreement on what constitutes "better" (Velenturf & Purnell, 2021).

Previous studies of CE, explain the fundamental role of understanding of the social, technological, economic, and environmental opportunities it's essential to achieve CE system (Reuter, 2016).

Thus, in the new global economy, CE has become a central issue for achieved sustainable development goals (Bag et al., 2020).

According to Bressanelli et al., (2018) digital are essential for implementing served BMs, and at same time, supporting the implementation of the CE into business.

Due to the current globalization and expansion of markets it is vital for organizations to continually reinvent their business to continue competitive on global markets. Moreover, organizations that already have dominated the market are all the time confronted by new competitors, that change established industries (Rachinger et al., 2019).

According to Richter et al., (2017) the SE (Sharing Economy) is a technological approach involving a sustainability element and may be considered a strategic component in the field of sustainable innovation, as previous said digital technologies support their implementation, because due to the increasingly digitalized environments, working situations are always changing as the mindset, and these aspects drives the SE. Thus, sharing digital content it's considered a main component, moreover, establishing a strongly relationship with trust customers that act as providers and consumers and especially the obligation of an existent trust BM, are the necessary basis for the SE context. The top 3 papers identified on this cluster are described on Table 10.

Table 10: Sustainability Cluster

Title	Authors	Year	Source	Cited
Exploring how usage-focused business models enable circular economy through digital technologies	Bressanelli, G., Adrodegari, F., Perona, M., Saccani, N.	2018	Sustainability (Switzerland) 10(3),639	212
Development of a risk framework for Industry 4.0 in the context of sustainability for established manufacturers	Birkel, H.S., Veile, J.W., Müller, J.M., Hartmann, E., Voigt, K.-I.	2019	Sustainability (Switzerland) 11(2),384	165
Sustainable business model archetypes for the banking industry	Yip, A.W.H., Bocken, N.M.P.	2018	Journal of Cleaner Production 174, pp. 150-169	118

Author: Rangel, João

3.2.2 Co-authorship – Countries

Considering the same data (20 most cited papers), and changing the settings on VOSviewer, a "Co-authorship – Countries" analysis was performed, resulting in 6 distinct clusters with 31 items (countries), presented in Table 11.

Table 11: Co-authorship - Countries (cluster items)

Cluster	Country
Cluster I	India
	Netherlands
	New Zealand
	South Africa
	Taiwan
	Turkey
	United Kingdom
Cluster II	Austria
	Finland
	Germany
	Norway
	Sweden
	Switzerland
Cluster III	Brazil
	France
	Greece
	Ireland
	Portugal
	Spain
Cluster IV	Belgium
	Denmark
	Italy
	Russian Federation
	United States
Cluster V	China
	Hong Kong
	Malaysia
	South Korea
Cluster VI	Australia
	Canada
	Singapore

Author: Rangel, João

Notwithstanding the fact that 7 of 38 items in the network didn't meet the threshold, and the minimum number of documents of a country stablish was 1 document to be eligible. Moreover, to have a total view of their relation, for all 31 selected countries, the total strength of the links between the nodes with other countries will be measured. The ones with more total link strength will be chosen and described. Thus, from the selected countries in Table 11 a top 4 in

means of total link strength was performed, where the highest are United Kingdom (UK), fol-lowing by United States (US), Italy and Germany, represented in Table 12, followed by the network visualization to complement. The link strength between "X Country" items with other countries items can increase the strength based in the average publication year or citations.

Table 12: Top 4 of countries based in total link strength

Country	Documents	Citations	Total Link Strength
United Kingdom	29	3654	38
United States	29	3488	27
Italy	21	2334	24
Germany	20	2663	19

Author: Rangel, João

Figure 7: Network Visualization (VOSviewer Software)
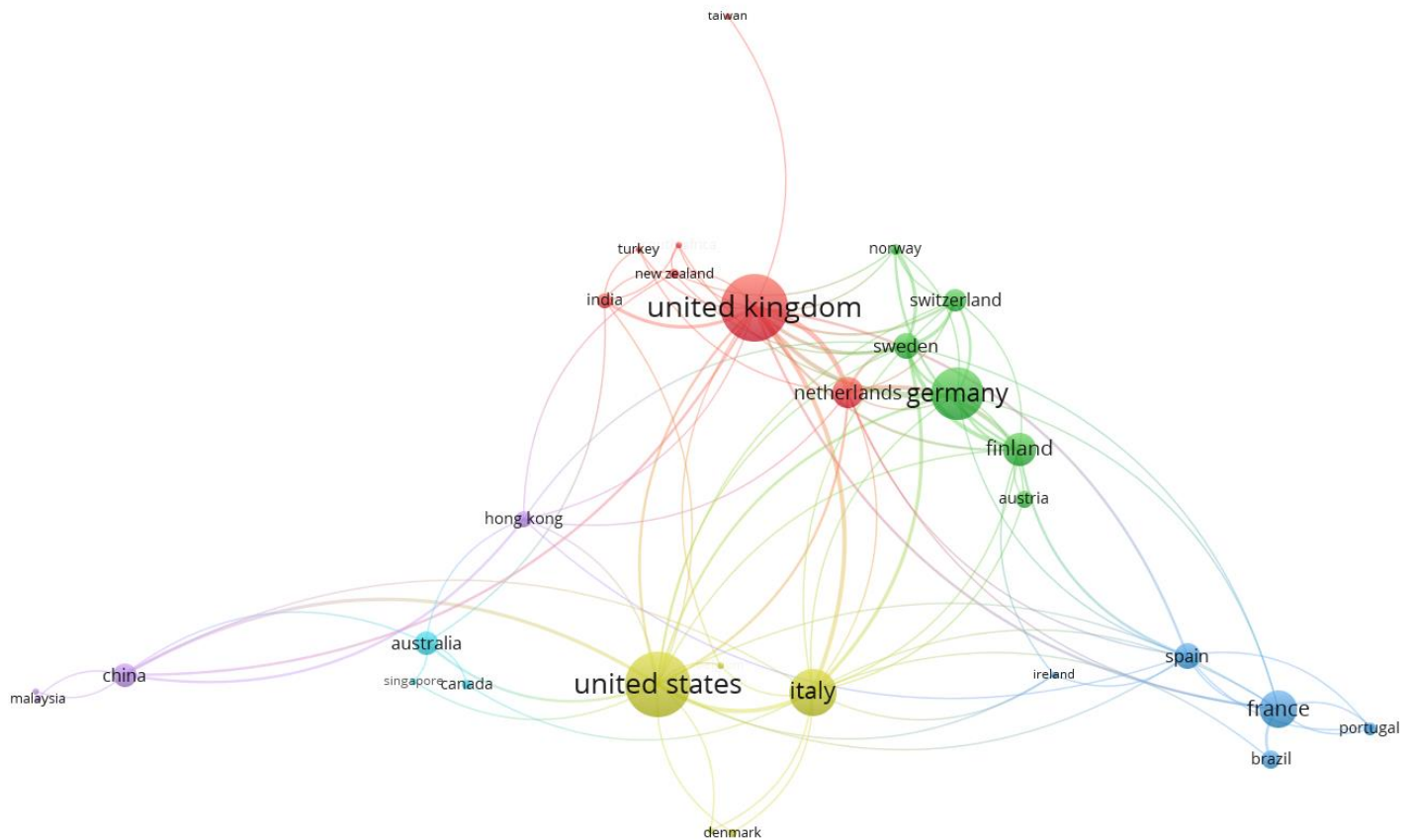
The analyse "Co-authorship – Countries" generate two outputs represented in the Figure 8 and Figure 9. In Figure 8 is the result of the average of publications per year, from 2016 until 2021. Where the items more visibly mean higher weight, and for that reason it's easy to identify United States of America, United Kingdom, Italy, Germany, Finland, and Netherlands have a significant higher weight in terms of average publications per year, owing to the total number

of publications using the keyword. In this respect, to establish this output with has been utilized as weight the "documents "and as score the "average of publications per year". Represented with more detail in Table 13.Figure 8: Scored by average of publications

Figure 8: Scored by average of publications (VOSviewer Software)
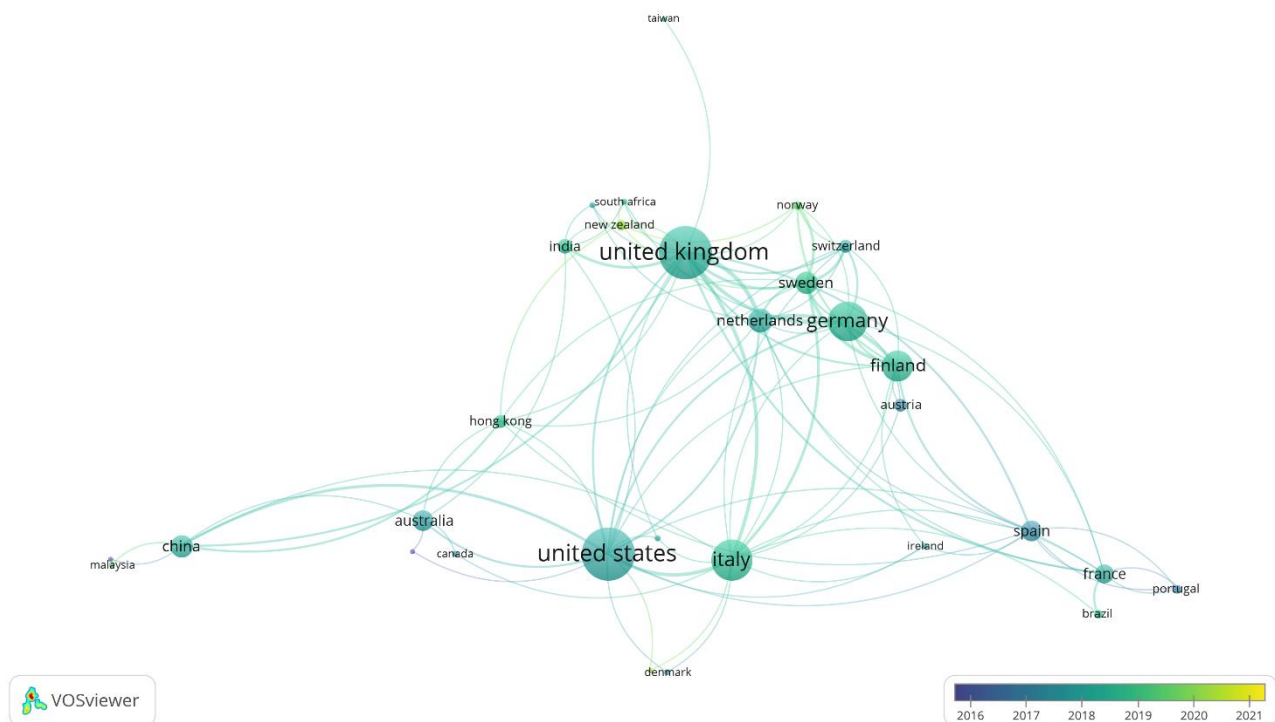
Once the option of visualisation selected as the weight, the Table 13 was sorted based on the total number of documents. In this table and previously said in this paper, the stronger the link between two items, the heavy the line displayed in the visualization of the map. For example, the United Kingdom has 29 connections between the UK and other third countries, and in terms of average of publications per year, represented in Table 13, UK, IT, DE, and FIN have the most recent date average which means the publications are significantly more recent, than in this case US.

Table 13: Countries sorted by highest average publications

Country	Cluster	Link	Total Link Strength	Documents	Avg. Publications year
United Kingdom	1	18	38	29	2018
United States	4	18	27	29	2017
Italy	4	16	24	21	2018
Germany	2	12	19	20	2018
Finland	2	11	21	15	2018

Author: Rangel, João

On the other hand, in Figure 9 is the result of the average of citations, where the weigh is the same as average of publications. For instance, is possible to identify the top 5 countries with the highest citation rate. Thus, DE in first place, following by, UK, US, IT and FIN, described in Table 14.Table 14: Countries sorted by highest average citations

Figure 9: Scored by average of citations (VOSviewer Software)
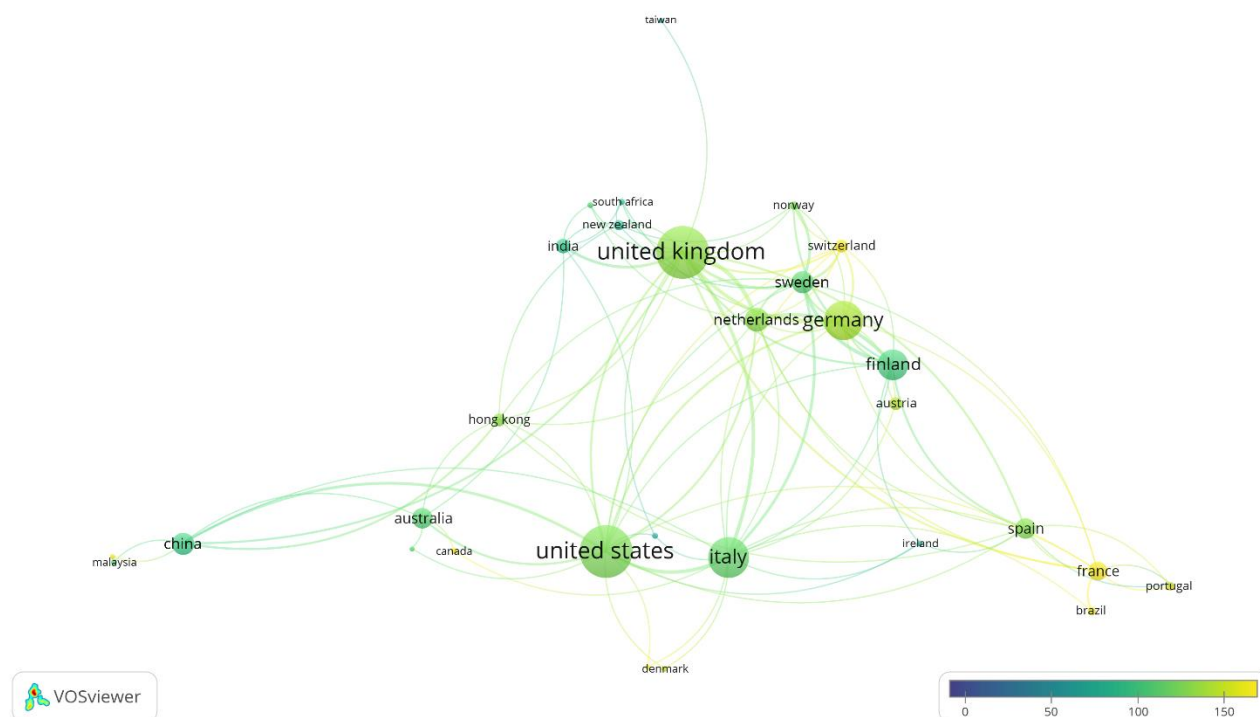
In Table 14, are represented the ranked countries with a higher average citation rate. For example, the DE outshine the UK and US with a considerable difference, meanwhile FIN is positioned in the last position and not even close to IT.

Table 14: Countries sorted by highest average citations

Country	Cluster	Link	Total Link Strength	Documents	Avg. Citations
Germany	2	12	19	20	133.15
United Kingdom	1	18	38	29	126.00
United States	4	18	27	29	120.28
Italy	4	16	24	21	111.14
Finland	2	11	21	15	100.67

Author: Rangel, João

3.2.3 Co-authorship – Organizations

In addition to retrieve information from the dataset with reference to organizations, a "Co-authorship – Organizations" was performed where the maximum number of organizations per document was 25, the minimum number of documents of an organization was 1, and the minimum number of citations of an organization was 100. Thus, of the 336 organizations, 146 meet the thresholds. These 146 items were clustered in 58 new clusters, being 37 clusters with more than one item and the remaining ones with only 1, the information is represented in Figure 10.

Figure 10: Co-authorship – Organizations citations overlay (VOSviewer Software)
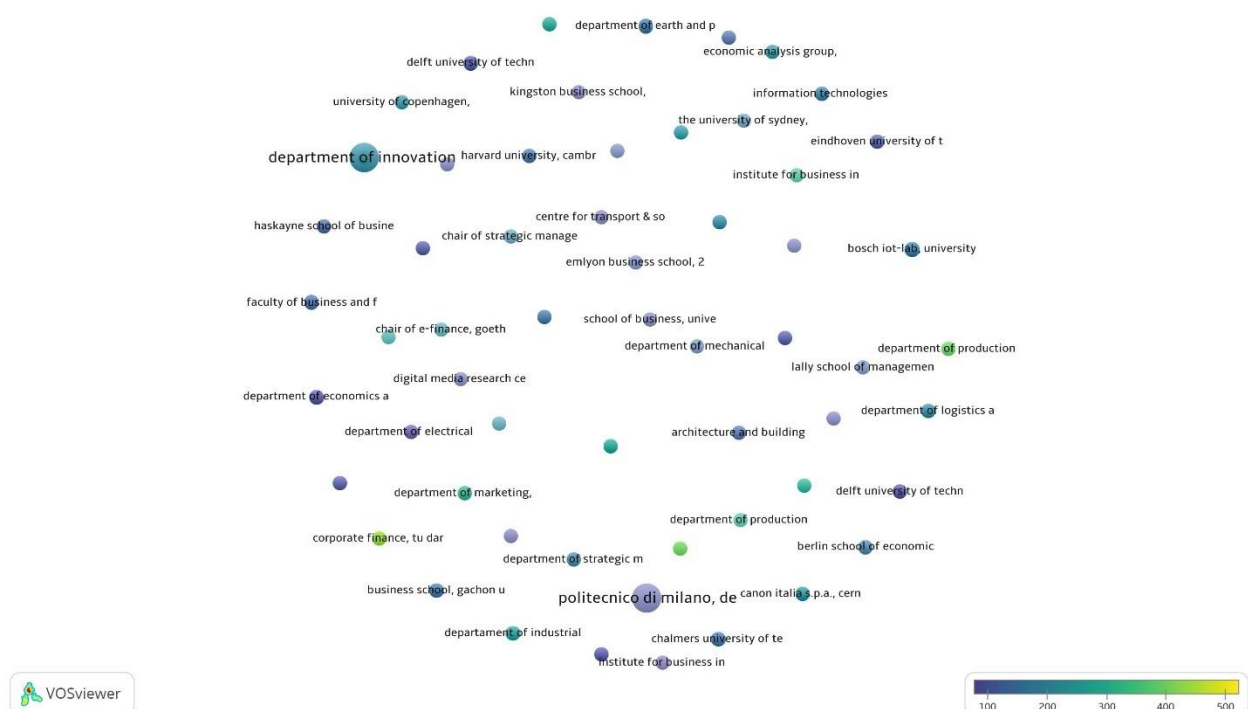
For instance, Figure 10 is the visualisation with the overlay method where the minimum score of citations was 100 and the maximum was 500, representing the organizations with the highest average citation rate. Moreover, the larger the number of items in the locality of a point and the higher the weights of the zone items, the colour will point to yellow, the opposite will point to blue. Thus, the distance between clusters indicates how close their relationship is in terms of citations, which shows organizations close to another proximity tend to be more related, the opposite leads to a low or inexistent relationship.

To have a better idea which organizations have more citations, a table with top 3 was created that shows the highest rate citations, represented in Table 15.

Table 15: Top 3 Organizations with the highest rate citations

| Organization	Documents	Citations
Department of innovation and entrepreneurship, imperial college business school	2	410
Tilburg university school of economics and management	2	410
Politecnico di Milano, department of management, economics, and industrial engineering	2	218

Author: Rangel, João

The result from the selected organizations with more than 400 citations the department of innovation and entrepreneurship, imperial college business school and Tilburg university school of economics and management are the ones with higher number of citations, following by Politecnico di Milano, department of management, economics, and industrial engineering with 218 citations.

3.2.4 Co-authorship – Authors

The "Co-authorship – Authors" analyse was performed, to determine the relatedness of publications, based on direct citation relations, some filters were applied to the query. Thus, of the 432 authors of the 20 most cited papers, choosing 2 as the minimum number of documents of an author, 21 of 432 meet the thresholds. These 21 items were clustered in 10 new clusters. Some of the authors aren't connect with each other and the largest set of connect items is 8, however, in this representation the decision was include all the items. The results are presented in Figure 11 where the chosen weight was the citations, and the score was the average publication per year.

Figure 11: Co-authorship – Authors citations overlay (VOSviewer Software)
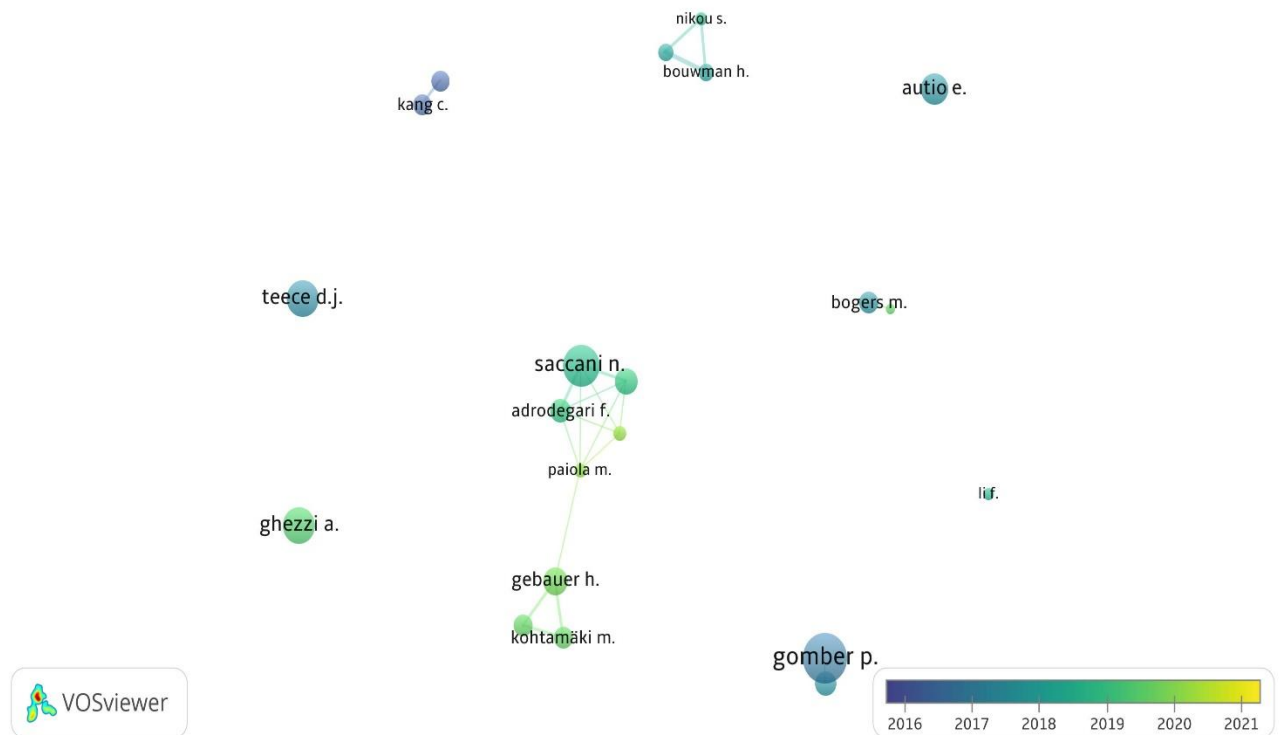
In this, overlay visualisation the items with bigger size, means higher number of citations and the ones closer, between other authors, represents the level of connection among them in citations and publications. For example, the Table 16 shows the authors with more citations related with the keyword "digital business model".

Table 16: Authors with more citations related with business case keyword

Author	Documents	Citations	Total Link Strength
Gomber p.	2	727	1
Saccani n.	3	587	6
Ghezzi a.	3	536	0

Author: Rangel, João

The author Gomber has two papers in the dataset related with the innovation of the business models, and digitalization, where the author proposes the adoption of new disruptive innovations and turn the focus to digitalization, allowing new insights into one of the questions of this research. According to Gomber et al., (2017) a shift in the focus of digitalization to improve

the delivery of traditional functionalities is needed, to create and generate new business opportunities and models.

The author Saccani, has three papers, related with sustainability, management, and digital technologies. In all papers, the author assumes the co-authorship. Thus, in relation to the research questions of this study the main proposes of the three papers, are a clearly understanding about the role of digital technologies, helping managers to understand the service innovation, making decisions about the digitalisation of their business with a consistent business model innovation (Marco Ardolino et al., 2018). Moreover, how digital technologies support the implementation of CE paradigm to the business, and the importance of the acceleration of digital transformation (Bressanelli et al., 2018; Rapaccini et al., 2020).

Finally, Ghezzi has two papers of him, and assumes the co-authorship in one. The main proses of the author in relation to this study questions and give more literature information about them are, to support BMI (Business Model Innovation), companies should implement lean and agile principles known as LSAs (Lean Start-up Approaches), creating entrepreneurial opportunities through digital technologies (Ghezzi, 2019; Ghezzi & Cavallo, 2020b). Once we are facing a digitalized era, it's essential to adopt constantly new technologies, and establish the mindset to implement in organizations a technology-push innovation approach (Frank et al., 2019b).

Chapter 4. Discussion and Findings

4.1 Discussion

In the present investigation work, it was examined how BMs evolve all over the years, currently, once we leave in a digitalization era, the implementation of a DMB is essential for companies staying competitive and prepared to deal with the disruption, that can appear out of nowhere. Moreover, this section discusses the results considering the literature and suggests future research directions in the field of digital business models. Finally, the findings of literature for the implementation of DMBs and techniques, the role played by digital technologies and the process of digitalization to help achieving sustainability goals and innovation.

4.2 Q1 – Which are the most relevant factors in the adoption of DBM?

Through the analyse made on fourth chapter, it seems for the implementation of a successful DBM, there are three essential things, represented in Table 17, with some examples, besides that they are all connected.

Table 17: Factors considered for the implementation of a DBM

| Factors considered	Examples	Authors of papers related
Drivers of innovation	LSAs, DC, Digital technologies	(Ghezzi & Cavallo, 2020a), (Ghezzi, 2019)
Adoption of digital and new technologies and digitalization process	Big data, IoT	(Paiola & Gebauer, 2020), (Rachinger et al., 2019) (Bouwman et al., 2018), (Gunasekaran et al., 2017),
Sustainability goals	CE	(Fuertes et al., 2020), (Birkel et al., 2019), (Bag et al., 2020), (Velenturf & Purnell, 2021), (Bressanelli et al., 2018), (Richter et al., 2017)

Author: Rangel, João

Therefore, for instance, if companies don't have built a system of DC, pass through a digital transformation and survival in this technological changing era, it seems impossible. According to Warner & Wäger, (2019b) building DC is now an imperative strategy to ensure the survival in the digital era. Thus, to companies pass to a digital transformation, DC is needed, also in order to achieve sustainability, the constant adoption of new technologies is a requirement, according to Happonen et al., (2020) the adoption of the newest technologies, also innovation, for example Artificial Intelligence are one way to companies reach and produce new circularity and sustainability.

Thus, to the adoption of new technologies and digitalization processes be successful innovation is then needed, also, according to Bouwman et al., (2018) reveals that the impact of big data in generate innovative activities and strategy are extensive, which means that the opposite is also true. For that reason, adopting an innovation trajectory, in order to attempt to innovate BMs, for example, technology-push according to Frank et al., (2019a) it's the progressive addition of technology, it seems important during a digital transformation journey.

Moreover, according to M. Ardolino et al., (2018) IoT is essential in the implementation of any service transformation strategy, being a fundamental tool, to offer digital solutions.

Then, innovation and digitalization are fundamental for a successful implementation of a DBM, that it's only possible with digital technologies, that are enablers to achieve sustainability goals, in Figure 12 are represented a diagram that illustrates the relations.

Figure 12: DBM relations
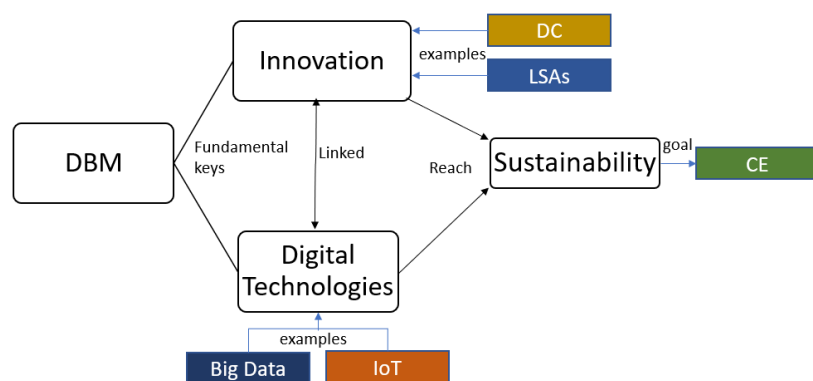
Author: Rangel, João

Until now, there has been little discussion about the implementation of DBM, to extend literature in this topic, this research paper was done, bringing information for further studies.

4.3 Q2 – How has it evolved over the past years, with the adoption of new technologies?

Through the bibliometric analyse made on fourth chapter, with the data retrieve from Figure 2 and Figure 3, we can conclude that, over time the number of publications on DBM decreased, however, to some journals like "Industrial Marketing Management" the number of publications increased. Despite of the decreased over time, the evolution of BMs is important to companies, specifically in a digitalization era. Knowing how to increase innovation to their business processes and core competencies, in this case through the adoption of new technologies.

Although business models have existed for a long time, new topics are surfacing as technology evolves and some of the old problems are resolved, according to Enterprises, (2020) digital transformation of BMs is a crucial process that helps traditional business solutions increasing their scop of functionalities using new innovative technologies.

Thus, companies are always competing and trying to reach competitive advantage through their BMs, and according to Verhoef & Bijmolt, (2019) with the advancement of technology, digital developments are changing BMs, and for that reason firms are digitally transforming themselves.

4.4 Q3 – Which are the most influential contributions and who are the most influential authors of DBMs research published between 2016 and 2021?

Through the analyse of the results on fourth chapter, it's possible to identify the authors most influential of DBM, they are represented in Table 16: Authors with more citations related with business case keyword. The most influential contributions are represented in Table 18.

Table 18: Most influential contributions of the most influential authors of DMBs

Author	Influential Contributions	Paper
Gomber P.	• Outstanding the fact that the emergence of innovative business models and the rise of new competitors, makes traditional services pass to a substantial transformation.	• Digital Finance and FinTech: current research and future research directions. *Journal of Business Economics*
	• The concept of intersection of a technology, markets, and business models. In other words, the adoption of a disruptive innovation that might change the existing business models.	• Blockchain. *Journal of Digital Policy, Regulation and Governance*
Saccani N.	• Outstanding the fact of the importance of some technologies as IoT, on service transformation paths.	• The role of digital technologies for the service transformation of industrial companies. *International Journal of Production Research*
	• IoT as an enabler to introduce sharing BMs. Therefore, reference to the fact that digital technologies may reach CE value drivers.	• Exploring how usage-focused business models enable circular economy through digital technologies. *Sustainability (Switzerland)*
	• Digital servitization makes the business less vulnerable by a disruption crisis.	• Navigating disruptive crises through service-led growth: The impact of COVID-19 on Italian manufacturing firms. *Industrial Marketing Management*
Ghezzi A.	• Outstanding the importance of the progressive adoption of digital technologies, in servitization, and how they can bring value. Relation between business models and digital transformation journey, through innovation.	• Servitization and Industry 4.0 convergence in the digital transformation of product firms: A business model innovation perspective. *Technological Forecasting and Social Change*

	• Introduction of LSAs, tools that supports entrepreneurial opportunity creation.	• Digital startups and the adoption and implementation of Lean Startup Approaches: Effectuation, Bricolage and Opportunity Creation in practice. *Technological Forecasting and Social Change*
	• Facing changing environments digital startups continues to carry out BMI, through agile strategies, as lean startup approach.	• Agile Business Model Innovation in Digital Entrepreneurship: Lean Startup Approaches. *Journal of Business Research*

Author: Rangel, João

Conclusion, limitations and future investigations

The current study only gives a general perspective of the relations between DMB drivers, their implementation and importance. Contributing to a better understanding of the DBMs, and how the process of digitalization in BMs works, techniques to get through a digital journey and finally the role of innovation.

Outstanding the fact that it's important to optimize continuously the business processes, adopting digital technologies to achieve CE, and offer digital solutions to the customer.

Evidently, this research has some limitations, for example, was only retrieved the papers from one database, to have more sample to analyse the ideal was to mix two different sources and eliminate de duplicates. The queries used, couldn't be the more indicated, but this is more difficult to know, but different queries give different results, and maybe there was relevant research that probably were omitted. Moreover, the software VOSviewer didn't enable more options of analysis, maybe because of the type of dataset.

In future research, understanding DMB paths and roadmaps to implement is important and needed to be developed for not only topics such digitalization, disruption innovations, sustainability goals, but also how DBM works with certain technologies. Moreover, the impacts of culture side on technology adoption and the costs associated with their adoption, needs more research.

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