A Bibliometric Analysis of Digital Transformation for a Resilient Organization

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Abstract. Digital transformation and resilience are being intensively focused on areas of research in the current period. This is due to the current situation the world is facing because of Covid-19. Many organizations not only failed to grow during this turbulent event but also, to remain functioning in the market which led to their disappearance. On the other hand, organizations that focused their core responsibilities towards being resilient tend to shift from surviving to thriving organizations. Combining both adoptions in literature needs to be more analysed. Therefore, this paper will be focusing on conducting bibliometric analysis on digital transformation and its impact on the resiliency of an organization to conquer the unexpected events such as the pandemic of Covid-19. The bibliometric analysis will be implemented using a software called VOS viewer. It will support in observing the research clusters, emerging topics and leading scholars. From the analysis, information regarding the top countries that contributed to the research, main keywords and number of documents published were defined. Moreover, providing topics for future research was also determined from the analysis.

Keywords: Digital transformation · resilience · bibliometric analysis · Scopus · VOS viewer

1 Introduction

Nowadays, digital technologies are in rapid development being very critical aspect for organizations to take into their strategic plans for better performance and sustainable development. After the Covid-19 pandemic, many organizations failed to survive in the market. Therefore, the call for a resilient organization is the primary focus of organizations. In this paper, a closer insight will be focused on combing both areas in the sense of digital transformations and organizational resilience to achieve a resilient organization that will not only survive but thrive in the face of any turbulent event in the future. Specifically, this paper will mainly focus on conducting a bibliometric analysis in this research area. The bibliometric analysis discipline is used for a very long time due to its importance in the analysis between journals. The first term of bibliometric analysis emerged to show the connection between journals that were related to information science since 1972 (1972). This paper will be focusing on using this discipline on journals related to organizational resilience and focusing specifically in its impact on organization performance. The bibliometric analysis, computer assisted methodology review, will help

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in identifying core research of related areas. Also, discover the relationship between authors and their publications. The bibliometric analysis with journals extracted from a database such as Scopus or science web and a software such as VOS viewer which has dimensions that goes beyond the normal literature in order to enable new researchers absorb the extend of the topic and emergent trends in the related field market.

Furthermore, bibliometric analysis is helpful for understanding and outlining the accumulated scientific knowledge and evolutionary opinions of established areas since it has the capacity to rigorously make sense of massive volumes of unstructured data. Therefore, properly conducted bibliometric studies can lay the foundation for novel and important advancements in a field; it enables and empowers scholars to (1) gain a thorough understanding, (2) identify new opportunities, (3) develop original research ideas, and (4) position their intended contributions to the field (Donthu et al. 2021). Many researches indicate that the implementation of digital transformation strategies in businesses contributes to the improvement of organizational resilience. In addition, digital transformation has a beneficial effect on the organizational business resiliency (Zhang et al. 2021).

The objectives of this paper will be deliberated in more details and insights from literature about digital transformation and resilience will be discussed below. Looking into more details, the method of conducting this paper will also be mentioned in the methodology section to show the source of all documents used for the bibliometric analysis and all the software and databases utilised for the data analyses when combining digital transformation and resilience. Finally, the discussion of the analysed data is made with the conclusion for this paper.

2 Research Objectives

The main objectives of the current study are to create a bibliometric analysis of digital transformation and its impact on the resilience of the organization through a digital culture. To conduct the bibliometric analysis there are certain steps that need to be implemented. First of all, to create maps using the software VOS viewer based on journals that are published derived from the Scopus network which are related to digital organization, digital culture and organizational resilience. Also, to visualize the network data to be able to investigate the citation trends and links between the published journals. Last but not least, to explore the corresponding geographical distribution of authors, publication sources and the main keywords existence.

3 Related Literature

3.1 Digital Transformation

Digital transformations are defined as an international fast-moving technology revolution process done by people, organizations, and nations and result from digitization. Expressions such as Mobile applications, the Internet of things, and industry four means have similar meanings. In addition, digital transformations relate to culture span, discipline cross, borderless, and computer-generated data (Collin et al. 2015).

Also, digital transformation is defined as a business stimulating method by technical innovation either to interrupt or to defend a digitalized organization from interruptions (Ali 2019). Similarly, Digital transformation definition according to the US government is "Data and Analytics Innovation, Emerging Opportunities and Challenges" (Gudergan and Mugge 2017).

Moreover, according to (Jakubik and Berazhny 2017) digital transformation is considered a crucial part of the industry four revolution. According to (Bunse et al. 2013) the definitions of Industry 4 are equal to economic change and industrial transition. Industry 4 relates to the 4th industrial age, which is based on technology innovations from physical cybernetic systems to the Internet-Things (IoT) implanted devices. The basis on which innovative solutions are developed is technologies of Data, communication and Information Technology (IT). Also, Industry 4.0 demands technical creativity like companies require a new competitive emphasis, new working competences, and new skills to be established (Berman et al. 2016); (Harvard Business Review Analytic Services 2017).

Moreover, the organization digital strategy is the basis for an effective business transition according to (Wade 2015). The digital strategy essential questions are why changing? what transforming? and how transforming? Different urgings motivate organizations' digitalization, such as digital clients, agile operation, largescale, supervisory modifications, and digital technique. However, new competitors can trigger further incentives for digital change, including expanded options, enhanced engagement mechanisms, and better values (Wade 2015). Furthermore, according to the authors (Schoemaker et al. 2018; Swanson et al. 2017).

Dynamic capabilities address repetitive process problems in which the organization must familiarize regarding resources, processes, products, and services. Also, to enable the development of the organization's dynamic capabilities, organizations must establish adaptable capability and create creativity. Dynamic capabilities modify organization business model to respond to changes and transformation of the market environment. Besides, dynamic capabilities progression can be improved by alignment with flexible strategy (Wasono et al. 2111). Also, Information Management is one of the Digital Transformation prerequisites. It is clear that the informational tools advance Digital transformation and its quality (Mahsud Ali 2019; Williams et al. 2014).

Digital transformations implementations require a profound adjustment which is more considerable than the classical change in organizations (Kwon and Park 2017). Also, according to the authors (Bongiorno et al. 2018) who stated that other enablers alongside the technology platform are vital to transforming a digital company, such as business processes, products, services, business models. Similarly, (Fitzgerald et al. 2013) claimed that practically no company will defend itself from digitalization and aggressive interruption only by embracing modern emerging innovations and organizational business models.

3.2 Digital Transformation Technologies

According to the authors (Foerster-Metz et al. 2018) explanations and summaries of the digital transformation technologies (trends) are categorized into 5 categories. Technologies are categorized into five groups which focus on connections and accessibility, data

and intelligence, robotics and automation and efficiency, communication and interactions and finally the security. The first group is mainly focusing on mobile applications, internet of things and cloud computing. The second category includes big data and data analysis. Moreover, robotics category comprises of robotics, intelligent automation and artificial intelligence. Generally, the fourth category consists of social media and specifically internet communication channels, engagement and content sharing. The final category is related to new security which focuses on both cybersecurity and physical security.

3.3 Digital Transformation Models and Types

On the other hand, according to the report presented by (Brynjolfsson et al. 2016) there are four models of digital organizations named as following; Tactic model focused on opportunity and innovation, Central model focused on setting agenda, a Champion model focused on change and Usual business model focused on Normality. While, the champion model aims at establishing a deep connection between management and staff. Whereas, the common business model aims at business flexibility and agility.

3.4 Organizational Resilience

The term "resilience" is originated from the Latin word "resilire" which means to leap or jump back. The concept of resilience has been widely used for a long period of time in many disciplines. Due to this fact, there is no single consistent understanding of resilience construct. Looking into more details, the construct of resilience goes back to the nineteenth century where it was used in engineering as engineering resilience. This term was used to explain the ability of steel to absorb and endure shocks and tension (Holling 1996; Alexander 2013). After that, resilience was used in the psychology field referring to patients of Schizophrenic disorders who are capable of tolerating shocks in the 1950s (Yates and Masten 2004). In the1970s, the word resilience appeared in the academic field of Ecology by Holling. It emerged to define the development and reorganization of the dynamics of the system and the adaptive capacity. Also, He defined and illustrated the differences between the resilience approaches in engineering and ecology (Holling 1996, p.33). Engineering resilience draws the attention on efficiency, reliability and predictability because it concentrates on handling risks to develop responsive perturbations techniques. While ecological resilience concentrates on changeability and unpredictability to ensure that systems function sustainably in dynamic conditions (Carpenter et al. 2001; Seville et al. 2006).

4 Research Methodology

The material utilized for this study is derived from the secondary data to start our research on digital transformation and its impact on an organization to be resilient and be able to face any turbulent event. As well as, reviewed the existing literature on the different topics creating a link between digital transformation and organizational resilience. This study of digital transformation to create a resilient organization is a phenomenon that

researchers are taking into consideration as we are still in the Covid-19 era. This is taken into consideration in order to accomplish the objectives of this bibliometric analysis.

Primarily all published journals were extracted from the Scopus network using the search fields terms such as: "digital transformation" and resilience. Initially, a result of 199 documents was derived from digital transformation and resilience only. Therefore, to create a bibliometric analysis from the derived journals, the VOS viewer software was employed for this analysis. This is to support in demonstrating the quality of the studies, scrutinize the key areas of the research and support in the anticipation of the research future direction (Yu et al. 2020). After using the data from Scopus, it turned out that the life span of the research is between the years of 2017 and 2022.

The results of the search in Scopus which included 199 documents included all sort of documents and not limiting the research on specific type of document. Due to the fact that the main purpose of the research to induct a bibliometric analysis on the citation of the selected research area. Therefore, no exclusion of any document type for this research which made it result as 199 documents for this study. For further citation analysis in this paper, not only VOS viewer was utilized but also, did a comparison of citation from Google Scholar for the documents resulted from Scopus. To view data in a clear perspective, tables from excel sheet were created and graphs from VOS viewer and Scopus were extracted.

5 Data and Results

5.1 Research Areas

Digital transformation and its impact on the resiliency of an organization was introduced in several research fields. The first document published in that specific research area was in 2017 in the engineering field. There are several subject fields focusing on this research area from the total search results of 199 documents. The two main research areas of digital transformation and resilience were in computer science and business, management and accounting. Table 1 demonstrates the top five research areas.

Table 1. Top 5 research areas assigned to papers in the sample

Research areas	Records	% of 443
Computer Science	89	20.1%
Business, Management and Accounting	66	14.9%
Engineering	58	13.1%
Social Sciences	56	12.6%
Decision Sciences	44	9.9%
Total top 5 research areas	**313**	**71%**

As indicated in the table above, computer science field has the highest percentage of publications regarding the topic of digital transformation and organizational resilience.

Lot of research is done in that subject area as derived from the network of Scopus. This can be evident from the computer science percentage which is 20.1% from all other field publications. The second highest subject area is in business, management and accounting resulting in 14.9%. However, engineering and social sciences have very similar percenatges in their publications of the topic showing as 58% and 56% respectiavley. The below pie chart shows the total publication percentages from different subject area and not restricted to the top five subject areas for more information (Fig. 1).

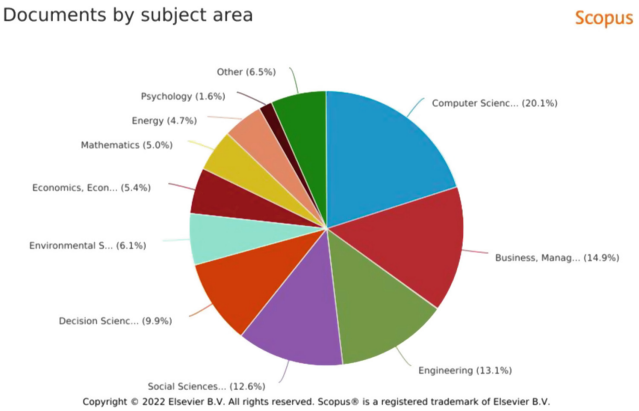

Fig. 1. All published documents of the topic from different subject areas, generated with the database Scopus (https://www.scopus.com).

5.2 Citation Analysis

Top Countries Contributed in the Area of Research. Using the VOS viewer, this paper examined the countries with publications that are more than five documents per country. In a total of 63 countries, 19 of the countries met the threshold of five documents per country. The result ended with a total of 8 clusters for the 19 countries. However, 4 countries in 4 different clusters were not connected to each other. The four countries are Japan, Russian Federation, Saudi Arabia and Spain. Therefore, only the largest sets of connected items were created minimizing the number of clusters into 4 clusters which consist of 15 countries as shown in the figure below (Fig. 2).

The countries that participated in conducting and publishing documents of the topic were minimized to 15 countries that had connections between them. For more details, the first cluster which is in red color included 5 countries which are Australia, Austria, Germany, Romania and Switzerland. The second cluster, the green cluster, included five countries as well which are Brazil, France, Italy, Portugal and United Kingdom. The blue cluster which is the third one included 3 countries which are Greece, India and the United States. Finally, the yellow cluster which included only two countries, Canada and China.

Generally, it is demonstrated from the above graph that the highest document published by a country is 19 documents and the least published documet country wise is 5

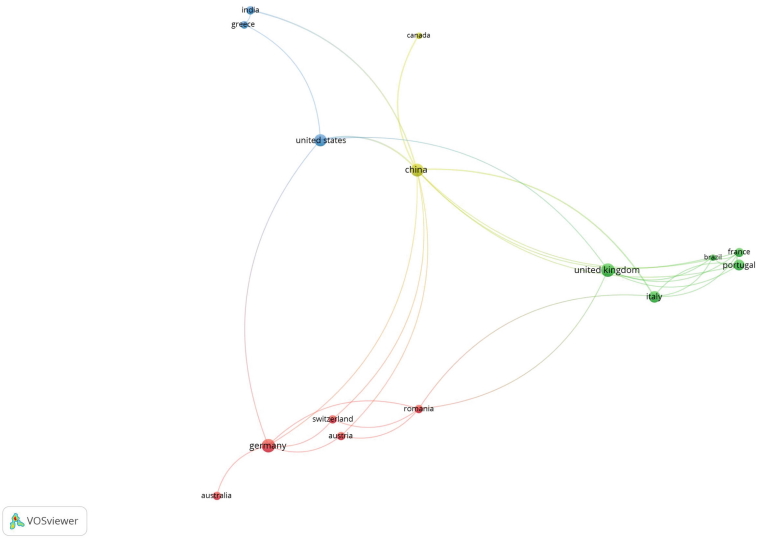

Fig. 2. Top countries contributed in the research in four main clusters, generated with VOS viewer (http://www.vosviewer.com).

documents. As indicated Germany and the United Kingdom are the two mian countries with highest published papers conducted in digital transformation and resilience resulting with 19 documents published each and a citation of 77 and 132 citations respectively. On the other hand, China comes in the third place with a total of 17 published documents and a total of 101 citations. Both Spain and the United States have the same number of publications with a total of 16 pubications each. Finally, the least countries among all pulished countries of the research topic are Canada and Brazil with 5 documents each.

Table 2 indicates the 10 highest average citations from the published countries. It is evident that the average citaion is not related with the number of documents published. For instance, the country with the highest average citation is Italy. Yet, the number of published documents is not the highest among all published countries where it is resembled as 14 published documents. On the contrary, Germany which is one of the highest countries in number of oublished documents, has the lowest average citations of its documents with a link strength of 6.

Top Organizations Contributed in the Area of Research. All organizations seek for improvements in their strategies and procedures within the organization in order to achieve high perfromance results. This is done throug different business development tools in areas that need improvements. To be more specific, in the current sitaution of Covid-19, many organizations are moving towrads being more resilient which is proven in this study after analysing the fields of digital transformation and resilience. It was noticed from the number of research that was done in the current years as this topic was grabbing the intrest of many countries around the world. In the table below, organizations with the highest citations of their publication will be displayed. From a total of 199 documents in the area of digital transformation and its impact on the resiliency of

Table 2. Top 10 average citations from published countries.

	Country	Documents	Citation	Avg. Citation	Total Link Strength
1	Italy	14	245	17.5	6
2	Canada	5	68	13.6	2
3	Brazil	5	55	11	5
4	India	7	60	8.57	3
5	United Kingdom	19	132	6.95	5
6	Austria	7	46	6.57	3
7	France	9	54	6	6
8	China	17	101	5.94	15
9	Australia	8	39	4.88	1
10	Germany	19	77	4.05	6

Table 3. Top Organizations in the Research Area

No.	Organization	Documents	Citation	Total Link Strength
1	Department of Economics and Management, University of Padua	1	148	7
2	Department of Industrial and Mechanical Engineering, University of Brescia	1	148	7
3	Department of Industrial Engineering, University of Florence	1	148	7
4	Department of Management and Engineering, Linkoping University	1	148	7
5	ICT Industry, United Kingdom	1	67	7
6	Newcastle University Business School, United Kingdom	1	67	10
7	Chitkara Nusiness School, India	1	51	10
8	Department of Engineering, University of Naples Parthenope	1	51	2
9	Department of Industrial Engineering, University of Naples Federico	1	51	2
10	Labonfc, Canada	1	51	2

an organization, 430 organizations contributed in the research area. However, among all organizations, only 8 organizations met the threshold of having atleast 2 documents that are published. Other organizations have done only one publication during the period of 2017 – 2022. The eight organizations that have atleast 2 published documents are Nanfang College in China, Roskilde University in Denmark, Intellectual Capital Association in Portugal, Federal University of Santa Catarina in Brazil, Physikalisch-technische in

Table 4. The top 15 Publications in the domain of the study with the same period between 2017 - 2022

No	Document	Citations_Scopus	Citations_Google Scholar	Links	Title
1	(Rapaccini et al., 2020)	148	298	2	Navigating disruptive crises through service-led growth: The impact of COVID-19 on Italian manufacturing firms
2	(Papagiannidis et al., 2020)	67	140	3	WHO led the digital transformation of your company? A reflection of IT related challenges during the pandemic
3	(Shashi et al., 2020)	51	85	22	Agile supply chain management: where did it come from and where will it go in the era of digital transformation?
4	(Klein & Todesco, 2021)	49	123	0	COVID-19 crisis and SMEs responses: The role of digital transformation
5	(Korhonen & Halen, 2017)	48	81	0	Enterprise architecture for digital transformation
6	(Belhadi et al., 2021)	44	67	1	Artificial intelligence-driven innovation for enhancing supply chain resilience and performance under the effect of supply chain dynamism:
7	(González et al., 2021)	41	57	0	Innovative multi-layered architecture for heterogeneous automation and monitoring systems: Application case of a photovoltaic smart
8	(Trenerry et al., 2021)	27	68	0	Preparing Workplaces for Digital Transformation: An Integrative Review and Framework of Multi-Level Factors
9	(Fonseca & Azevedo, 2020)	27	64	1	COVID-19: Outcomes for Global Supply Chains
10	(Chonsawat & Sopadang, 2020)	23	33	0	Defining smes' 4.0 readiness indicators
11	(Gürdür Broo et al., 2022)	22	39	0	Rethinking engineering education at the age of industry 5.0
12	(Lincaru et al., 2018)	21	33	0	Low-low (LL) high human capital clusters in public administration employment-predictor for digital infrastructure public investment
13	(Ding et al., 2020)	19	43	0	Building stock market resilience through digital transformation: using Google trends to analyze the impact of COVID-19 pandemic
14	(Scholz et al., 2020)	19	38	2	Organizational vulnerability of digital threats: A first validation of an assessment method
15	(Zhang et al., 2020)	16	31	4	How does digital transformation improve organizational resilience?—findings from pls-sem and fsqca

Germany and The New Club of Paris in France, all organziations with 2 published documents. The only organization with 3 published documents is the Dinamia'cet-iul – iscte-iul in Portugal. The top cited orgniations from all 430 organizations will be illustrated below (Table 3).

Top Cited Documents in the Area of Research. The interest in this research area has grown during the short period between 2017 and 2022 among organizations from different parts of the world. Research is still going on since organziations are thriving to be resilient after facing the crisis of Covid-19. As the main network of documents used for this paper analysis which is Scopus, the highest cited documents were derived from Scopus and displayed the number of citations per document. Moreover, a comparison of the citation number was displayed for every document using Google Scholar. It indicates the differences in citation and ease in accessing each network. From all the published documents, the top 15 documents will be the highest citation in Scopus and its comparison with Google Scholar will be illustrated in the below table for the research period (Fig. 3) (Table 4).

Published Documents from Different Sources

For further details regarding publication, the above graph demonstrates the documemnts that were published annually by source for the time period between 2018 to 2022 derived from Scopus network. In total, five sources for publications were selected to publish the documents that focused on acheving a resilient organization through the implemntation of digital transformation. The sources are ACM International Conference

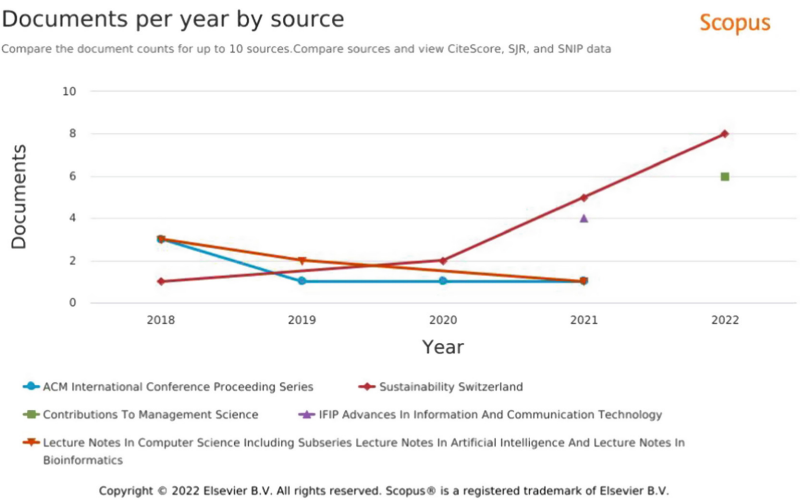

Fig. 3. Publication of all documents on yearly bases from different sources, generated with the database Scopus (https://www.scopus.com).

Proceeding Series, Sustainability Switzerland, Contributions to Management Science, IFIP Advances In Information And Communication Technology and Lecture Notes in subject areas such as, Computer Science with subseries lecture notes in Artificial Intelligence and Bioinformatics. It is evident that all documents were published by different sources in 2018. However, even though all strated published in the same year, only one source was able to thrive to the maxmim of all sources and other declined from their strating point. To be more specific, the Sustainability Switzerland started with the lowest number of published documents in 2018 but started to have a slight increase in the following two years of 2019 and 2020. The turning point for the Sustainability Switzerland source occurred in 2020 in the number of published documents. A significant growth of published documents was clear between the years of 2020 and 2022. It makes this sources the highest source of the published documents among all other sources. On the contrary, the other two sources which are the ACM International Series and the lecture notes started publishing the highest documents among others in 2018. As the time passed, the two sources started having a decline in the number of published documnents. This resulted in being the lowest two sources by the year of 2021.

5.3 Co-occurrence Analysis (Keywords)

Figure 4 represents the cloud map of co-citation analysis and keywords used in the search field of "digital transformation" and resilience. In that search the documents were limited more specifically to in the sense of digital transformation in which the final search was resulted to 199 documents rather than 345 documents. In the comparison of the two figures, Figure 4 clearly indicates the link and connection between digital transformation, resilience and COVID 19 being the largest clusters among all others. From the 690 keywords, 52 keywords met the threshold of having 3 as a minimum

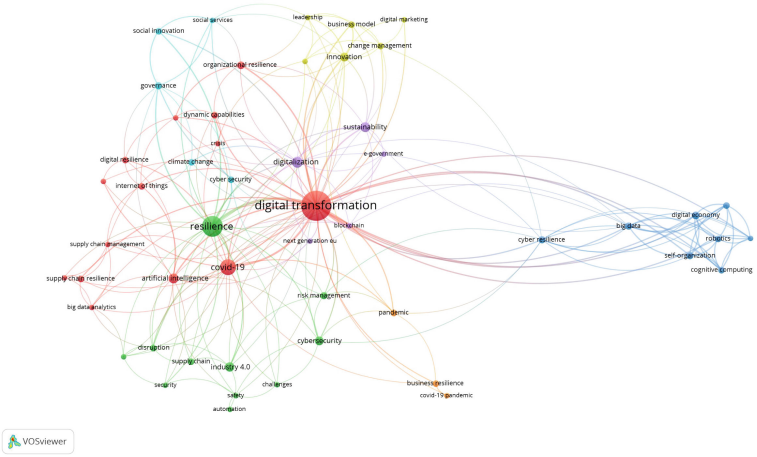

Fig. 4. A cloud map of co-occurrence with 3 as minimum number of occurrences, generated with VOS viewer (http://www.vosviewer.com).

number of occurrences of keyword resulting in having 7 clusters with 224 links between them.

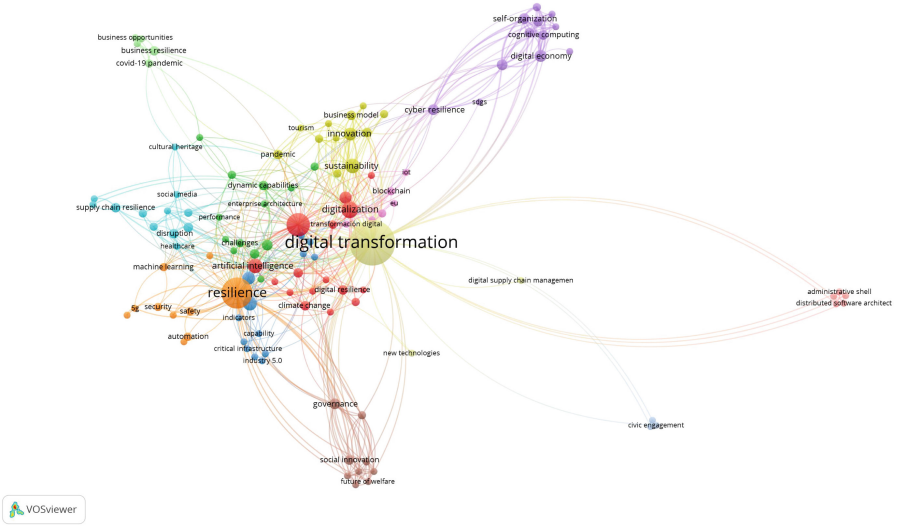

Fig. 5. A cloud map of co-occurrence with 2 as minimum number of occurrences, generated with VOS viewer (http://www.vosviewer.com).

Figure 5 signifies the cloud map with the related words between all published documents. This map represents number of times the words that were utilized by researchers and clearly shows the link between them. It can be indicated that digital transformation and resilience are very linked together resulting in the largest clusters. It is also indicated that covid-19 is very much related to the biggest two clusters being resembled in the orange color. When reducing the number of occurrences, 119 documents met the threshold resulting in 119 items and a total of 13 clusters.

6 Discussion

The relationship between the researched fields of this paper is clearly evident from the cloud map. It represented a visible connection between the two research topics which are digital transformation and organizational resilience. The VOS viewer, was an essential tool that gave an insightful analysis of the two topics and the links between them. Moreover, gave an insight on the future research fields that are very much related to this paper. The utilization of VOS viewer, indicated a broad image of showing that digital transformation, resilience were the largest two clusters in the map. From those two large fields, other research areas were closely linked.

Looking into more details, the digital transformation showed a strong and multi-connection with other fields such as governance, change management, leadership, risk management and blockchain. However, resilience focused merely on risk management, social innovation, cybersecurity and sustainability. As well as, focused on innovation and transformation. Combing the two research fields for analysis, showed that this topic is one of the new trends in literature and research is still going on to fill the gaps of the field. Also, the analysis indicated that the rise of the research area is because Covid-19 is a worldwide pandemic that all countries and organizations have suffered from. Therefore, the term digital transformation was one of the aspects that organizations had pay attention to in order to achieve a resilient organization.

Computer science was the largest subject area that published documents in regards to the research topic. As from the geographical lens, Germany and the United States published done research on the topic and published the most documents out of the other countries with a total of 19 documents each.

7 Conclusion

In a world of technologies, digital transformation is widely spreading between different countries. Many organizations have moved their attention to implementing the digital transformation to be more resilient when facing sudden turbulent events. Since this aspect of research is essential to many countries, it is a call for other countries to consider the topic in future research. As well as, the link between the resulted keywords to address new gap in literature that will have an impact on digital transformation and organizational resilience. The results demonstrated that digital transformation has a positive impact on organizational resilience and by consequence will improve organizational performance. From the analyzed data between digital transformation and resilience, the focus of both terms defined together has gained attention from the past five years only. This indicates

the new concentration countries and organizations are moving toward. In literature combining efforts for the digital transformations to have better organizational resilience is one of the business strategies to resist unexpected global market challenges and to stay competitive during and after COVID-19 pandemic.

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