

Digital Transformation In The Covid Era- A Bibliometric Thematic Analysis

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Abstract

Digital transformation is the buzzword of the new age and modernity is in the wings of the same. Covid 19, the pandemic has affected the normalities of daily lives gravely and the economy is reviving by exploring the digital possibilities in the guise of contactless transactions. A bibliometric thematic analysis of a dataset, containing the bibliometric details of 257 documents extracted from Web of Science within PRISMA framework, explains 'the how' of this digital transformation effected during this pandemic. Researchers' tools such as Biblioshiny R- Package, Quiqqa and Maxqda etc. are used to trace the patterns and evolution of various themes in the scientific production. The study presents a detailed review of various themes developed during the COVID ERA and also gives qualitative content analysis of the emerging topics in digital transformation. The methodology adapted in the article for bibliometric thematic analysis takes the systematic review protocol to a different dimension of presenting the conceptual structure of the topic purely based on bibliometric data. The categorisation of themes and sub themes in topic 'Digital Transformation in the Covid Era' is made and emerging themes are conceptually defined. Hence the article paves way for the prospective researchers to identify the suitable gaps in the existing body of knowledge of digital transformation in the covid era, and to fill the gap through exploratory studies. The article also encourages the young researchers to take up bibliometric thematic analysis to proceed with the systematic review for any research.

Keywords: Bibliometric Analysis, Thematic Analysis, Covid era, Digital Transformation, Maxqda,

1. Introduction

Fatalities do not merely make human life severe or harder; what they earmark for us is a universe of 'possibilities'. Agastly, the COVID-19 pandemic has brought disturbing recesses and unprecedented necessities. This has also ushered in an alternate cosmos of possibilities. This wave of possibilities has touched upon every nook and corner of the world, be it education, banking, health, fashion as well as food. The human race

has already embarked on the digital road. The covid era, forces us to reckon with the reality of an isolated and confined existence and streamlines the digital revolution into new possibilities of remote human assemblies. Money has thoroughly become virtual with banking forced to operate digitally. Classrooms have been re-assembled remotely; online learning platforms are mushrooming by the day and have re-wired the conventional learning experience. Medical

service is one touch away with teleconsultation and thorough home services.

The COVID-19 pandemic has undoubtedly caused organizational changes worldwide, forced a redefinition of economic strategies, and, acts as a catalyst for digital transformation in many sectors of the economy, healthcare and education. Therefore, it is worth to analyse whether COVID-19 accelerated digital transformation, or whether digitization or digitalization has revamped the economy. Further, research questions are formulated to identify various themes emerged in digital transformation during Covid 19 and also to categorize and develop a conceptual structure of these themes. Therefore, an enquiry into the same based on the above questions and concerns are planned by way of a bibliometric thematic analysis on the literature of Digital Transformation in Covid Era. This analysis will explore various categories of themes developed in this research area and will also help to identify the potential areas of research.

2. Objectives

- 1.To identify various themes in digital transformation during covid 19.
- 2.To categorize themes with the help of mind map brainstorming.
- 3.To elucidate the conceptual structure by means of qualitative content analysis.

Figure 1 shows the various softwares used to analyze and interpret the datasets

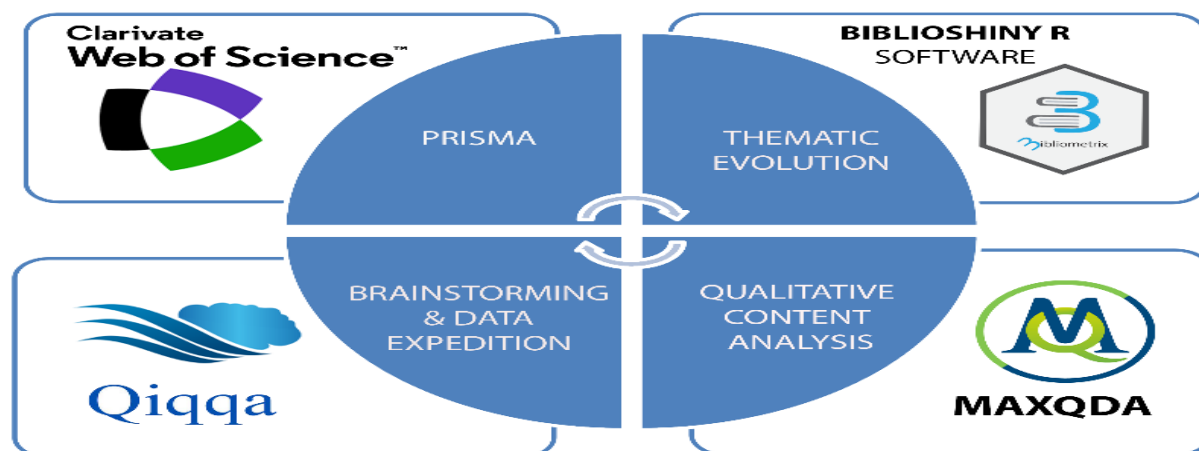


Fig. 1: Research Tools

3. Methodology

Researchers can make use of various tools such as science mapping, brainstorming and data expedition for a bibliometric thematic analysis (Fink, 2019) of a specific dataset. The dataset is designed after searching for and refining documents from the repository of Web of Science ensuing a PRISMA framework. To review the literature base of digital transformation in covid era and to analyse the evolution of various themes within it in a wider angle, three datasets are retrieved each focusing on 'covid era', 'digital transformation' and 'digital transformation in covid era' respectively. Co-word analysis of the bibliometric method is employed to analyze the thematic evolution of the three topics and thereby an exploration and insight into the conceptual structure of the datasets are carried out.

In the subsequent phase, the themes developed from science mapping are categorized and organized to identify the most specific and contributing literature apropos of the topic 'Digital Transformation in Covid Era' with the help of research tools such as data expedition and brainstorming.

The final stage of the review elucidates the research topic with the help of brief content analysis and qualitative mapping of documents.

4. PRISMA

Three datasets are designed to situate the thematic analysis of 'Digital Transformation in Covid Era' among a wide range of topics. Figure 1 describes how the datasets are searched for and refined from the repository of Web of Science. Figures 2,3 and 4 elucidates the reasons behind the inclusion and exclusion criteria observed in identifying the specific datasets to analyze the prominent themes in them.

Covid Era	<p>"digital transformation" OR "digital economy" OR "Digital world" OR "Digital Innovation" OR "Digital Life" OR "Digitalization" OR "Informatization" OR "Digital trade" OR "Future of Work" OR "Artificial Intelligence" AND "Digitalization" (Topic) and "Coronavirus" OR "Pandemic" OR "Covid 19" OR "Corona" OR "Covid era" OR "Epidemic" (Topic) and 2013 or 2017 or 2018 (Exclude – Publication Years) and Retractions or Letters or Meeting Abstracts or Editorial Materials (Exclude – Document Types) and Russian or Hungarian or French or German (Exclude – Languages) and Arts & Humanities Citation Index (A&HCI) (Exclude – Web of Science Index)</p> <p>https://www.webofscience.com/wos/woscc/summary/ba0c2384-81bf-41e2-b588-591586879f7c-0325335d/relevance/1</p>
Digital Transformation	<p>"digital transformation" OR "digital economy" OR "Digital world" OR "Digital Innovation" OR "Digital Life" OR "Digitalization" OR "Informatization" OR "Digital trade" OR "Future of Work" OR "Artificial Intelligence" AND "Digitalization" (Topic) and Retractions or Letters or Meeting Abstracts or Editorial Materials (Exclude – Document Types) and Russian or Hungarian or French or German (Exclude – Languages) and Arts & Humanities Citation Index (A&HCI) (Exclude – Web of Science Index) and Articles (Document Types) and Business Economics (Research Areas) and Spanish (Exclude – Languages) and Business or Economics (Web of Science Categories) and Articles (Document Types)</p> <p>https://www.webofscience.com/wos/woscc/summary/000cfea7-81be-41b7-a095-0b8c4eddf738-05689728/relevance/1</p>
Digital Transformation in Covid Era	<p>"Coronavirus" OR "Pandemic" OR "Covid 19" OR "Corona" OR "Covid era" OR "Epidemic" (Topic) and 2013 or 2017 or 2018 (Exclude – Publication Years) and Retractions or Letters or Meeting Abstracts or Editorial Materials (Exclude – Document Types) and Russian or Hungarian or French or German (Exclude – Languages) and Arts & Humanities Citation Index (A&HCI) (Exclude – Web of Science Index) and 2021 or 2020 (Publication Years) and News Items or Corrections or Book Reviews or Proceedings Papers or Book Chapters or Data Papers or Biographical-Items or Reprints or Retracted Publications or Bibliographies (Exclude – Document Types) and Business Economics (Research Areas) and English (Languages) and Social Sciences Other Topics or Women S Studies or Public Administration or Agriculture or Development Studies or Environmental Sciences Ecology or Transportation or International Relations or Health Care Sciences Services or Psychology or Information Science Library Science or Mathematical Methods In Social Sciences or Nursing or Government Law or Communication or Computer Science or Geography or Operations Research Management Science or Engineering or Mathematics or Public Environmental Occupational Health or Food Science Technology or Demography or Sociology or Nutrition Dietetics or Education Educational Research or Energy Fuels (Exclude – Research Areas) and Area Studies or Urban Studies or Family Studies or Science Technology Other Topics (Exclude – Research Areas) and Open Access</p> <p>https://www.webofscience.com/wos/woscc/summary/434feb99-873d-4720-9e29-3a2d5420ef34-056ad7be/relevance/1</p>

Fig. 2:Keywords and Search terms

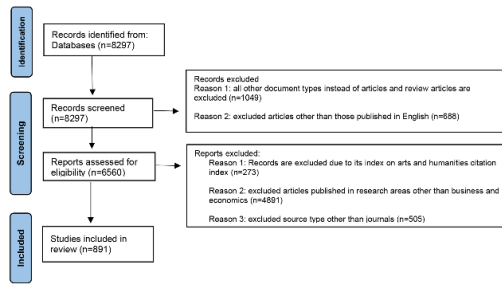


Fig. 3: Covid Era- Data Refining

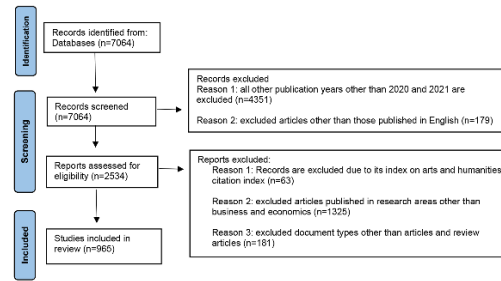


Fig. 4: Digital Transformation- Data Refining

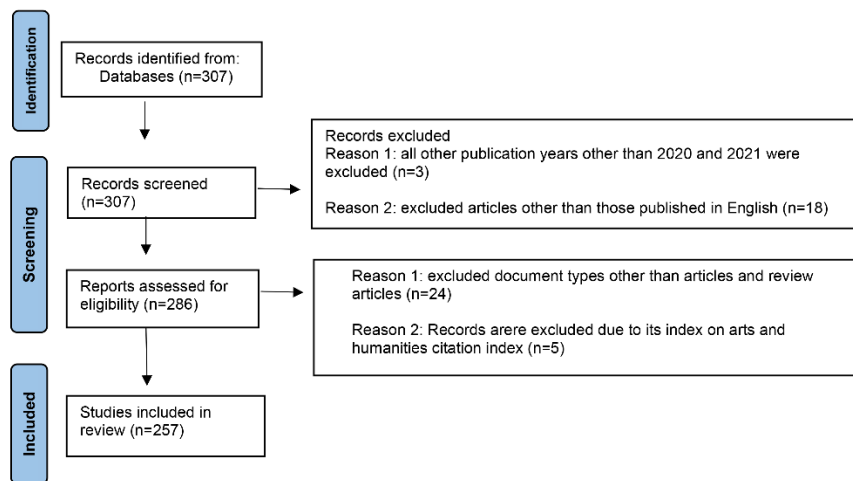


Fig. 5: Digital Transformation in the Covid Era- Data Refining

Interpretations:

- The inclusion and exclusion criteria to design the datasets indicate that the topics to be covered under analysis are purely finance related and economically significant
- The wide range of documents under the topics 'covid era' and 'digital transformation' call for a very specific 'identification-screening- inclusion' procedure without omitting a document that is relevant to the foci of analysis.

5. The COVID ERA- A Thematic Analysis

The era of Covid -19 has begun in Wuhan, China in December 2019. It has spread to 212 countries and territories around the world, infecting millions of people. It has become a trending topic for researchers and several studies have been carried out for the past two years. A thematic

mapping is employed to find out the major themes in the dataset to identify the evolution and potential development of topics related to Covid-19. The themes are developed by making clusters out of the authors' keywords in the dataset.

In a thematic analysis, density and centrality are the properties of a theme. Density, the development degree, measures the cohesiveness among the nodes and centrality, the relevance degree, measures the degree of correlation among different topics. A thematic map is divided into four quadrants. The upper right quadrant represents the motor or driving themes and lower right quadrant shows the basic themes. The upper left quadrant is the niche themes or very specialized themes. The lower left quadrant exhibits emerging or declining themes.

The basic themes in 'Covid Era' are Covid-pandemic, Covid and inequality. These themes are the foundation blocks in the area of study. There are several sub topics attached with each node. For Covid-pandemic, the sub themes

are China, resilience, stock market, sustainability, contagion, supply chain, bitcoin and financial crisis. Under the node inequality there are subthemes which are the problems resulted from the Covid 19 pandemic. The sub themes are unemployment, fiscal policy, employment, gender, monetary policy, childcare, health, mental health and recession. The node of Covid is constituted with the major changes the world is facing after the emergence of Covid pandemic. The subthemes under this node are pandemic, corona virus, crisis, lockdown, social distancing, entrepreneurship etc. There is a node which is represented by the keyword 'altruism' in between the motor themes and basic themes. The subthemes in this node are corona virus, Germany

and infectious diseases. The motor themes in 'Covid Era' on which most number of articles emerging are innovation and uncertainty and the node uncertainty consists of the sub themes globalization, risk, covid 19 outbreaks, Google trends and trade. The niche or very specific theme is Covid and populism is a subtheme in it. Supply chain resilience and Japan are the emerging themes. Under supply chain resilience there are themes such as disruption, dynamic capabilities, paradox, strategy and tensions. Under the node Japan the only subtheme is natural experiments. There is node in the name of panel data in between the basic theme and declining theme. Under that node, the sub themes are efficiency and Europe.

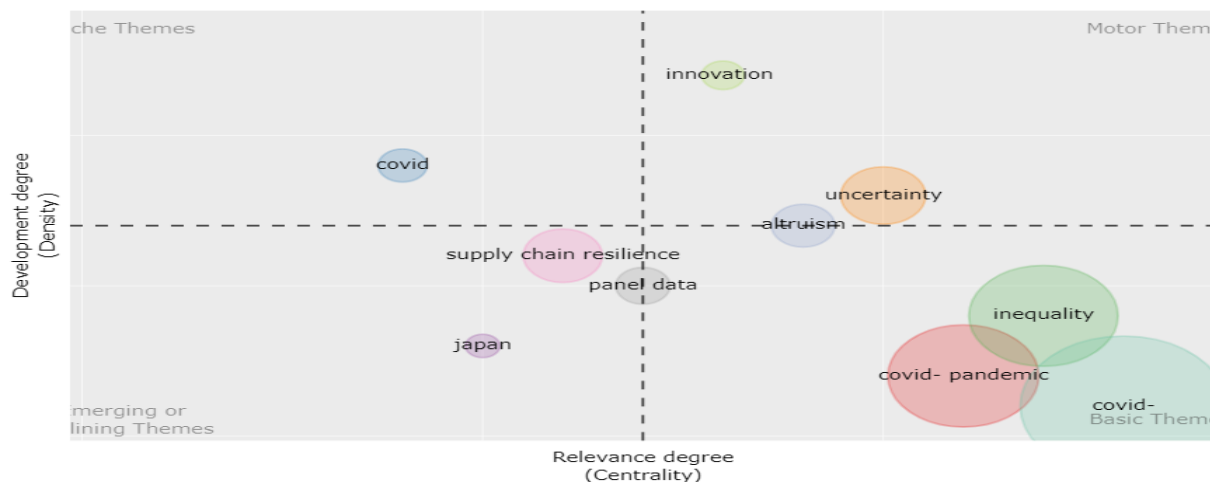


Fig. 6: Thematic map-the Covid era

Interpretations:

- The Basic Themes- 'Covid- Pandemic', 'Inequality' and 'Covid'- and their subthemes -resilience, stock market, sustainability, contagion, supply chain, bitcoin, entrepreneurship, unemployment, fiscal policy, employment, gender, monetary policy, childcare, health, mental health and recession, digital divide, digital maturity, artificial intelligence- can be widely classified as two dimensions of the pandemic viz., one enhancing the life of the economy and the other infringing the sustenance of the economy.
- The theme 'Innovation', encompasses topics widely discussed in the digital world such as cloud computing, big data, machine learning,

artificial intelligence (AI), Internet of Things (IoT), robotics, smart manufacturing, predictive and data analytics and other new digital technologies.

- The theme 'Resilience' comes up as an emerging theme in the topic which also discusses the coping mechanism based on digital technologies.

5.1 Digital Transformation- Thematic Evolution

The thematic evolution of digital transformation speaks for itself how the word 'transformation' attached with the topic 'digital' is meaningful and apt. For analyzing the thematic evolution of digital transformation, the dataset is divided into five time slices. The cutting years are 2005, 2010, 2015 and 2020.

5.1.1 Time slice from 1993 to 2005.

It is the initial period in the development of studies in the field of digitalization. The two

themes in figure 7, internet and electronic commerce, are the fundamental themes of a digital economy.

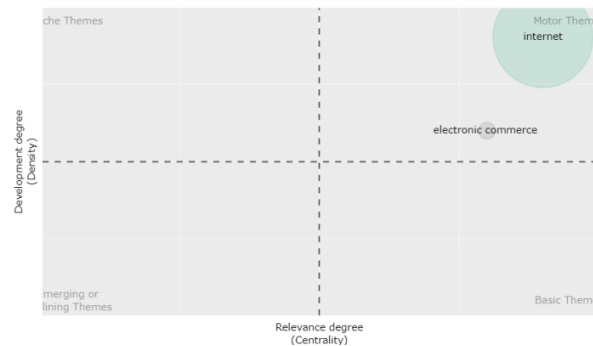


Fig. 7: time slice 1993 to 2005

5.1.2 Time slice from 2005 to 2010.

During this period, ‘digital economy’ and ‘digitalization’ become the basic themes and internet ranks down to become a sub theme. The theme ‘ICT’ develops at this stage and E-commerce remains as the motor theme.

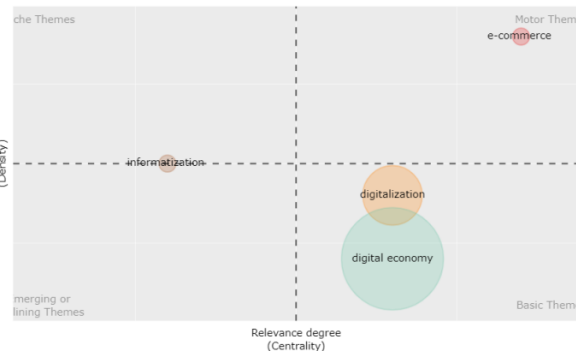


Fig. 8: Time slice from 2005 to 2010

5.1.3 Time slice from 2010 to 2015.

The theme ‘digital economy’ is in the declining region and digitalization becomes a basic theme. The theme ‘digital innovation’ takes the place as an emerging theme and the theme ‘creative economy’ becomes a motor theme and ‘creative industry’ becomes a subtheme attached to it.

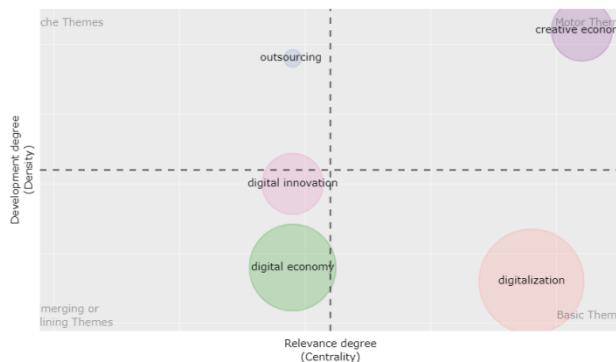


Fig 9: Time slice from 2010 to 2015

5.1.4 Time slice from 2015 to 2020.

Major developments take place in this time frame and several sub themes are developed along with digital innovation such as social media, open innovation, digital entrepreneurship, machine learning, crowdsourcing, digital marketing,

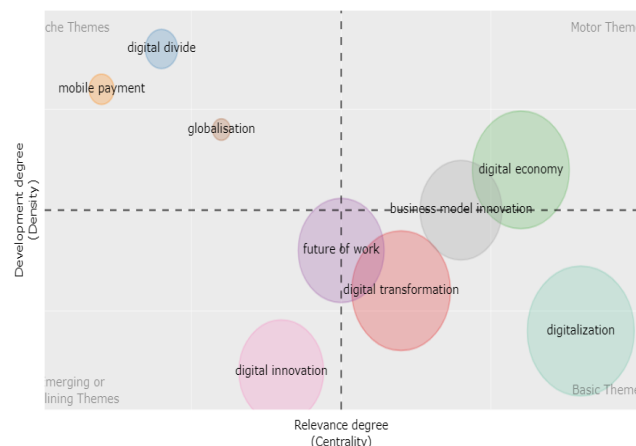


Fig 10: Time slice from 2015 to 2020

information technology, marketing and value chain. Digitalization and digital transformation are the basic themes during this period. Sub themes such as industry 4.0, big data, artificial intelligence, servitization, maturity models, internet of things, inequality, sustainable

development and technology adoption form part of the basic themes.

5.1.5 Time slice from 2020 to 2021.

This is the time frame the topic under discussion is analytically documented to cull out insights into the trending topics in it and to evaluate how

significantly digitalization has evolved in the covid era. Figure 11 shows that several nodes are clustered in the basic themes' region, and cybersecurity, competitive advantage, dynamic capabilities, digital economy, innovation, digital transformation, and digitalization are the main nodes in this region.

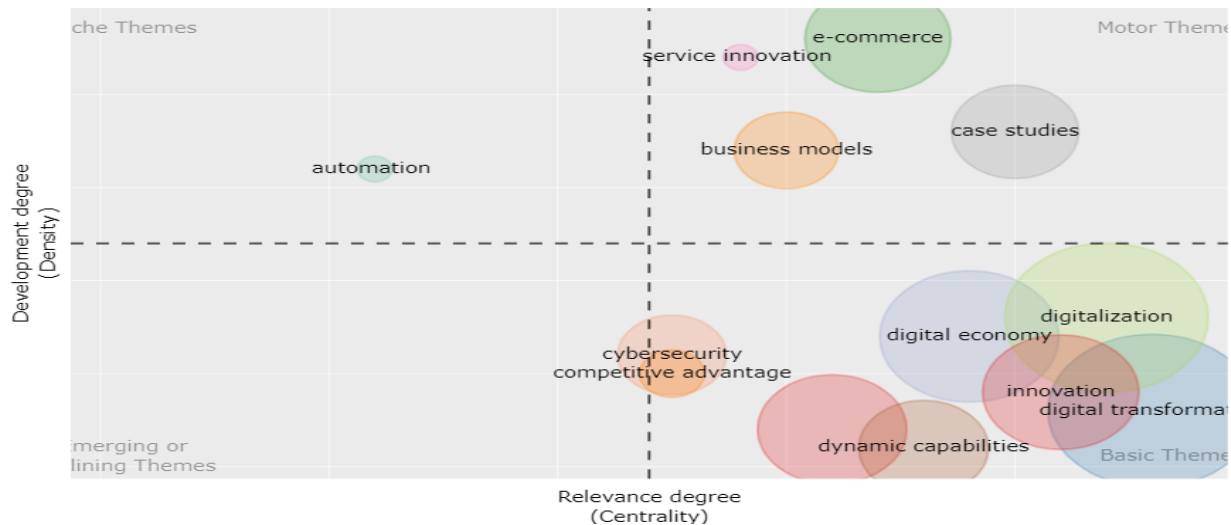


Fig 11: Time slice from 2020 to 2021



Fig. 12: Themes-sub themes in

Interpretations:

- The trajectory of digital transformation shows that the growth of various relevant themes is phenomenal and that the emerging themes are mostly in e-commerce and service innovations.
- The Basic themes in digital transformation have a lot of subthemes in them and it confirms that the digital innovations pave way for the realization

a digital economy which is drastically evolving.

- Unlike in other time frames, there are no declining themes and emerging themes in this time frame. The thematic map specifies that the basic or motor themes subsume any emerging themes and keep them alive and active without losing their relevance.

5.2 Thematic map: Digital Transformation in the Covid Era

The thematic map displays the major themes when the two important keywords are merged 'covid 19' and 'digital economy'. The outbreak of pandemic has necessitated the use of digital technology to ensure the safety of humans. Meetings, seminars and even education to all levels of students are conducted through online platforms. Digital technology and the faster digitalization of the economy have helped to survive the pandemic.

The niche or very specific themes are pandemics (Fletcher & Griffiths, 2020; Grover & Sabherwal, 2020; Papagiannidis et al., 2020; Renukappa et al., 2021) and e-commerce (Agrawal & Fox, 2021; Silva & Bonetti, 2021). In the emerging or declining themes there is only single node, digital (Gauthier & Cardot, 2021; Majchrzak & Shepherd, 2021; Rosenbaum & Russell-Bennett, 2021) and there are no sub themes attached with it. The motor or driving themes in the area of study of covid 19 and digital economy are digital technology (Agostino et al., 2021; Christiaensen et al., 2021; Trenerry et al., 2021), behavior (Butu et al., 2020; Dey et al., 2020; Zamfiroiu et al., 2020) and public health (Badr et al., 2021; Hassounah et al., 2020; Sullivan et al., 2021). Digital technology and public health are nodes with no subcomponents and under the node behavior, there are two sub themes, e-learning and local producers.

The largest basic themes in lower right quadrant is digital transformation (Abouhashem

et al., 2021; Garcia-Penalvo, 2021; Krishnamurthy, 2020; Kudyba, 2020; Nguyen, 2021) and covid (Coombs, 2020; Jovanovic et al., 2021; Naidoo, 2020; Toubes et al., 2021). The sub themes under digital transformation are higher education, covid-19 pandemic, online education, education, digital, distance learning, information technology, online learning and anxiety. The sub themes of covid are digitalization, pandemic, digital health, corona virus, social media, innovation, crisis and digital economy and other major nodes in the basic themes are artificial intelligence, telemedicine, and future of work, augmented reality and crisis management.

The major sub themes in artificial intelligence are health care, block chain, deep learning, industry 4.0, internet of things, smart city, virtual reality and 5G. Under the node telemedicine the sub themes are technology, e-health, machine learning, mobile, AI, digital divide, digital literacy, electronic health records and internet of medical things. There is a connecting node namely future of work and the sub themes under this node are sustainability, automation, decent work, firm performance, globalization, health and inequality. The sub themes under the node augmented reality are ICT, tourism, productivity, public policy and sustainable development goals. The smallest node is crisis management and the sub themes under this node are digital innovation and SMEs.

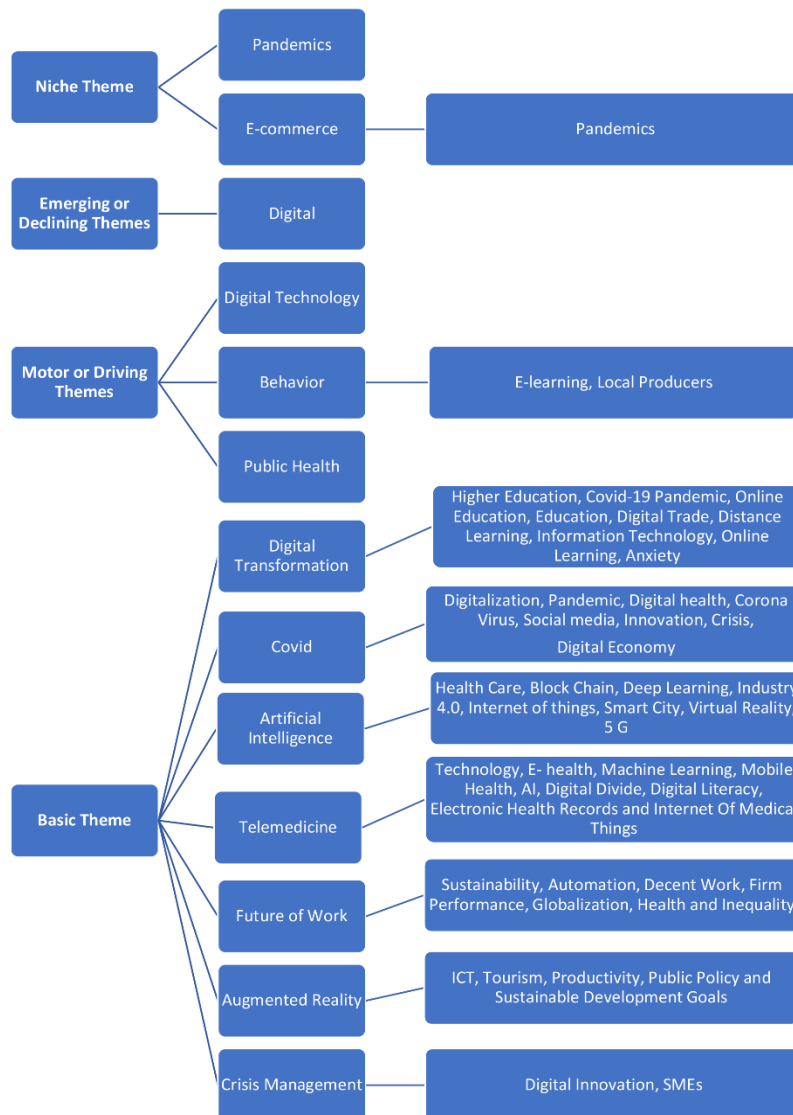


Fig. 13: themes-sub themes set 2

Interpretations

- The niche themes remain very specific and wholly different general areas of research. The theme ‘pandemics’ is a main theme and a subtheme of e-commerce at the same time. It shows the concomitant relation between the two.
- The theme ‘digital’ remains as an emerging theme in new forms and manners
- The motor themes ‘digital technology’, ‘public health’ and ‘behavior’ take the lead among the emerging and innovative research areas. Themes, ‘E- learning’ and ‘local products’ are grouped under the theme, ‘behavior’, indicating that the behavioral studies are on the rise
- The list of basic themes includes many current and active topics in digitalization. It shows that the basic themes are highly relevant to accelerate the growth of research in the topic.

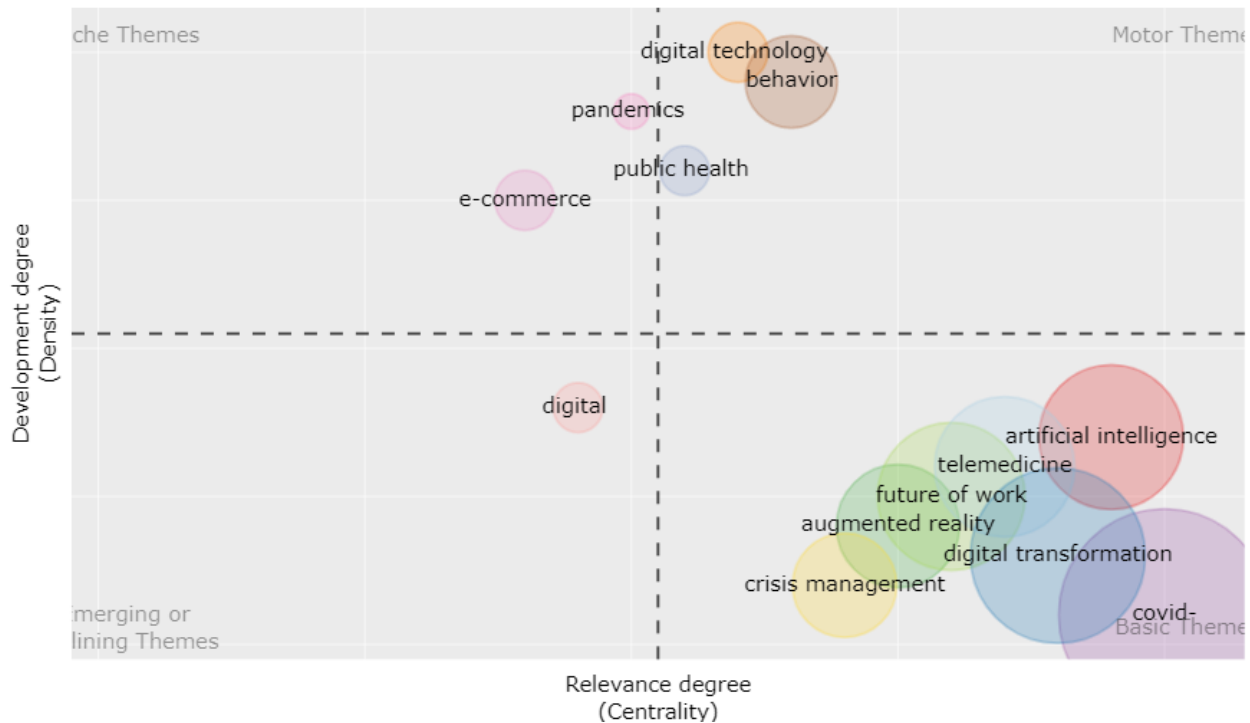


Fig. 14: Thematic map: Digital Transformation in the Covid Era

6. Thematic Categorization: A Mind map Brainstorming

The categorization of the identified themes is the third phase of the analysis. The expedition and brainstorming tools of the research management software, Qiqqa is used to group the documents to thematically organize the literature. An advanced data expedition conducted to categorize the themes in the literature base has given the output as below. The articles in the dataset are accessed online and exported to the software. Qiqqa provides mainly three analysis for the libraries created.

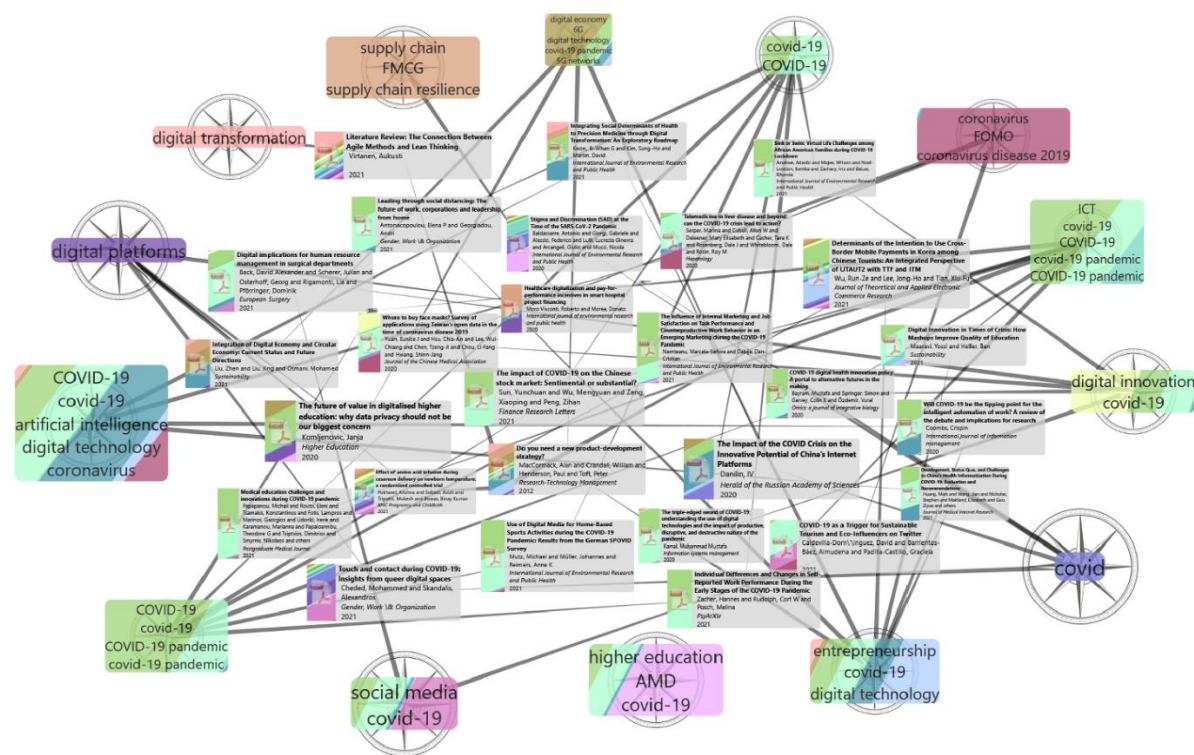
1. Data Expedition
2. Pivot Tables
3. Brainstorming

It searches for and downloads the bibtext file for each document uploaded from google scholar with its bibtext sniffer tool. Automatically the bibtext file is added to the original document added. It creates autotags for the documents in the libraries and generate themes through data expedition. These tags and themes provide an

interface for the researcher to assess the interconnections and importance of all documents in a library. The data expedition conducted onto the 256 articles, mostly open access documents, creates 15 themes and brainstorming conducted in them identifies 27 major articles which have significantly cut across these themes in the mainstream academic arena.

1. digital transformation
2. supply chain; FMCG; supply chain resilience
3. digital economy; 6G; digital technology; covid-19 pandemic; 5G networks
4. digital innovation; covid-19
5. COVID-19; covid-19; COVID-19 pandemic; covid-19 pandemic
6. OSH (Occupational Safety and Health)
7. covid-19; COVID-19
8. ICT; covid-19; COVID-19; covid-19 pandemic; COVID-19 pandemic
9. COVID-19; covid-19; artificial intelligence; digital technology; coronavirus
10. entrepreneurship; covid-19; digital technology
11. covid
12. digital platforms
13. higher education; AMD; covid-19

15. coronavirus; FOMO; coronavirus disease
2019



sources. MAXQDA allows for the thematic coding and systematic, qualitative and quantitative analysis of content. MAXQDA is therefore not primarily used for the collection of bibliographic data, although this is possible, nor for the creation of reference lists for publications, rather the core utility of the software is a qualitative content analysis of the literature.

Among the many research tools provided by MAXQDA, such as the Coding Query, Memos, Summary Tables, the word frequency functions, the graphical representation, the present study makes use of the Summary tables, with which compressed summaries of sources can be effectively compared and represented. The study also makes use of the ‘Document Map’ visual tool to identify the clusters of documents concerning specific themes in the dataset. The whole dataset is autocoded and the major themes, which are identified with the help of Qiqqa are selected to run the ‘Similarity Measures’ in the ‘Document Map’ function. A simple matching command is executed in the 257 files with 16 major autocoded themes. The initial check gives

- The 15 major categories of themes prominently cited in 27 articles in the dataset give a comprehensive view of the research topic
- The articles have crisscross references, showing how interrelated the nodes are. The 27 articles which are identified and classified according to the prominence of each in dealing with the category of themes are interconnected to implement a qualitative content analysis.

This is the final phase of the bibliometric thematic analysis and the qualitative analysis research tool, MAXQDA, is used to conceptualize the thematic structure of the dataset. MAXQDA can provide valuable support in all phases of literature review, particularly in the thematic and content development of primary

the output of 8 clusters of documents in the dataset and the cluster 5 in the figure 16 is identified as the core cluster with 18 documents. The cluster set 5, with 18 documents are again mapped with the same autocoded themes to refine it and thus the Document Map function identifies 12 documents as shown in figure 17 as Cluster 5.

Thus, a qualitative analysis of the dataset identifies 12 major papers which specifically deal with the topic 'Digitalization in the Covid Era' and the conceptual structure of the dataset is followed.

Number	Title	Author
1	Leadership matters in crisis-induced digital transformation: how to lead service employees effectively during the COVID-19 pandemic.	Bartsch, S et al. - 2021
2	COVID-19 Digital Health Innovation Policy: A Portal to Alternative Futures in the Making	Bayram, M et al. - 2020
3	Digital Transformation of Marketing Strategies during a Pandemic: Evidence from an Emerging Economy during COVID-19	Dash, G & Chakraborty
4	Impact of COVID-19 pandemic on information management research and practice: Transforming education, work and life	Dwivedi, YK et al. - 2020
5	Driving Digital Transformation During a Pandemic: Case Study of Virtual Collaboration in a German Hospital	Frick, NRJ et al. - 2021
6	Has COVID-19 Accelerated Digital Transformation? Initial Lessons Learned for Public Administrations	Gabryelczyk, R - 2020
7	The future of business education: A commentary in the shadow of the Covid-19 pandemic	Krishnamurthy, S - 2020
8	Covid-19 Accelerates Digital Transformation in Industries: Challenges, Issues, Barriers and Problems in Transformation	Kutnjak, A - 2021
9	COVID-19 and Beyond: Employee Perceptions of the Efficiency of Teleworking and Its Cybersecurity Implications	Mihailovic, A et al. - 2021
10	Digital Is Political: Why We Need a Feminist Conceptual Lens on Determinants of Digital Health	Ozdemir, V - 2021
11	WHO led the digital transformation of your company? A reflection of IT related challenges during the pandemic	Papagiannidis, S et al. - 2020
12	Impact of COVID-19 on water sector projects and practices	Renukappa, S et al. - 2021

Table 1: core documents on the topic.

	Cluster 1 (N=2)	Cluster 2 (N=2)	Cluster 3 (N=90)	Cluster 4 (N=116)	Cluster 5 (N=18)	Cluster 6 (N=16)	Cluster 7 (N=4)	Cluster 8 (N=9)
Code: Artificial Intelligence, Number (%)	0 (0.0)	1 (50.0)	5 (5.6)	1 (0.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Code: coronavirus, Number (%)	0 (0.0)	0 (0.0)	4 (4.4)	2 (1.7)	0 (0.0)	0 (0.0)	1 (25.0)	3 (33.3)
Code: Covid-19, Number (%)	0 (0.0)	2 (100.0)	90 (100.0)	0 (0.0)	18 (100.0)	0 (0.0)	0 (0.0)	9 (100.0)
Code: COVID-19 pandemic, Number (%)	2 (100.0)	0 (0.0)	2 (2.2)	7 (6.0)	0 (0.0)	2 (12.5)	1 (25.0)	0 (0.0)
Code: DIGITAL ECONOMY, Number (%)	0 (0.0)	0 (0.0)	1 (1.1)	3 (2.6)	1 (5.6)	0 (0.0)	1 (25.0)	0 (0.0)
Code: digital innovation, Number (%)	0 (0.0)	0 (0.0)	2 (2.2)	1 (0.9)	0 (0.0)	0 (0.0)	3 (75.0)	0 (0.0)
Code: Digital platforms, Number (%)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Code: digital technology, Number (%)	0 (0.0)	2 (100.0)	1 (1.1)	0 (0.0)	0 (0.0)	1 (6.3)	0 (0.0)	0 (0.0)
Code: digital transformation, Number (%)	2 (100.0)	2 (100.0)	0 (0.0)	0 (0.0)	18 (100.0)	16 (100.0)	0 (0.0)	0 (0.0)
Code: ENTREPRENEURSHIP, Number (%)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.9)	0 (0.0)	0 (0.0)	0 (0.0)	2 (22.2)
Code: fear of missing out (FOMO), Number (%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (11.1)
Code: Higher education, Number (%)	2 (100.0)	0 (0.0)	3 (3.3)	5 (4.3)	3 (16.7)	1 (6.3)	1 (25.0)	0 (0.0)
Code: ICT, Number (%)	0 (0.0)	0 (0.0)	1 (1.1)	3 (2.6)	1 (5.6)	0 (0.0)	0 (0.0)	0 (0.0)
Code: resilience, Number (%)	0 (0.0)	0 (0.0)	2 (2.2)	1 (0.9)	0 (0.0)	0 (0.0)	0 (0.0)	6 (66.7)
Code: social media, Number (%)	0 (0.0)	1 (50.0)	5 (5.6)	4 (3.4)	0 (0.0)	1 (6.3)	0 (0.0)	4 (44.4)
Code: SUPPLY CHAIN, Number (%)	0 (0.0)	0 (0.0)	0 (0.0)	2 (1.7)	1 (5.6)	0 (0.0)	1 (25.0)	3 (33.3)
N = Documents	2 (0.8%)	2 (0.8%)	90 (35.0%)	116 (45.1%)	18 (7.0%)	16 (6.2%)	4 (1.6%)	9 (3.5%)

Fig.16: clusters of documents on the topic

	Cluster 1 (N=1)	Cluster 2 (N=1)	Cluster 3 (N=1)	Cluster 4 (N=3)	Cluster 5 (N=12)
Code: Artificial Intelligence, Number (%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Code: coronavirus, Number (%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Code: Covid-19, Number (%)	1 (100.0)	1 (100.0)	1 (100.0)	3 (100.0)	12 (100.0)
Code: COVID-19 pandemic, Number (%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Code: DIGITAL ECONOMY, Number (%)	0 (0.0)	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)
Code: digital innovation, Number (%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Code: Digital platforms, Number (%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Code: digital technology, Number (%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Code: digital transformation, Number (%)	1 (100.0)	1 (100.0)	1 (100.0)	3 (100.0)	12 (100.0)
Code: ENTREPRENEURSHIP, Number (%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Code: fear of missing out (FOMO), Number (%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Code: Higher education, Number (%)	0 (0.0)	0 (0.0)	0 (0.0)	3 (100.0)	0 (0.0)
Code: ICT, Number (%)	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)
Code: resilience, Number (%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Code: social media, Number (%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Code: SUPPLY CHAIN, Number (%)	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
N = Documents	1 (5.6%)	1 (5.6%)	1 (5.6%)	3 (16.7%)	12 (66.7%)

Fig. 17: Refined clusters of documents on the topic

Thematic clustering

Therefore, a literature review based on a bibliometric and thematic analysis of the dataset concerning digital transformation in the covid era gives the following insights and gaps for further research.

7.1 Digitalization to new horizons

Digital innovation(Agasisti et al., 2020; Danilin, 2020; Oborn et al., 2021) has important implications for sustainability(Bekrar et al., 2021; Elavarasan et al., 2021; Koncar et al., 2020), which is fostered by increasing the accessibility to quality education(Habanik et al., 2019), health services(Sharma et al., n.d.; Sheikh et al., 2021), entrepreneurship(Hrivnak et al., 2021; Lungu et al., 2021; Ratten & Jones, 2021), supply chains(Bai et al., 2021; Queiroz et al., n.d.; Rapaccini et al., 2020; Zhang & Qi, 2021) and various digital platforms including ICT(Scanlan, n.d.; Vu & Hartley, n.d.; Wohlfart et al., n.d.).Digital economy is addressed as a topic contributing to the stream of research that investigates how digital innovation in various fields happens and how such an innovation can support sustainability. Critical challenges and opportunities of digital innovations for the coming decades call for immediate interventions from the part of governments to address digital literacy(Kwon et al., 2021; Tran et al., 2020), digital divide(Kwon et al., 2021; Scanlan, n.d.), digital administration(Gabryelczyk, 2020), digital crises and anxieties, enforcing taxes in a digital world(Dwivedi et al., 2020), determining

sustainable digital goals and dealing with online market(Jimenez-Zarco et al., 2021)places and facilitators. Further, the rise of the coronavirus disease 2019 (COVID-19) in a digital world has expectedly given rise to newtechnologies ranging from digitalwearable(Yilmaz et al., 2020), mobile devices(Dwivedi et al., 2020; Vizcaya-Moreno & Perez-Canaveras, 2020), AI enabled instruments(Coombs, 2020; Ho et al., 2020; Lai et al., 2020; Lin & Wu, n.d.; Piccialli et al., n.d.) and play store applications to innovative services like virtual tourisms(Akhtar et al., 2021), deployment of proximity tracking innovations and digitalization of virtual enterprises(Akhtar et al., 2021; Hopkins, 2021; Matthews et al., 2021). Future researches can be in line with these developments.

7.2 Battling out Covid pandemic through digitalization

Digitalization has curtailed the spread of COVID-19 outbreaks and ensured the safety of the healthcare teams and maintained patients' physical and psychological healthcare conditions(Dave & Gupta, 2020; Gleiss et al., n.d.; Ho et al., 2020; Lin & Wu, n.d.). Adaption of digitalization helps the governments(Bormann et al., n.d.; de la Porte & Jensen, 2021; Obrenovic et al., 2020)to reduce the impact of unprecedented outbreaks like COVID-19. (Abdel-Basset, M et al. – 2021). Concerning the education of the students all over the world, their learning processes are digitally enhanced to combat the virtual classrooms' limitations and to

develop new learning environments. Social media, specifically, have been widely used to reach a broader portion of the population. (Agostino, D et al. – 2021). Also the COVID-19 pandemic has revolutionized the public service delivery systems(Sim et al., n.d.)relying on the available digital technology. Thus, the importance of family-school collaborative engagement and social and digital empowerment have been addressed in various walks of life. Digitalization has affected every aspect of business and society(Koley, 2020). It is transforming how firms organize for value creation(Bai et al., 2021; Cortez & Johnston, 2020; Zhang & Qi, 2021), delivery, and capture. It has also significantly influenced the government interventions in public administration and policy(Koley, 2020; Vu & Hartley, n.d.)makings through their resiliency(Hrivnak et al., 2021; Lungu et al., 2021; Queiroz et al., n.d.; Rapaccini et al., 2020) in the face of global disruptions like those associated with the COVID-19 pandemic. (Autio, E et al. – 2021)

7.3 Digitalization and the human interaction.

Digital programs, digital structures, and digital tools can today be used by human resources departments(Tursunbayeva et al., n.d.) to advertise their strengths and opportunities and to make the recruitment of future candidates increasingly attractive. In addition, by making digital tools available, the employees' satisfaction(Cooke et al., 2020) can be raised. A key aspect of the digital transformation has been increased digitalization of business operations and its accelerated implementation has influenced the human interactions beyond time and place constrains (Barnes, SJ – 2020). On the other hand, the current shrinking of the physical and social interactions in offices and government departments amid a devastating pandemic raises principled questions on the broader and long-term impacts that digital technologies will have on democratic governance of planetary health and society. (Bayram, M et al. – 2020)

Because of the COVID-19 pandemic, most teaching and learning or student services in the higher education setting have moved to online

world and thus the teacher- student relation is constantly being redefined. (Cheng, MWT et al. – 2021). As part of the urgent need to respond to the COVID-19 pandemic, governments, healthcare providers, education institutions(Hendrickson et al., 2020; Iivari et al., 2020; Ratten & Jones, 2021; Taglietti et al., 2021) and businesses have looked to applications of Artificial Intelligence (AI) to compensate for the unavailability of human workers. The automation of business operations has made social and physical distancing rather easy and has ultimately canonized the AI to be the ultimate companion to a human person.

Conclusion

Adopting and adapting to digitalization is more than just an option. The ongoing changes in the needs and behaviour of the people forces both entities and public administrations to switch over to adigital transformation. On the business level, the use of digital tools enables the people to become more productive and thus more efficient in relating with the world and various issues in it. Therefore, for businesses to stay competitive and avoid being left behind, it is crucial to consider, plan and progress their transition to digital.

Thus, the article seeks to identify the relevant themes in 'Digital Transformation in the Covid Era' and and a bibliometric thematic analysis picks up themes potential for future research. The evolution of various themes emerged in the scientific community over the past yearsareexplained and the prominent ones are categorised and sub categorised. The emerging themes are conceptually defined and placed in a spectrum of voluminous literature. Thus, the conceptual structure of themes are qualitatively coded and the potential areas of further research are identified in the present scenario of digital transformation. The article remains as a model attempt for bibliometric and thematic analysis of previous literature by clubbing available bibliometric tools for refined results.

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