

## ORIGINAL RESEARCH ARTICLE

# Digital transformation and business model in management & business research: An overview and future perspectives

Akram Bouwdad\*, Younes Lafraxo

*Management Sciences Department, Faculty of Legal, Economic and Social Sciences, Cadi Ayyad University of Marrakech, Marrakech 40000, Morocco*

\* **Corresponding author:** Akram Bouwdad, a.bouwdad.ced@uca.ac.ma

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## ABSTRACT

During pre-pandemic times, organizations acknowledged the importance of digital transformation (DT), but encountered challenges during implementation, such as complexity and cost, which hindered progress. The Covid-19 outbreak elevated DT to an urgent priority, necessitating resilient and competitive consumer-aligned business models. Morocco's post-Covid-19 programs, such as government initiatives like INDH, Forsa, CRI boost-lab, and university incubators, fostered "digital entrepreneurship", promoting awareness and platform-based business models across industries. Digital entrepreneurship involves creating new businesses or transforming existing ones through technological innovations. Nonetheless, this transition presents challenges and potential pitfalls. Existing reviews often focus on limited business and management domains, often leaning towards early optimism regarding DT's trajectory. In this context, our study employs bibliometric analysis using the Scopus database. We provide a comprehensive literature review to reveal DT's evolution within business and management. Our focus lies on the international and national DT landscape, considering three critical clusters: Digital transformation, Cloud computing, and business models. This approach enhances our understanding of the multifaceted implications of digital transformation (DT). We offer insights into the complex interplay among DT, cloud computing, and evolving business models. This study serves as a valuable resource, contributing to the comprehension of DT's dynamic progression.

**Keywords:** digital transformation; business model; cloud computing; bibliometric analysis

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## 1. Introduction

Prior to the pandemic, many organizations understood the importance of digital transformation (DT), but the process of its implementation was slowed down for most, due to various factors such as complexity and cost<sup>[1]</sup>, until Covid-19 unleashed a digital transformation as an urgent priority to accelerate digital evolvement<sup>[1,2]</sup> and developing new resilient business models with more value that are more competitive and aligned with the behavior that consumers developed during the latter crisis. This global transformation is referred to as the Fourth Industrial Revolution (i.e., Industry 4.0). Its ultimate goal is to make everything around us "smart", making it more of a digital transformation and less of a physical one<sup>[1]</sup>.

On this context we can understand that digitally-based tools have been an integral part of business life cycle for many years, being used to improve processes, expand into new markets, transform business models and, not least, influence the way in which companies—and indeed countries—are perceived in terms of competitiveness. However, the transition to this transformation should not be underestimated

because every change contains several risks, and one of major challenges that businesses face today is, not carefully consider the context into which the technology is introduced and how to derive any practical or monetary benefits<sup>[3]</sup>.

Thus, many reports were claimed from both industries and academic literature emphasize that successful DT initiatives lead to improved and sustained performance<sup>[4]</sup>. Despite the promising results, industry reports and studies have shown that these initiatives have a failure rate ranging from 60% to 85%, and that up to 70% of large organizational changes fail<sup>[2,5]</sup>. And its outcomes are by no means instantly, for instance, numerous studies on the diffusion of organizational innovations have emphasized that diffusion is by no means instantaneous, and that the benefits of an innovation can persist for many years before being rivalled by competition<sup>[6]</sup>.

For example, despite the many benefits of cloud computing, its adoption and diffusion among SMEs has been slow. While cloud investments remain timid with only \$14 million invested in 2014, mainly on public cloud services<sup>[7]</sup>, large Moroccan public companies are investing huge resources in adopting ERP tools, for example, they pay little attention to the factors underlying this decision<sup>[8]</sup>. In this light, several parameters are holding back investment in Cloud services, including security issues<sup>[7]</sup>.

In this context, digital technologies (DTs) are increasingly becoming a valuable source of future competitiveness for today's organizations, and they are used in the digital transformation process and disruptively to create, capture, deliver value and impact the business model of companies<sup>[2-4,9]</sup>. Not only that, the DT is also a ROI for the companies' Dynamic capabilities which allows the company's internal IT resources to be focused on more important activities such as digitizing an existing business or crafting new digital business models<sup>[10]</sup>. Meaning that by leveraging this resource for non-sensitive IT tasks, companies can eliminate the burden of maintaining their very own server to process all kinds of non-critical data.

In light of the growing importance of DT and its effects on businesses and societies, the present paper provides a systematic literature review on DT. For this purpose, a bibliometric through co-occurrence analysis based on selected keywords has been carried out. The most influential publications between the period (2019–2023), before and after the COVID-19 crisis, will be analyzed as part of a qualitative and quantitative review of the literature on DT in the context of digital business transformation, and technologies, through Cloud computing adoption will be considered here as our main driver of digital business transformation, and is seen as having societal and institutional implications and impact on companies' Business models.

The current document is organized into several sections and which their main objective is to analyze our three main clusters. The first part provides an overview of the theoretical constructs of “Digital transformation”, “Business Model”, and “DT-based Cloud Computing”. The second part presents the methodology of the selection process, including the criteria, terms and tools used, and thus subdivided into two analysis waves. The first wave highlights results from the bibliometric analysis of co-occurrences. And the second wave, describes the bibliometric analysis of the three identified clusters. Finally, the last part concludes and comments on the findings, including limitations and opportunities for future research.

## **2. Defining digital transformation in business and management**

Digital technologies are becoming critical to making activities, production processes and industrial facilities more flexible... they have been adopted by companies to create and capture value at a large scale<sup>[11-14]</sup>. As a result, they are increasingly becoming a valuable source of future competitiveness for today's organizations<sup>[15]</sup>.

Before going through more explanation about DT's paradox, it was cited in extremely recent study by examining various authors' contributions, that DT should be differentiated from other related terms that are

often used interchangeably<sup>[2,9,16]</sup>.

With this we distinguish:

Digitization is the technical process of converting analog signals into digital ones. This process allows the decoupling of form, function and access, and is a fundamental prerequisite for everything from smartphones to artificial intelligence, as the automation of processes by information technologies is deemed digitization<sup>[2-4,9,12,13]</sup>. According to Vial. G, digitalization includes “broader individual, organizational, and societal contexts”<sup>[4]</sup>. It also enables a new form of communication and collaboration that uses digital technologies and data to create new revenue streams, enhance business processes, and replace or transform business processes<sup>[2-4,11,13]</sup>.

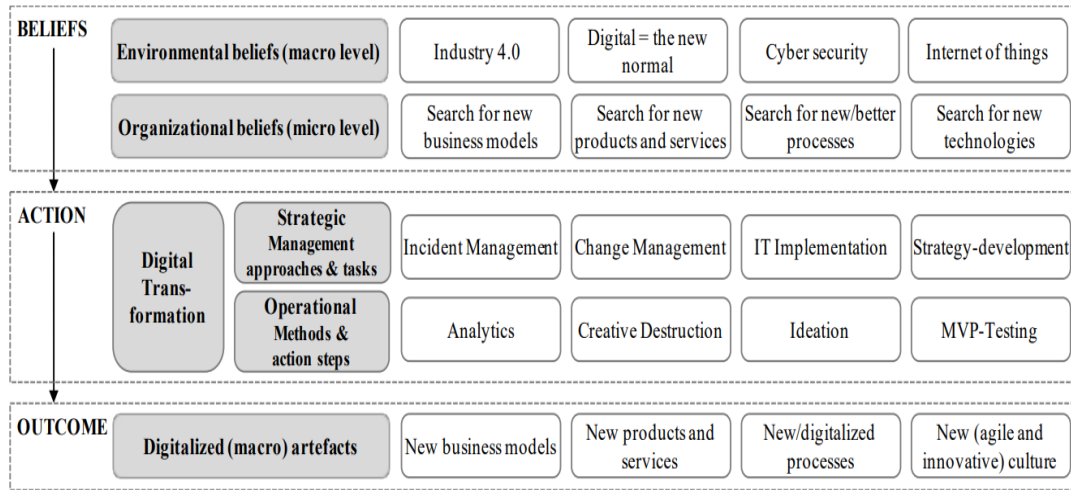
As for our main subject, digital transformation, has been identified as an important and growing phenomenon in strategic information systems research<sup>[17,18]</sup> and an evolution of IT-enabled transformation<sup>[4]</sup>. In a study<sup>[4]</sup> that took into account DT’s definitions from 23 analyzed articles, this latter constructed a conceptual definition of DT as, a “process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies”. Thus, and within the framework of digital transformation, organization capabilities and DT-based BM context, it can be seen as “the modification (or adaptation) of BMs, resulting from the dynamic pace of technological progress and innovation that trigger changes in consumer and social behaviors”<sup>[19]</sup>. As seen above, the DT is a process of integrating digital technologies (such as Cloud Computing, AI, Big Data...) into all aspects and operations of an organization, which leads to creating, capturing and diffusing value for customers, within the framework of a completely new business model<sup>[2,4,5,9,11,14,20]</sup>.

In his study<sup>[4]</sup>, Vial identified three types of DT disruption: affecting consumer behavior and expectations, the competitive landscape and data availability.

Consequently, these disruptions trigger strategic responses within organizations, which occupy a central place in the DT literature<sup>[4]</sup>. And thus, call for the merging of organizational strategy and information systems strategy rather than their alignment, and was powered by an emerging new concept, “Digital Business Strategy”, a concept involving an organizational strategy formulated and executed by leveraging digital resources to create differentiated value<sup>[4,17]</sup>. In Vial. G’s explanation, the digital transformation strategy calls for the fusion between organizational strategy and IS strategy<sup>[4]</sup>. In order to create this fusion company should create a flexible and innovative business unit that has a large access to the required resources for a successful DT deployment.

The implication is that digital transformation goes beyond changing simple organizational processes and tasks. In fact, it affects the entire business<sup>[14]</sup>. For example, research conducted by Krüger. N and Teuteberg. F explored the potential benefits of digital business models for consulting firms seeking to transform their traditional activities and operations<sup>[21]</sup>.

Their study produced an explanatory model of digital transformation in the consulting industry (**Figure 1**). According to their explanation, the model illustrates macro-level beliefs identified during interviews that led to micro-level beliefs within the organization. The main action steps of DT comprise management approaches and operational steps, categorized as actions. The result of digitization at a macro level is represented by externally visible artifacts.



**Figure 1.** Explanatory model of digital transformation collected from Krüger, N and Teuteberg, F research<sup>[21]</sup>.

With this we can proceed with Kronblad, C and Envall Pregmark, J finding, that digital transformation can be seen as using technology to impact three dimensions<sup>[22]</sup>: externally, focusing on digitally enhancing the customer experience and value proposition; internally, shaping operations, organizational structures, and work processes; and holistically, where the entire organizational system is impacted, leading to entirely new business models, and with it triggering companies' capabilities to deploy and implement change<sup>[9,14,22–25]</sup>. Which brings us to the following group of concepts.

### 3. Business model

Since business model concept came from practice, literature and research struggled to fixing an exact definition of the term “Business Model”, and so many definitions were made by the academics over the years<sup>[19]</sup>.

According to management guru Peter Drucker, “a business model is supposed to answer who your customer is, what value you can create/add for the customer and how you can do that at reasonable costs”.

A business model describes the architecture that governs how a company creates and delivers value to its customers, as well as the mechanisms used to capture a share of that value. Thus, the business model provides a means by which technological innovation and know-how, combined with the use of tangible and intangible assets, are converted into a profit stream<sup>[10]</sup>. In practices, BM was defined by Osterwalder and Pigneur<sup>[26]</sup> in their book in the form of Business model Canvas (BMC) as “the rationale of how an organization creates, delivers, and captures value” and composed of 9 essential building blocks (key partners, key activities, key resources, value propositions, customer relationships, channels, customer segments, cost structure, and revenues stream). This latter was co-created with 470 practitioners from around 45 different countries<sup>[26]</sup>. The latter definition was also used in various research that include digital transformation and business model together<sup>[10,27]</sup>.

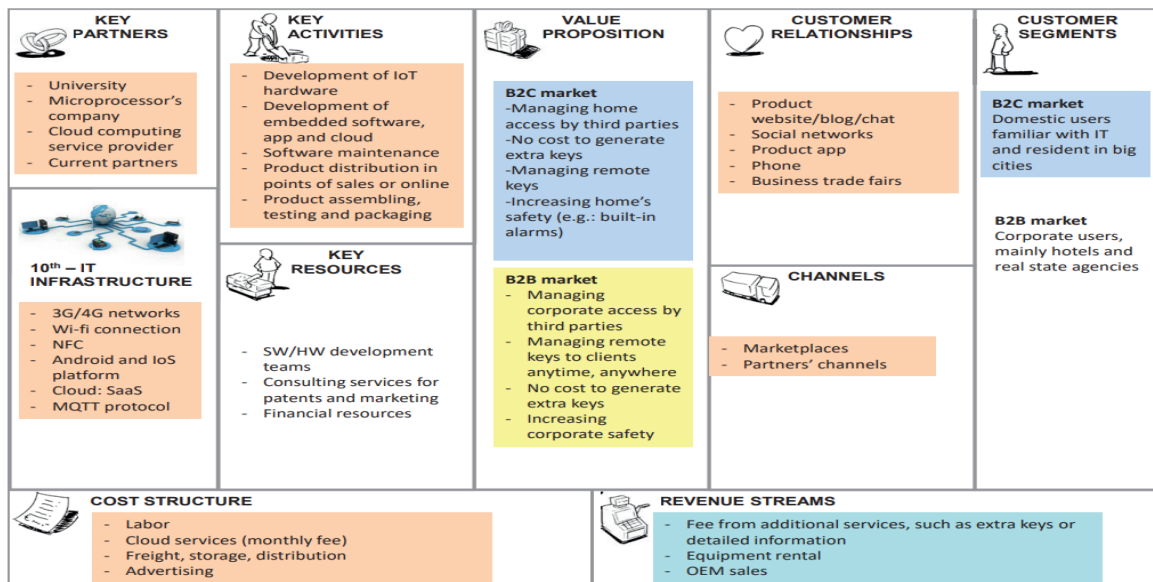
Aligned with digital transformation, the literature highly linked BM and DT by identifying the digital transformation as a disruptive process that brings changes to companies' BMs<sup>[14]</sup> and which entails creating entirely new business models and modifying existing ones.

In their studies, various authors included the term “BM” in all DT's definitions, emphasizing that DT impacts BM and transforms, renews or can even create a new brand business model (See **Table 1**).

**Table 1.** Linked DT and BM definitions.

References	Definition
[23]	An ongoing process of using new digital technologies in everyday organizational life, which recognizes agility as the core mechanism for the strategic renewal of an organization's business model, collaborative approach, and eventually the culture.
[4]	A process where digital technologies create an impetus for organizations to implement responses to gain or maintain their competitive advantage. Key questions related to the efficacy of these responses are the ability for firms to sense disruptions, seize them (e.g., through strategic responses), and to reconfigure elements of their business model accordingly.
[18]	Digital transformation is a process of major business change aiming to improve customer experience and innovate business models by leveraging new digital technologies (e.g., cloud computing, mobile technologies, social media, big data analytics).
[9]	Digital technologies not only impact the transformation of products, business processes, or sales, but entire business models as well.
[22]	Digital transformation can be seen as the use of technologies to impact three dimensions: externally, with a focus on digital enhancing of the customer experience and the value proposition; internally, shaping operations, organizational structures and work processes; and holistically, where the whole organizational system is affected, leading to entirely new business models
[28]	Digital transformation is a holistic concept that considers all the organizational dimensions, such as business models, strategies, cultures, processes, and capabilities and that DT often causes, but simultaneously requires, organizational changes in SMEs and in large firms.

Regardless of the particularities offered by digital value propositions, digital transformation is profoundly transforming the established activities and innovation strategies of software suppliers and end-user companies alike<sup>[27]</sup>. Moreover, the outcomes of digital innovation also include platforms (e.g., Uber) and business models (e.g., Netflix) extending beyond new products (e.g., e-books), processes (e.g., online banking), services (e.g., software updates). **Figure 2** presents a business model canvas (BMC) for an IoT-based product designed for a “Smart Lock” company. The example showcases the effect of diverse digital artifacts on every building block of the BM<sup>[29]</sup>.

**Figure 2.** Smart door lock BMC.

Based on the preceding statements, we can draw that the impact has been questioned many times, debated in numerous research studies, and leveraged by three value dimensions (Value creation, value capture, value delivery) that have been defined in the literature and in practice (e.g., Platform-based BMs)<sup>[13,26,27,30]</sup>. Value delivery dimension or value proposition or value offer of a business model as how cited on many works<sup>[13,30]</sup>,

refers to the assortment of products and services that characterize the business model and generate value for a specific group of customers<sup>[13,27,30]</sup>. Value creation dimension of the business model consists of the key resources and key activities that companies use to create value<sup>[26,30]</sup>. It refers to the degree to which the value proposition (Pain killer) aligns with what the customers desire (Pain reliever) and how they want to satisfy it<sup>[13,27,30]</sup>. In fact, this latter isn't created from only the product/service, in some cases, experts have stressed the importance of the role of executive staff as a resource contributing to value creation (e.g., Platform-based BM)<sup>[30]</sup>. Finally, value capture dimension refers to the business's appropriation of the ROI as compensation for the value proposition and offering provided by the company. In other words, it is the revenue stream through which a company is remunerated by its customers, and through which it maintains its commercial activity<sup>[13,27,30]</sup>.

Within the three dimensions of business models, Rohn et al.<sup>[30]</sup> qualitative research analysis has identified specific factors for the successful design of platform-based business models (**Figure 3**). Even though the list isn't exhaustive.

Dimension	Business Model Elements	Findings			
Value Creation	Key activities	Creation of matches; facilitation of direct interaction between new trading parties			
	Key resources	Network; user/installed base; interaction; information and product exchange; strategic thinking/strategic focus; developers/human talents			
Value Delivery	Key value proposition	Increased speed and efficiency of transactions; time-independence; improvement of inefficient value chains and time-consuming price comparisons; automatic offer preparation; price transparency; faster mapping of customer needs; efficient, quicker and more convenient trading process; free shipping exactly to customer needs			
Value Capture	Key revenue stream	Commission/transaction based model	Subscription	Advertising	Service sales
	Price mechanism	Market pricing	Fixed pricing	Differentiated pricing	

**Figure 3.** Representing value dimensions in accordance with BM's building blocks.

As explained above digital transformation impact BMs through an array of digital technologies change<sup>[9,14,22–24]</sup> (such as AI, Big Data...) and Cloud Computing is obviously one of them.

## 4. DT-based cloud computing

According to the RMC (Reference Model for Cloud), cloud computing is a tower architecture in which the virtualization layer sits directly on top of hardware resources and supports high-level cloud services. Cloud computing has its foundations in a range of different technologies, including internet technologies, virtualization, distributed and parallel systems, multi-core chips, and grid computing<sup>[31]</sup>. According to a systematic literature review study conducted by Olakunle et al<sup>[31]</sup> and another study by Bogataj and Pucihar<sup>[32]</sup>, the latter differentiates cloud computing from traditional IT, through 5 fundamental characteristics:

**Pervasiveness:** it provides ubiquitous access to resources, allowing users to connect to the cloud from anywhere and at any time. This accessibility is not constrained by complex hardware installations, making it easy to obtain resources.

**Flexibility:** cloud computing offers flexibility by allowing users to scale computing resources based on their business demands. This includes expanding or compressing storage, CPU, bandwidth, and more.

**Scalability:** It enables scalability by supporting the extension or expansion of application software and hardware, allowing businesses to rapidly deploy new solutions.



Resource Sharing: It facilitates resource sharing by distributing computing and preservation resources from a pool of available resources.

And last but not least, Pay per use: Cloud users only pay for the resources they use, allowing for cost efficiency and aligning charges with actual usage that are defined through a SLA.

Which are also the basis of the NIST (National Institute for Standards and Technology)'s definition of cloud computing. According to Mell and Grance<sup>[33]</sup>, cloud computing is “a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction”.

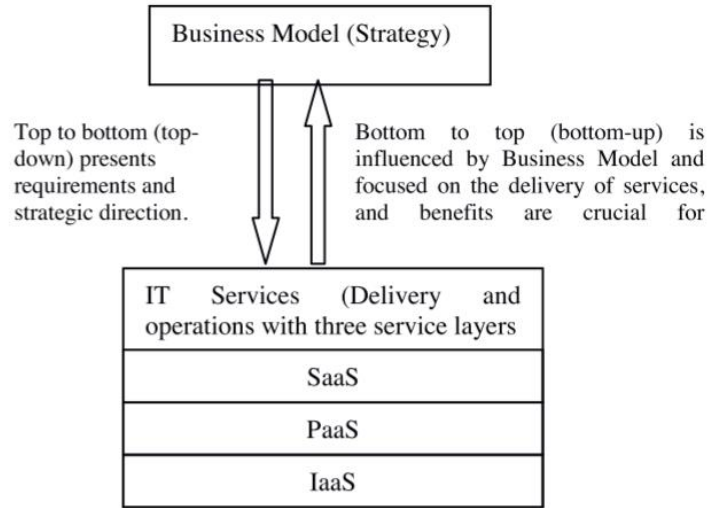
It goes without saying that cloud computing is one of the most disruptive and affordable technologies that can improve the performance and competitiveness of SMEs by enabling them to communicate smoothly across all functions (Shared pool with minimal management effort or service provider interaction)<sup>[31]</sup>, while ensuring a continuous and timely flow of information<sup>[34]</sup>. So, it's clearly revolutionizing IT implementation and delivery.

Service provider models are classified into three categories on the basis of the service offered, such as PaaS (Platform as a service), SaaS (Software as a service), and IaaS (Infrastructure as a service)<sup>[29,30,32–36]</sup>.

Through their studies, the researchers<sup>[29,30,32–37]</sup> have analyzed each model, explaining the advantages and limitations of each:

SaaS is a software delivery model in which software is hosted locally and delivered over the Internet, using a subscription-based payment method. SaaS business technology applications, such as sales management, CRM, financial management, and human resource management, are included. Meanwhile PaaS offers developers a platform that covers the development, testing, distribution, and hosting of advanced web applications as a service. Several ready-made services are provided by Facebook F8, Salesforce App Exchange, Google AppEngine, Bunzee Connect, and Amazon C2. This suggests that PaaS is capable of supporting multiple applications on a single platform. Then IaaS, is the most fundamental service of cloud computing, defined as the idea of purchasing IT hardware on a pay-as-you-go (post-pay) basis.

Even though, SaaS is the most used and studied model among them, as it was put on the top of the virtualization and hardware layers (RMC). As it was explained through Chang et al.<sup>[38]</sup> research on cloud computing business framework. In their analysis, SaaS offers a higher SLA (Service Level Agreement) and it's intended for the end user, which means the provider manages everything (e.g., data, storage, servers, vitalization, networking...), but SaaS requires an IaaS and PaaS base, for example, Trello's production environment is hosted on an AWS EC2 platform and the security and self-management applied to all of them to ensure: (authenticated and authorized cloud services, identity management, access control and auditing...). Also, PRINCE2 2009, ITIL V3, IBM SOA and Luo et al. in 2010 have shown that the business model is strategic and operates on top of operational levels of IT services such as cloud computing<sup>[38]</sup> (**Figure 4**).



**Figure 4.** The simplified relationship between business models and IT services<sup>[38]</sup>.

According to Olakunle et al.; Mell and Grance; Chang et al<sup>[31,33,38]</sup> there's four deployment models of cloud computing where which service models can be deployed in. For the public Cloud, it's a cloud services offered in the public domain, such as Amazon EC2 and S3. This approach is for organizations that want to save cost and time without the commitment of deployment and maintenance. For organizations without cloud computing deployments, this is the fastest way to get started with cloud computing. Private Cloud (In-house private cloud is a customized cloud services are deployed within the organization, so data and access are only available to internal users. This approach is suitable for organizations that are concerned about privacy and data security, or want to change or simplify the way people work. The downside is that implementations can be complicated, time-consuming, or with costly deployment. For the hybrid cloud, the alternative approach here is to use part public cloud and part private cloud to deliver a solution. This approach works well for organizations looking to reduce costs while maintaining privacy and data security. The downside is that integrating different architectures is not easy, and it is likely that this model will end up as either a public cloud or a private cloud due to the complexity and time involved. And lastly community cloud, which is very recent and interesting.

This model is the most recent and most relevant to the academic community, such as the UK National Grid Service. What is interesting about it is that it is not classified as a public, private or hybrid cloud, but contains characteristics of each. It is a community-built model that may start as a private cloud from individual research initiative. Because of the data sharing involved and the need to make it public, the private clouds then added to the public domain. It is not a hybrid cloud because it is ultimately used and by internal community members for knowledge sharing, research analysis, and discussion. It is an ideal platform for test beds or proof of concepts.

McKinsey & Company identified three main reasons why CEOs switch to cloud computing models. Firstly, to establish a sustainable funding model. Secondly, to develop a new business technology operating model. And lastly, to set up policies to attract and retain the right engineering talent. Fortune 500 companies have predicted that the cloud could generate over \$1 trillion in value by 2030<sup>[39]</sup>.

## 5. Bibliometric analysis

### 5.1. Methodology

In the first part we detailed theoretically each cluster individually and we even highlighted some interactions between clusters. Now on this part, bibliometric analysis was conducted using quantitative

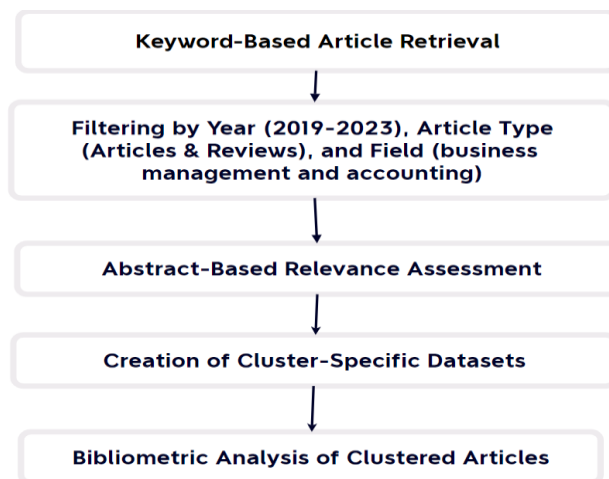


research methods.

The bibliometric analysis was carried out in two stages:

First, we will be doing a bibliometric analysis to identify and select the main theoretical references on digital transformation (DT), Business model, Cloud computing through quantitative analysis of a sample of publications and citations. Secondly, the results for each selected variable were analyzed and discussed, highlighting areas of convergence and divergence.

Our research procedure included the following four main steps: (1) Sample presentation, (2) Analysis procedure, (3) Reporting results, and (4) Discussing results. We followed Kraus et al.<sup>[40]</sup> and Facin et al.<sup>[2]</sup> to structure our research (see **Figure 5**). More details are incorporated in the following sub-sections.



**Figure 5.** Research methodology.

### 5.1.1. Sample presentation

The collection of paper process was examined through 5 phases:

Step 1: Articles were searched using the keywords “Digital Transformation”, “Business model” and “Cloud computing”, and their synonyms in the same meaning and context in the Scopus database:

Step 2: The three groups of results were filtered, first by year (2019–2023), then limited to articles and journals only, and finally limited to the field of “business management and accounting”;

Step 3: Each abstract of the selected articles in each cluster was analyzed to determine whether the selected cluster was the main subject of each article, otherwise it would be excluded from our database;

Step 4: The final sample of each cluster is imported into a separate sheet of the database, which will contain only those articles corresponding to our criteria;

Step 5: The final sheet containing the three groups of articles is then subjected to bibliometric analysis to obtain quantitative and qualitative information on trends and relationships between articles as well as between clusters of articles.

### 5.1.2. Sample cleaning

We will be proceeding as follows. Individually and for each cluster, we will be: exporting documents with us including publication titles, keywords, and abstracts for 2119 published research literature between 2019 and 2023. The first step and second step resulted 664 research paper for DT, 756 for BM, and 699 for CC, respectively to the following criteria: Only “English articles”, “Articles & Reviews”, “Limited to Business, Management and Accounting”, “Journals” and with a “2018 < PUBYEAR < 2024”. Each cluster database

sheet is analyzed individually to exclude articles that aren't relevant to each of our main clusters. **Table 2** provides a descriptive summary of the articles included in the present study.

**Table 2.** Summary of articles resulting from the searches.

Description	Results
DT Documents	664
BM Documents	756
CC Documents	699
Sources	Articles and Reviews
Period	2019–2023
Total of Documents after the merging	2119
Documents after reviewing	1438
DT-BM/BMI analyzed documents	646
DT-CC analyzed documents	68
DT-BM-CC analyzed documents	15

### 5.1.3. Analysis procedure

We will conduct separate analyses for the groups to gain a better understanding of their unique characteristics. After comprehensively understanding each group, we will merge the databases to explore their interactions. Considering that we have three clusters of main variables (“Digital Transformation”, “Business Model”, and “Cloud Computing”), here, s how we can adapt the suggested analyses using VOSviewer to accommodate these clusters.

## 6. Results and discussion

This section is structured as follows: the first wave of keyword analysis provides a large panorama of analyzed keywords and abstracts from 1438 published articles and reviews in the field of business and management to explore the trending macro topics between 2019 and 2023, where they converge, and whether our three main clusters are among them. The following analysis of keywords for the second wave features shortened summaries of reviews and articles that focus on the merging of BM with digital transformation and the convergence of Cloud computing with digital transformation. This analysis aims to investigate sub-topics and trends, and verify their convergence in this area.

In both waves, we conducted co-occurrence analyses by topics using VOSviewer. We further performed cluster analysis, citation network analysis, and timeline analysis to examine each individual cluster. This methodology enabled the identification of overarching themes that converge across the three clusters within our framework.

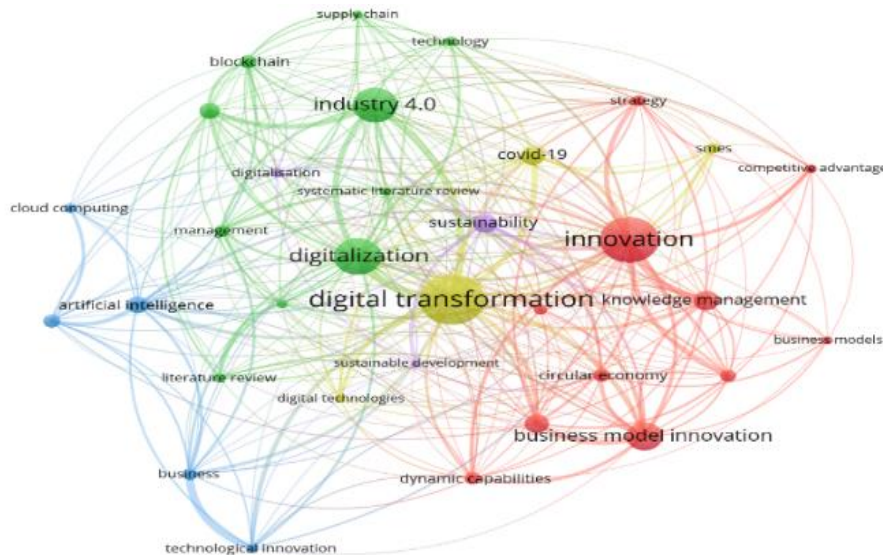
### 6.1. First wave of keywords analysis

In order to ensure a strong and significant database of the frequently occurring keywords of titles and authors keywords from the articles studied, we took a criterion of minimum number of 20 of occurrences of a keyword on VOSviewer. From 4342 keywords, only 33 meet the thresholds.

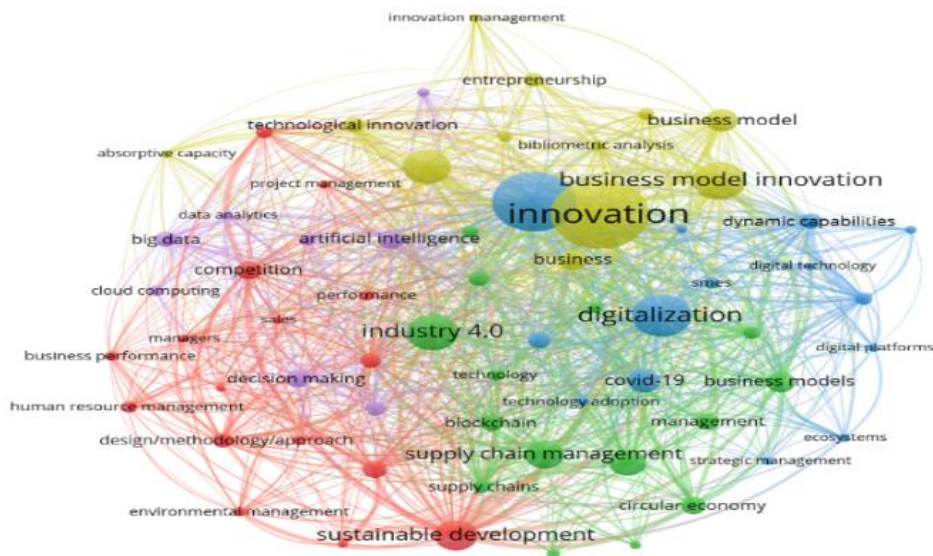
As **Figure 6** demonstrates keywords with strong occurrences within the 5 clusters of keywords, and are: “Digital transformation”, “Business model innovation”, “Industry 4.0”, “Innovation”, “Digitalization”, “Cloud computing” and “Big data”. Surprisingly they all has a link with Covid-19 context.

Secondly **Figure 7** shows the most popular keywords on all articles, again to ensure a significant result, we took a criterion of minimum number of 20 of occurrences of a keyword. From 6607 keywords, only 65

meet the thresholds. The keywords are: “Innovation”, “Digital transformation”, “Business model innovation”, “Digitalization”, “Industry 4.0”, “Cloud computing”, “Big data”, “Knowledge management”, “SCM” and “Sustainable development”. When the results are brought together, it can be concluded that “Digital transformation”, “Digitalization”, “Business model innovation”, “Industry 4.0”, “Big data” and “Cloud computing” are the most prominent themes in the selected articles in the areas of our research and research objective.



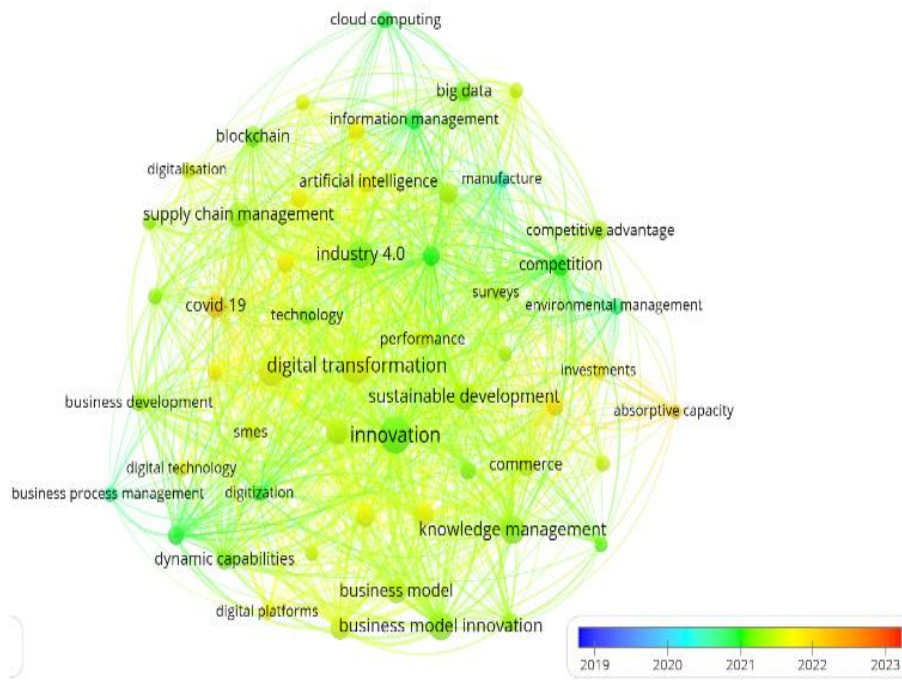
**Figure 6.** Occurring keywords of titles and authors' keywords analysis.



**Figure 7.** All occurring keywords on all articles.

During this analysis we only focused on co-occurrences and links between 2019 and 2023 and the ones that goes with our three main clusters (DT, BM, and CC), with this and as illustrated below in **Figures 6** and **8**, digital transformation has the most occurrences and links (361, 163) between 2021 and 2022. Secondly and between 2020 and 2021, we discovered business model innovation through analyzing business model keyword, with occurrences/links (103, 218) with a total of 20 links only with DT. Both of these concepts are closely intertwined with digital technologies and digital transformation. The latter is highly associated with technological artifacts such as AI, big data, blockchain, and CC... Additionally, the word “Innovation” in BMI, is the result or change brought after digitalization or infusing technological innovations through the deployment of an artifacts leading to a new and unexpected business model innovation.

Finally, and between 2020–2021, cloud computing is closely associated with innovation, adoption of technology, and particularly with Industry 4.0, with occurrences/links (30, 39). This latter is referred as the fourth industrial revolution, is a current trend in manufacturing technologies that involves automation and data exchange. This includes the Internet of Things (IoT), artificial intelligence (AI), and cloud computing. The latter is highly significant as it is a part of digitalization, digital transformation goes beyond Industry 4.0 by transforming physical products into digital services (Servitization)<sup>[2]</sup>. From this constatation, in the majority of cases cloud computing was cited in industry 4.0 works which they had a significant occurrence with a total of 17 links only with DT.



**Figure 8.** Most frequently used keywords between 2019 and 2023.

Overall, the co-occurrences and links between the three variables are very novices, and has an “Avg.Pub.Year = 2021” between 2019 and 2023. The finding can probably be explained by Covid-19, which catalyzes topics related to digitization and business innovation. Therefore, we identified specific subtopics, including “Resiliency”, “Sustainability”, “Value capture”, “Value creation”, and “Value proposition”. Furthermore, research on cloud computing was conducted using articles and reviews related to Industry 4.0.

This brings us to carry out and independently another search that converges first (DT, BM/BMI) and second (DT, CC) to determine the axes of convergence and thus the micro-topics.

## 6.2. Second wave of keywords analysis

In this wave, we’ll look at iteration and convergences, first between DT, BM/BMI, and then between DT and CC. The first search yielded 646 documents, and the second 68. In this wave, only articles and reviews were considered in order to maintain the quality of our search and thus to confirm our chosen three clusters coexistences.

### 6.2.1. Digital transformation and Business model

Authors have explained the high interdependence between digital transformation and business model<sup>[4,9,18,22,28]</sup>. Through the literature review, we confirmed that, DT is an ongoing disruptive process that brings changes to the company’s business model, and the impact has recently been drawn through three key value dimensions (value creation, value capture, value delivery), and which again draw the impact in the 9

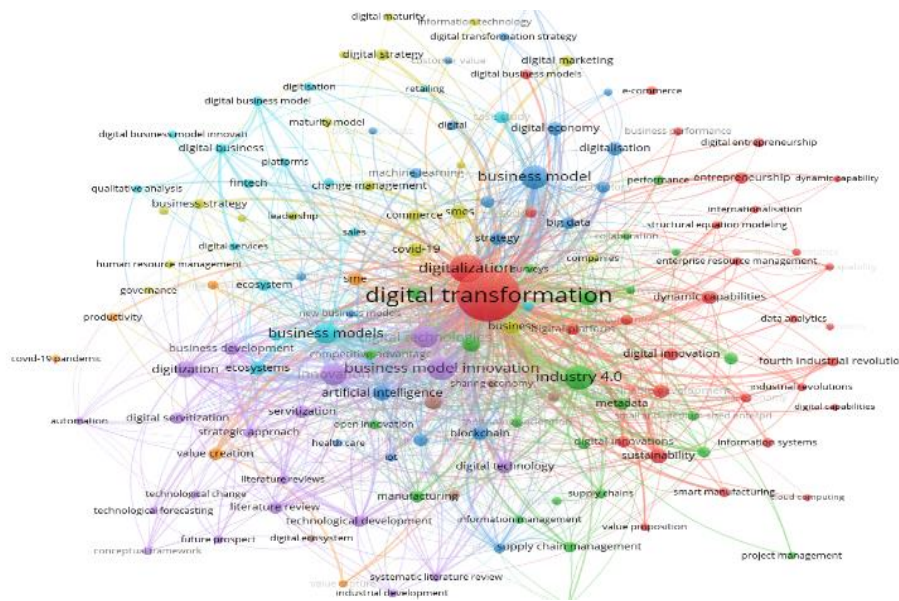


building blocks of the business model<sup>[13,26,27,30]</sup>.

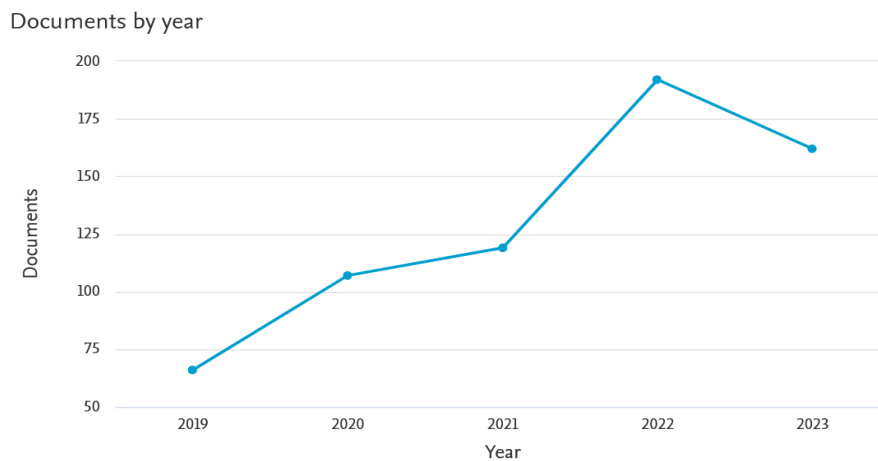
Analysis of findings by the number of articles:

**Figures 9 and 10** present the links and evolution of published documents from 2019 through 2023. It is noticeable that the number of studies related to business model has notably increased during 2021–2022, as emphasized in the previous analysis (refer to **Figure 5**). The growing interest in business models (BM) in the field of digital transformation (DT) is closely linked to the post-COVID-19 era and has led to studying new digital technologies (AI, Cloud computing, Big data...).

There have been theoretical and empirical studies examining the impact of digital transformation on BM and how it leads to innovation of incumbents' BMs towards a more advanced business model innovation (BMI).



**Figure 9.** BM and DT occurring keywords.



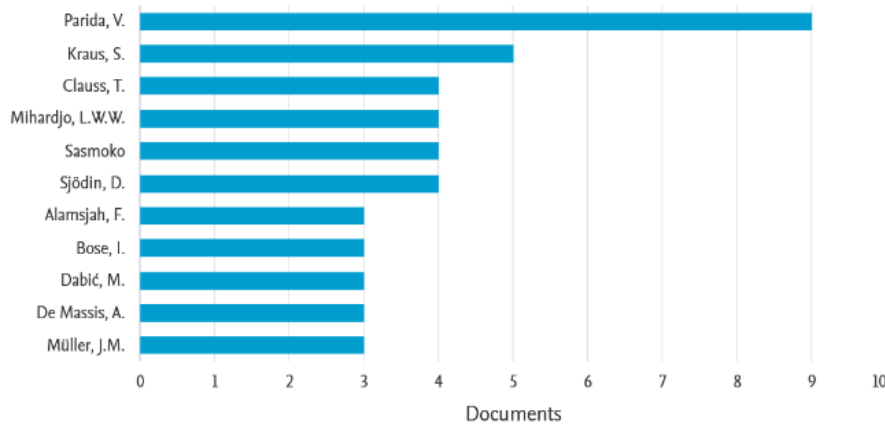
**Figure 10.** BM and DT documents by year.

**Figure 11** lists the 11 authors with the highest number of publications. The authors with the highest number of publications in DT-BM are the works of Paridan, V. (9 documents), Kraus, S. (5 documents), Clauss, T. (4 documents), and Mihardjo, L.W.W. (4 documents).

The majority of published articles on DT-BM cover various areas and topics from (see **Figure 12**): Germany (85 documents), Italy (65 documents), UK (54 documents), US (51 documents), and Morocco (7 documents).

### Documents by author

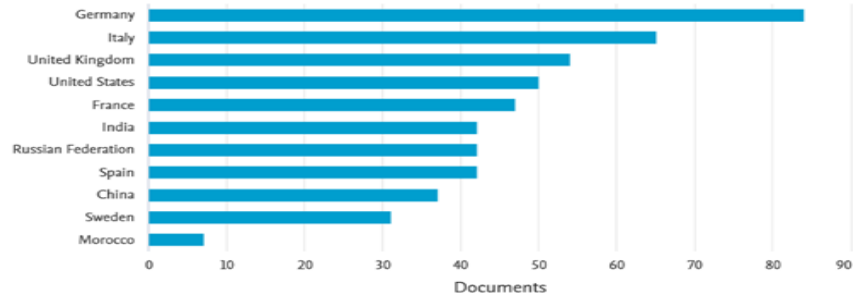
Compare the document counts for up to 15 authors.



**Figure 11.** BM and DT documents by author.

### Documents by country or territory

Compare the document counts for up to 15 countries/territories.



**Figure 12.** BM and DT documents by country or territory.

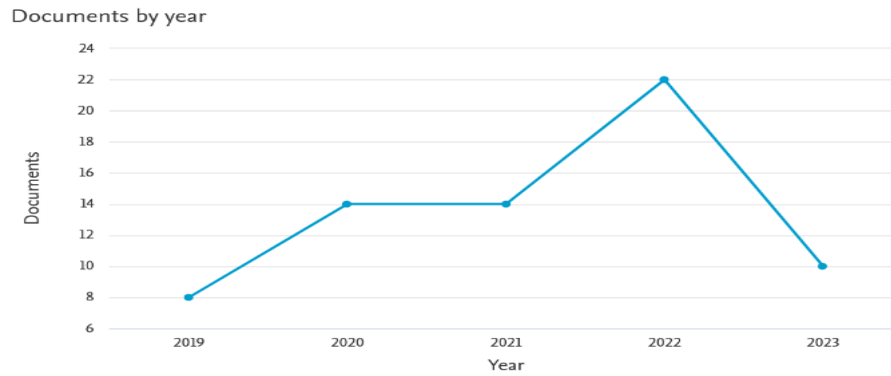
## 6.2.2. Digital transformation and Cloud computing

As highlighted in the previous sections, digital transformation is the deployment of digital technologies. One frequently used digital technology is Cloud computing, particularly under a SaaS model according to RMC, due to its five fundamental characteristics: Pervasiveness, Flexibility, Scalability, Resource Sharing, and Pay per use<sup>[32]</sup>. Therefore, it is at the top of IT services and directly concerned with the business model that operates on the operational level of IT services and gives strategic direction to the three layers of cloud computing<sup>[38]</sup>.

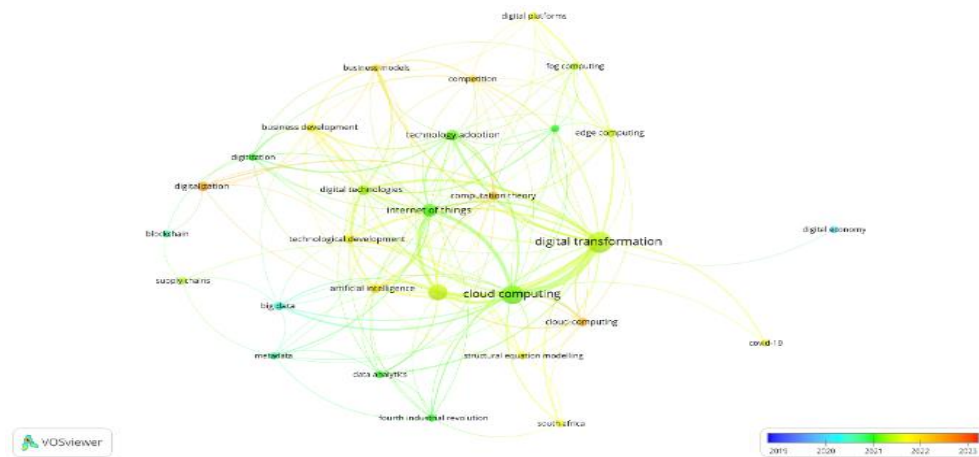
Analysis of finding by the number of articles:

**Figure 13** presents the evolution of published documents from 2019 through 2023. It is noticeable that the number of studies related to cloud computing has notably increased during 2021–2022 and decreased again during the first two quarters of 2023. Still, cloud computing is one of the topics that still has novice growing links with Digital transformation, business model, AI, big data, and even COVID-19 during 2021 (see **Figure 14**) with the growing usage and interest of online platforms within various fields, such as medicine, ecommerce, and entertainment. As for the literature, according to a very recent systematic literature review conducted by Olakunle Jayeola et al. [31], the vast majority 72.4% of studies focused on generic cloud computing services, while SaaS-based studies comprise only 6.6%. Despite SaaS being one of the primary cloud service models, it has received very little research attention. Conversely, both IaaS and PaaS have remained largely unexplored.





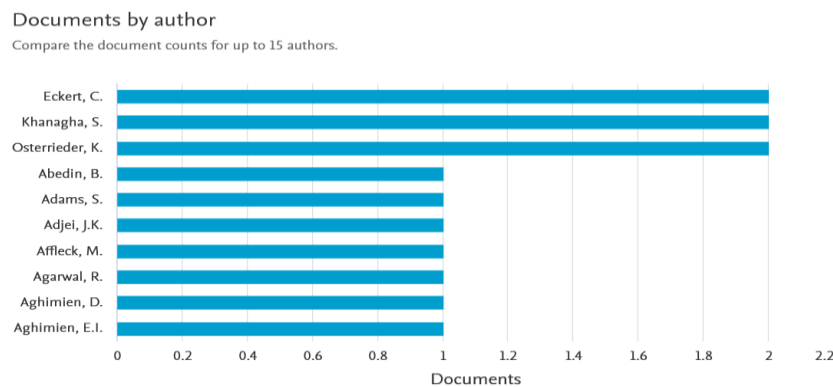
**Figure 13.** CC and DT documents by year.



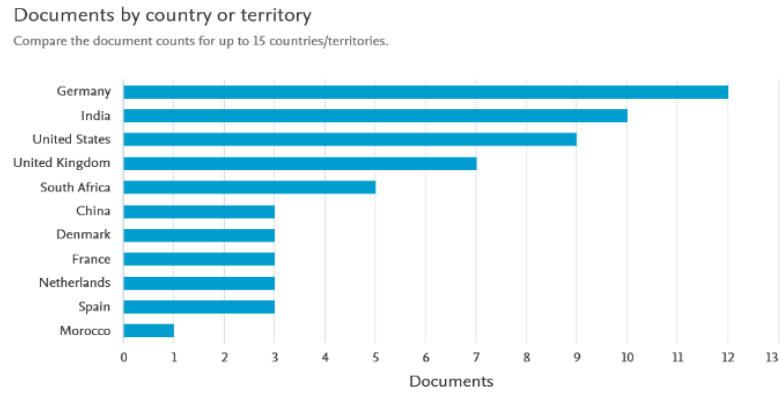
**Figure 14.** Co-occurrences analysis by topics by year.

**Figure 15** lists the 11 authors with the highest number of publications. The authors with the highest number of publications in DT-CC are the works of Eckert, C. (2 documents), Khanagha, S. (2 documents), and Osterrieder, S. (2 documents).

The majority of published articles on DT-CC cover various areas and topics from (**Figure 16**): Germany (12 documents), India (10 documents), US (9 documents), UK (7 documents), and Morocco with one contribution.



**Figure 15.** CC and DT documents by author.

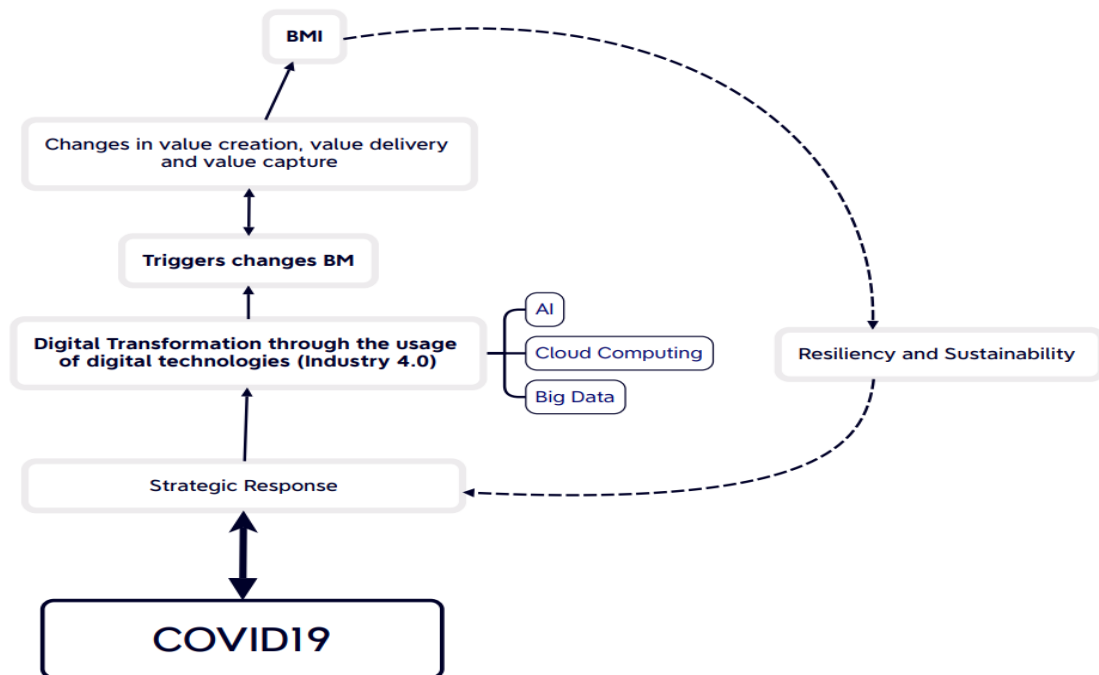


**Figure 16.** CC and DT documents by country or territory.

### 6.2.3. Digital transformation, Business model, Cloud computing

The previous findings indicate a significant connection between digital transformation and research in the areas of business and management.

A framework synthesizing the findings, as shown in **Figure 17**, presents digital transformation, business models, and cloud computing research as linked topics. We observed that the Covid-19 pandemic has triggered incumbents to undergo digital transformation processes in order to adapt to the context and behavioral changes in customer attitudes and expectations (both B2B and B2C). The change is driven by the adoption of various digital technologies, including cloud computing, which ranks among the top three categories of IT services and is directly linked to the business model.



**Figure 17.** Framework of core themes that converge with our three main clusters in the fields of business and management.

The business model presents requirements and strategic directions, while IT services focus on service delivery. And the Covid-19 pandemic was a primary driver for incumbents to re-evaluate their business model, leading to an adoption of cloud computing technologies that affect operations and a shift from a product-centric to a service-centric business model and logic (Servitization) with a focus on user-centric configuration. The change was explained through three dimensions of value (value creation, value delivery, and value capture). Value creation was the most frequently used explanation by researchers, as it links the company's value

proposition (key resources and key activities) directly to the customer<sup>[26,30]</sup>. Adjusting the business model can lead to business model innovation, which may help the company achieve its desired goals of resiliency and sustainability in response to the changing environment. It is important to consider the potential impact of these changes on the wider business ecosystem and stakeholders.

## 7. Conclusion

In conclusion, this bibliometric analysis has uncovered noteworthy insights into the interconnections among Digital Transformation (DT), Business Model (BM), and Cloud Computing (CC) in the domain of research and innovation. Through a focus on the co-occurrences and links between these three domains, significant trends and patterns have been revealed, which shed light on the developing landscape of digital business strategies.

The analysis shows a significant connection between DT and BM, with authors highlighting DT's ability to transform the business model. This connection becomes clear when the three value dimensions are examined and aligned with the components of the business model framework. The increase of this connection in the post-COVID-19 era emphasizes the need for organizations to adjust and innovate their business strategies to align with evolving customer behaviors and expectations. In addition, the integration of Cloud Computing as a pivotal digital technology reinforces the idea that CC plays a central role in enabling and implementing DT initiatives.

The co-occurrence analysis revealed a significant increase in interest in BM and CC during certain periods, indicating their growing importance in the wider context of digital transformation. Cloud computing was identified as a technology that not only enhances operational efficiency but also influences strategic directions within the business model. The connections between DT, BM, and CC were identified as dynamic, responding to external events and technological advancements.

From a broader perspective, this study's findings illustrate the varied impact of digital transformation on business models and its subsequent influence on the integration of cloud computing technologies. To adapt to this constantly evolving landscape, organizations must thoughtfully consider strategies for generating, delivering, and capturing value. This approach promotes resilience, sustainability, and innovation, ultimately resulting in sustained success and relevance in the digital age.

However, it is important to recognize that this analysis is not conducted in isolation. The connections identified among DT, BM, and CC span various industries and sectors, leading to a comprehensive transformation in organizational operations, value delivery, and stakeholder engagement. Further research is needed to investigate these connections in-depth and examine the intricate interactions and potential synergies between these domains. This bibliometric analysis provides a fundamental investigation into the interaction between these fields. The continuously evolving relationships highlight the significance of research, invention, and cooperation in promoting organizational successes in the digital age.

## 8. Future perspectives and limitations

Future research should investigate the digital transformation process in depth by examining the skills and knowledge required for successful digital transformation implementation, business model changes, and cloud computing technologies. It is essential to determine how organizations and individuals can acquire and develop these skills. Explore the methods and tactics employed by organizations to oversee the innovation process that arises from the assimilation of digital transformation and cloud computing into their business models. Analyze the precise influence that digital transformation and cloud computing have on different aspects of business models, including value creation, value delivery, and value capture. Measuring these influences could offer practical knowledge to organizations, such as taking into account: How does the adoption of cloud computing

and other digital technologies impact a company's capacity to derive value from its products or services? Do these technologies present opportunities for new revenue streams, pricing models, or monetization strategies? How do digital technologies, such as cloud computing, facilitate the development of innovative products, services, or solutions? Additionally, how does the utilization of cloud computing improve the delivery of value to customers? Are there advancements in customer experiences, accessibility, or personalization attributable to the implementation of digital technologies?

The assessment is restricted to articles published from 2019 to 2023, which may create a partiality towards more up-to-date research, potentially disregarding significant developments from preceding years that have established the grounds for the analyzed notions. Also, the analysis relies solely on the data extracted from Scopus, which may not encompass all pertinent articles in the field. Also, some relevant articles from non-indexed sources or databases may be missed, potentially affecting the comprehensiveness of the bibliometric analysis.

## Author contributions

Conceptualization, AB; methodology, AB; data curation, AB; writing—original draft preparation, AB; writing—review and editing, AB and YL. All authors have read and agreed to the published version of the manuscript.

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## Conflict of interest

The authors declare no conflict of interest.

## Abbreviation

CC, Cloud Computing; DT, Digital transformation; DTs, Digital technologies; IT, Information technology; BM, Business model; BMI, Business Model Innovation.

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