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Investigating the Emerging COVID-19 Research Trends in the Field of Business and Management: A Bibliometric Analysis Approach

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Abstract

The COVID-19 pandemic has been labeled as a black swan event that caused a ripple effect on every aspect of human life. Despite the short time span of the pandemic—only four and half months so far—a rather large volume of research pertaining to COVID-19 has been published (107 articles indexed in Scopus and the Web of Science). This article presents the findings of a bibliometric study of COVID-19 literature in the business and management domain to identify current areas of research and propose a way forward. The analysis of the published literature identified four main research themes and 18 sub-themes. The findings and propositions of this study suggest that COVID-19 will be the catalyst of several long- and short-term policy changes and requires the theoretical and empirical attention of researchers. The offered propositions will act as a roadmap to potential research opportunities.

Keywords: COVID-19, emerging research topics, business & management, bibliometric analysis, co-word analysis

Investigating the Emerging COVID-19 Research Trends in the Field of Business and Management: A Bibliometric Analysis Approach

1. Introduction

The coronavirus disease (COVID-19) is a human social and economic crisis that has attacked the core of human existence. It continues to spread uncontrollably around the world; as of May 11, 2020, 2,403,888 people had been infected globally (WHO, 2020). The outbreak is predicted to reach its peak in June 2020, declining only from July 2020 onwards (WHO, 2020). The COVID-19 pandemic has affected all segments of the population, especially vulnerable groups such as the old, the infirm, the disabled, the marginalized and the poverty-stricken (Donthu & Gustafsson, 2020). In response to the pandemic outbreak, the leaders of many countries decided to save lives before saving the economy, declaring sudden or phased lockdowns in their countries. Policies like "social distancing" and "stay-at-home" were implemented overnight, which severely damaged several businesses across industries (Donthu & Gustafsson, 2020; Leite, Hodgkinson, & Gruber, 2020).

According to the World Trade Organization (WTO, 2020), world trade was already experienced a slump in 2019, and then the COVID-19 pandemic precipitated a global financial crisis. Early estimates have predicted that major economies will lose around 2.4 to 3.0 percent of their gross domestic product (GDP) during 2020 due to the COVID-19 pandemic (WTO, 2020). It is becoming challenging for most businesses across the world to keep their financial wheels rolling, given reduced revenues and the high level of uncertainty. It is thus of the utmost importance for businesses to conduct proper assessment and feasibility analyses of their business models (Donthu & Gustafsson, 2020).

COVID-19 has also pushed businesses across the world to rapidly operate in newer and more resilient ways. As firms change their priorities in response to old challenges like real-time decision-making, workforce productivity, business continuity, and security risks, newer challenges introduced by the pandemic are testing businesses' resilience as they attempt to lay a foundation for the future (Ivanov, 2020). To help business practitioners and researchers understand the impact of the pandemic on future economic growth, this study analyzed a corpus of COVID-19 and business and management articles to address questions like the following: What are the growth trajectories and trends of publications in the early phase of the COVID-19 pandemic outbreak? What are the topical foci for research regarding COVID-19 and businesses? This review captures the current state of research about COVID-19 through a systematic literature review and develops propositions to guide future research. It can be described as a prescriptive study that reviews 107 articles pertaining to COVID-19 and aims to provide a reference point for practitioners and researchers alike. The paper includes sections delineating the methodology, results, discussion, conclusion, and future research avenues.

2. Methodology

Bibliometric analysis is an expedient approach to examine the evolution of research domains, including topics and authors, based on the disciplines' social, intellectual, and conceptual structures (Donthu, Kumar, & Pattnaik, 2020). Researchers have used this technique in a range of disciplines, like strategic management (Ferreira, Fernandes, & Ratten, 2016), corporate social responsibility (Bhattacharyya & Verma, 2020), medicine (Liao et al., 2018), and corporate universities (Singh, Verma, & Chaurasia, 2020).

Although a few recent bibliometric studies have addressed the impact of COVID-19 (Chahrour et al., 2020; Hossain, 2020; Park, Cook, Lim, Sun, & Dickens, 2020), each study has its own set of limitations.

Chahrour et al. (2020) only examined the most influential observational studies and therapeutic trials described in articles published in the PubMed and World Health Organization (WHO) databases. Also, they did not study the intellectual structure of the research area. The bibliometric analysis performed by Park et al. (2020) included only the PubMed database and the therapeutic aspects of the pandemic. Hossain (2020) collated articles published only in the Web of Science (WoS) database and reported that researchers largely targeted biological topics, such as those related to genetics, epidemiology, and zoonosis. Importantly, Hossain (2020) pointed out the necessity of extending the COVID-19 pandemic-related research to the field of socioeconomics.

To overcome the limitations of these earlier works, this study utilized the science mapping approach to understand the topical foci of the field of COVID-19 and business research (Figure 1). The science mapping approach helps researchers to understand the extent of a topic, its emergent trends, and its evolution over time (Singh et al., 2020). It is a holistic approach that provides better insights than a traditional literature review because it minimizes the potential subjectivity of the researcher (Bhattacharyya & Verma, 2020). This bibliometric study is novel in several respects. First, it applied the science mapping approach (consisting of bibliometric literature and scientometric analyses) in the emerging research domain of COVID-19 and business to minimize subjectivity and bias. Second, the research extended the science mapping approach with an in-depth analysis of the identified research themes. Third, it analyzed the research topics, identified significant research gaps, and provided future avenues in the research domain of COVID-19 and business.

To address the research questions of this study, we identified several research articles published within the business and management field. Figure 1 summarizes the research design. The publications was obtained using the Scopus and WoS databases. Data acquisition from existing literature is crucial in the

science mapping approach since it determines the dataset of articles from which pertinent conclusions will be drawn (Singh et al., 2020). We selected both the Scopus and WoS databases to ensure a wider range of high-quality peer-reviewed journals in the domain of business and management compared to EBSCO, Google Scholar, or others (Ferreira et al., 2016). We retrieved existing literature related to COVID-19 in the business management domain from the Scopus and WoS databases using keywords related to COVID-19 (Hossain, 2020): "2019-nCoV" OR "COVID-19" OR "Coronavirus Disease 2019" OR "Novel Coronavirus Pneumonia" OR "NCP" OR "2019 novel coronavirus" OR "SARS-CoV-2" OR "2019 Novel Coronavirus Diseases" OR "novel coronavirus" OR "pneumonia." The keyword search in Scopus and WoS was set to include titles, abstracts, and keywords in order to retrieve all relevant publications. The search period was set to include articles published between January 1, 2020, and May 11, 2020. Only English-language publications were considered for the review process.

[Insert Figure 1 here]

The initial search yielded over 12,068 papers, but narrowing the results to only the business research area yielded 142 papers published in the Scopus and WoS databases. Of these, 35 articles were duplicates (i.e., indexed in both databases) and thus were excluded from further analysis (Homrich, Galvao, Abadia, & Carvalho, 2018). A total of 256 different researchers published articles between January 1, 2020, and May 11, 2020, related to COVID-19 in the business and management domain. The screening process resulted in a unique sample of 107 articles published within the set time period from 71 different journals, 61 different countries, and 272 different institutions. Of these, four researchers had published two Scopus or WoS-indexed articles in journals like *Transportation Research Part E: Logistics and Transportation Review*, *International Journal of Production Research*, *Journal of Cleaner Production*, *International Journal of Scientific and Technology Research*, and *Journal of Risk and Financial Management*. This

indicates the adaptability and openness of researchers across the world to understand contemporary issues like the impact of COVID-19 on business. Further, the results indicate that this field is still evolving and is in its initial stage, as there are no dominant authors yet. Also, researchers with different backgrounds have contributed to the field.

3. Bibliometric analysis

3.1. Co-word analysis

In order to identify emerging themes related to COVID-19 in the 107 articles identified in the business research area, we performed a co-word analysis of keywords using VOSviewer. Co-word analysis applies text-mining techniques to the titles, abstracts, and keywords of articles (Van Eck & Waltman, 2010). Co-word links identify multiple keywords that occur together in the same articles. The relationship between keywords is determined based on the number of articles in which the keywords occur together (Van Eck & Waltman, 2010). To perform a co-word analysis, we combined the datasets retrieved from the Scopus and WoS databases and converted them into a Microsoft Word file for data cleaning and preprocessing. We manually eliminated the duplicate articles from the file and removed coding errors in the sources, affiliations, and cited references for further analysis. For example, we corrected duplication errors such as two different forms of the same author's name (e.g., "Lee S." and "Lee S.J.") through the data cleaning process. Further, we standardized keywords to ensure unification and consistency (i.e., singular/plural). After data cleaning, we conducted data analysis to understand the evolution of the corpus of COVID-19 literature in the business and management domain during 2020 using BibExcel and VOSviewer. BibExcel is a data analysis tool used for descriptive analysis of data (Ferreira et al., 2016). We used it in this study because of its high flexibility for data modification in databases like WoS and Scopus. Further, we employed the visualization tool VOSviewer, which collected all the keywords from the dataset and

created a co-word network. This network helped us to understand the research interests and relationships among keywords. It was from this analysis that the prominent research themes emerged. The study identified 4 themes and 18 sub-themes (Figure 2 and Table 1). Each theme and sub-theme is discussed in detail in the findings and discussion section.

[Insert Figure 2 here]

4. Findings and discussion

In comparison with the 2008 global financial crisis, the COVID-19 pandemic is associated with several new challenges, given that major economic activities have been stifled. The extent of COVID-19 spread across the world has heightened uncertainty regarding consumption and investment among different stakeholders, like consumers, trade partners, suppliers, and investors (Donthu & Gustafsson, 2020). Increasing the length of the lockdown and travel restrictions (national and international) are severely affecting the general economy. The COVID-19 crisis is generating spillover effects throughout global and regional supply chains, disrupting demand and supply (Pantano, Pizzi, Scarpi, & Dennis, 2020). Additionally, social distancing policies have almost destroyed service industries, like travel and tourism and hospitality, which could trigger a recession (Donthu & Gustafsson, 2020). The severe global challenges posed by COVID-19 can be tackled using a range of digital technologies, like the Internet of things, artificial intelligence, big data analytics, and drones (Donthu & Gustafsson, 2020). This study tried to examine the impact of COVID-19 on different facets of businesses through bibliometric analysis and identified four major discourses (Table 1) including impact of COVID-19 on overall business, technologies, supply chain management, and the service industry.

[Insert Table 1 here]

4.1. Cluster 1: Overall impact of COVID-19 on business

4.1.1. Cluster 1a: Impact of COVID-19 on business

The COVID-19 pandemic has already had dramatic, rippling effects across global economic activities in every region of the world (Bofinger et al., 2020). In order to flatten the curve of infection rates, several countries across the world have imposed widespread restrictions (e.g., lockdowns, quarantines, and closure of physical shops and businesses) to protect the functioning of healthcare systems (Michie, 2020). Understandably, these closures have had an immense, immediate impact on the economic activity in almost every sector. For example, activities involving direct contact between consumers and service providers have been adversely affected by restrictions on movement and social distancing (Giritli & Olofsson, 2020). The closure of the economy has also increased the risks associated with investments by households and businesses. Many companies are either facing bankruptcy or reducing their production capacity, which has led to higher unemployment and underemployment (Bofinger et al., 2020). A prolonged lockdown period also increases the risk of a massive increase in corporate and governmental debts, leading to fundamental financial imbalances that could prolong the recovery period from the COVID-19 crisis (Donthu & Gustafsson, 2020).

4.1.2. Cluster 1b: Impact of COVID-19 on the value chain

During the COVID-19 crisis, businesses are working faster to ensure a competitive advantage (Lee, Venkataraman, Heim, Roth, & Chilingerian, 2020). In order to solve emerging problems, firms are embracing methods and processes that are responsive rather than reactive to the crisis (Chesbrough, 2020), and they are switching to new operating models focused on the customer and supported by the

right governance (Graves & Karabayeva, 2020; Lee et al., 2020). They are quicker to decide where to invest and reallocate their resources. In addition, firms are pushed to create new product/services and radically adapt in order to remain visible, agile, and productive (Chesbrough, 2020; Kim, 2020).

4.1.3. Cluster 1c: COVID-19 & start-ups

The COVID-19 crisis has seriously threatened the potential for innovation and discouraged start-ups that could have been viable under normal circumstances (Kuckertz et al., 2020). A high percentage of start-ups are poised to go out of business in a few months as the capital and revenue required to sustain them are quickly drying up (Bofinger et al., 2020). Therefore, until the COVID-19 pandemic is over, survival must be the primary focus of start-ups and regulators. Further, the crisis has brought about a change in the investment patterns of venture capital firms, which are shifting their focus to start-ups operating in sectors like online grocery delivery, healthcare, fast-moving consumer goods, and home entertainment. (Kuckertz et al., 2020). The creativity and experimentation of start-ups is highly dependent on intense personal and social exchanges between stakeholders. The pandemic-induced lockdown has reduced the opportunities for direct communication and spontaneous encounters, resulting in deleterious impacts on start-ups' growth curves (Bofinger et al., 2020).

4.1.4. Cluster 1d: Impact of COVID-19 on trade

According to the WTO (2020), trade in 2020 will plunge by -13% or -32% according to the optimistic and pessimistic scenarios, respectively. Further, the recovery in 2021 is uncertain and will depend on the duration of the COVID-19 pandemic and the effectiveness of policy responses (Evenett, 2020). Despite the closure of international borders, maintaining trade flow is crucial to ensure access to essential goods like medicine and food in addition to supporting jobs and economic activities (Ozili & Arun, 2020).

COVID-19 is severely affecting service trades, threatening permanent closure (Garvey & Carnovale, 2020). However, some service trades, like information technology services, are booming because employees are able to work from home (Evenett, 2020).

4.1.5. Cluster 1e: Impact of COVID-19 on employment

The COVID-19 crisis has affected around 3.3 billion employees (Monitor, 2020). People across the world are unable to work because they are being asked to isolate or quarantine themselves. Due to COVID-19 lockdowns, businesses have increased layoffs and working hours and reduced wages (Dey & Loewenstein, 2020). Many employees have been affected by low wages, or loss of income. Sectors like travel and tourism, food services, retail, manufacturing, and business and administrative activities are at the highest risk of unemployment and under-employment (Bell & Blanchflower, 2020). COVID-19 is disrupting the economies of many countries by reducing economic activities across multiple sectors, leading to decreases in employment, and reducing revenue streams for several businesses (Dey & Loewenstein, 2020; Woodside, 2020).

4.1.6. Cluster 1f: COVID-19 & risk communication

During this crisis, understanding people's risk perceptions is critical for risk communication (Aven & Bouder, 2020). The risk perception of COVID-19 is influenced by several societal, cultural, and psychological factors and affect one's preparedness and planning (Giritli & Olofsson, 2020). Therefore, risk communication should be based on factors like risk attitude, risk perception, and trust in communicating authorities. Further, risk perceptions can affect how individuals evaluate threats and information communicated by authorities (Aven & Bouder, 2020).

4.2. Cluster 2: COVID 19 & technology

4.2.1. Cluster 2a (COVID-19, big data, & advanced analytics) and Cluster 2b (COVID-19 & data-driven decision-making)

During the COVID-19 pandemic, big data and advanced analytics are helping to detect surface indicators related to the pandemic (Guo et al., 2020). Specifically, real-time big-data-driven insights have helped policymakers and researchers to comprehend and forecast the reach and impact of the COVID-19 outbreak. Real-time COVID-19 trackers are helping epidemiologists, scientists, health workers, and policy-makers make more informed decisions to fight the pandemic by aggregating and synthesizing incident big data (Hancox, 2020). Further, real-time analysis of GPS data indicating people's movement within a certain locality is helping the government understand the population's compliance with social distancing mandates (Chen, 2020). Big data analytics are also helping many leaders to make difficult decisions that affect staff, customers, and operational capacity. For example, firms are leveraging their internal and external data on, for example, customers' contact history, employees' information, business operations monitoring, and social media to understand different scenarios for sustainable development during and after the COVID-19 pandemic (Donthu & Gustafsson, 2020).

4.2.2. Cluster 2c: COVID-19 & emerging technologies

During the COVID-19 pandemic, digital innovations quickly became the buttresses of personal and professional life (Panigutti, Perotti, & Pedreschi, 2020). Connected digital devices enable both remote work and education. Additionally, chatbots are providing instant life-saving information, partially relieving overwhelmed health systems (Leite et al., 2020). Further, geolocation information systems are helping health workers and researchers to track and map the spread of the virus. Firms and governments

are designing and piloting fast, responsive frameworks to implement emerging technologies, like data policy, digital trade, IoT, AI, drones, autonomous vehicles, blockchain telemedicine, and environmental innovations (Panigutti et al., 2020).

4.2.3. Cluster 2d: COVID-19 & digital healthcare

The public health emergency of COVID-19 confronting global healthcare systems has prompted the development of digital health solutions to mitigate the impact of the pandemic (Panigutti et al., 2020). These digital healthcare systems include telehealth; robust surveillance systems; technology-driven diagnostic and clinical decision-making tools; wearable tracking devices to measure physiological parameters like temperature, heart rate, and sleep-duration; and interactive chat services providing information about COVID-19 (Leite et al., 2020). Telemedicine administered through virtual chatbots and webbots is emerging as a viable option for communication and safe medical care. Digital healthcare solutions are helping to detect, report, and provide surveillance and rapid response for COVID-19 cases (Panigutti et al., 2020). Further, they are helping with the creation of geospatial dashboards that display pertinent information at the national and international scales to track COVID-19 statistics in real time (Panigutti et al., 2020).

4.2.4. Cluster 2e: COVID-19 & infodemic

According to the WHO Director General, the world is fighting not only an epidemic but also an "infodemic" (WHO, 2020). This infodemic is causing an over-abundance of information related to the COVID-19 situation, not all of which is accurate (Yu, Li, Yu, He, & Zhou, 2020). Such uncertainty can create confusion and distrust among people and, ultimately, hamper an effective public health response. The COVID-19 infodemic has largely dealt with the cause and origin of the novel coronavirus, its

symptoms and transmission patterns, available treatments and cures, and the effectiveness of interventions by health authorities (Krause, Freiling, Beets, & Brossard, 2020). In response to this, social media and search engine giants, like Facebook, Google, Pinterest, Twitter, and YouTube, are filtering out unfounded medical advice, hoaxes, and other false information that could risk public health (Krause et al., 2020). Along with several challenges, the infodemic is also creating opportunities to identify and adopt new preparedness and response tools to fight COVID-19.

4.2.5. Cluster 2f: COVID-19 & socio-technical transitions

According to Wells et al. (2020), the COVID-19 pandemic has led to a global socio-technical crisis and several alternative futures. It is globally, rapidly, and pervasively disrupting existing practices (Huynh, 2020) and is quickly emerging as a catalytic and meta-transition event that challenges and reshapes the legitimacy and efficacy of existing political and economic structures (Sendak et al., 2020; Woodside, 2020). These socio-technical changes will redefine future business activities and ecological burdens (Huynh, 2020).

4.3. Cluster 3: COVID 19 & supply chain management

4.3.1. Cluster 3a (Impact of COVID-19 on inventory management), Cluster 3b (Impact of COVID-19 on supply chain management), and Cluster 3c (Impact of COVID-19 on supply chain resilience)

The COVID-19 crisis continues to globally disrupt manufacturing and supply chains, with severe consequences for consumers, businesses, societies, and the global economy (Ivanov, 2020). The global production system has been badly affected due to surges in demand for essential goods, factory shutdowns, panic-buying, and shifts in consumer preference (e.g., online over physical shopping; Ivanov, 2020). Companies are modifying the supply chain by carefully managing interdependent factors, like

localization, complexity reduction, dual-sourcing, and investing in advanced manufacturing technologies (Garvey & Carnovale, 2020). Apart from these initiatives, manufacturing firms are taking measures to ensure business continuity. These measures include cross-functional controls and coordination on a global and regional level, increase in safety stocks and shift inventories, pivot freight models, improved customer support programs, rebound measures for demand returns, and quick reactions to changing sources of demand in order to secure revenue streams (Ivanov & Dolgui, 2020).

4.4. Cluster 4: COVID 19 & service industry

4.4.1. Cluster 4a: Impact of COVID-19 on travel & tourism

The viral outbreak has paralyzed the tourism industry, leading to job losses and devastating economies that are highly dependent on tourism (Boulos & Geraghty, 2020). Tourism and cities have strongly intertwined economic, social, and environmental relationships, which shape localities, landscapes, and regions. According to the United Nations World Tourism Organization (UNTWO), this pandemic has led to a potential loss of USD 30–50 billion for the travel and tourism industry (UNWTO, 2020), as several countries and regions have imposed entry and exit bans and other restrictions, which have decreased willingness to travel (Higgins-Desbiolles, 2020).

4.4.2. Cluster 4b: Impact of COVID-19 on education

Closure of educational institutes due to the pandemic has not only affected students and teachers but also created economic and social consequences related to digital learning, Internet facilities, childcare, food insecurity, healthcare, and housing (Arora & Srinivasan, 2020). As of May 10, 2020, 1.3 billion (approximately 73.5 percent) students across 177 countries have been affected by the closure of educational institutes (Zhang, Wang, Yang, & Wang, 2020). Educational institutes are opting to conduct

classes through internet, digital devices and online platforms (like group video programs) (Arora & Srinivasan, 2020).

4.4.3. Cluster 4c: COVID-19 & essential services

The COVID-19 crisis is affecting all service sectors due to either spikes or surges in demand. For example, while the retail, tourism, and aviation sectors have been badly affected due to the closure of services to mitigate the risk, food retailers and grocery stores are struggling with rising demand as consumers are trying to stock up for long periods of isolation (Addo, Jiaming, Kulbo, & Liangqiang, 2020). Essential service workers are working in grim and testing working environments, continuously exposed to the virus with no choice but to work (Frazer, Merrilees, Nathan, & Thaichon, 2020). Therefore, essential services need to consider the direct and indirect impacts on employees' occupational safety and health.

5. Research propositions for future studies

As the COVID-19 crisis continues to impact businesses in the next few years, economic, societal, and technological changes will become unavoidable for survival. Given this backdrop, the current study presents a bibliometric review of 107 papers on the ramifications of COVID-19 in the domain of business and management in order to delineate this emerging research field and summarize the available knowledge. This sub-section provides a synopsis of the four main clusters discussed in Section 4. The synthesis of four distinct research streams in the COVID-19 domain reveals several new opportunities for future practice and research work (Table 2).

5.1. Cluster 1: Overall impact of COVID-19 on business

Due to fears of a financial collapse and new recession, resilient businesses and sturdy government leadership are urgent and critical (Giritli & Olofsson, 2020). Short-, medium-, and long-term plans are required to rebalance and re-energize the economy (Michie, 2020). In addition, socioeconomic risk assessments and strategies for robust and sustainable business models are required across every sector. The COVID-19 pandemic is radically changing the demand pattern for products/services, which has in turn increased the risk of fragility in global and regional supply chains and networks (Lee et al., 2020). To sustain and position themselves for the "new normal," firms should improve their operational resilience, accelerate end-to-end value chain digitization, rapidly increase the transparency of capital and operating expenses, embrace remote work, reimagine sustainable operations, and ensure competitive advantage. In addition, start-ups need to be more flexible and adapt their business models to dynamic markets. Policy measures will only be successful if they are complemented by an entrepreneurial ecosystem. Further, policy-makers need to implement measures to protect start-ups and adopt or discard policies in the future based on the knowledge derived from crisis situations (Kuckertz et al., 2020). Based on this, we propose the following:

Proposition 1a: The COVID-19 crisis not only requires short-, medium-, and long-term plans to rebalance the economy but also raises a clarion call for robust and sustainable business strategies across every sector.

Proposition 1b: The COVID-19 crisis demands new operating models to meet changing demand patterns and remain agile and productive.

[Insert Table 2 here]

Reforms in trade policy during the COVID-19 pandemic will help to reduce the negative economic and social impact of the virus, which will eventually help to build resilience and ensure economic recovery. For instance, reforms in trade policy can reduce the need for close contact between transporters, traders, and officials, helping to maintain social distancing and limiting the spread of the virus (Carnevale & Hatak, 2020). Further, to mitigate disruptions in the regional and global value chain, interventions in logistics operations are required. The impact of this pandemic on employment is unprecedented and will continue to increase; therefore, economies urgently need to implement policy measures to boost the demand for labor. The new labor policies should effectively consider health protection measures and economic support on both the demand and supply sides (Bell & Blanchflower, 2020). Also, businesses should pay special attention to building capacity and updating employees' technological skills (Carnevale & Hatak, 2020). Based on this, we propose the following:

Proposition 1c: Reforms in trade policies are required to reduce the negative impact of the COVID-19 crisis.

Proposition 1d: Changes in existing labor policies are needed to boost the demand for labor.

5.2. Cluster 2: COVID 19 & technology

In the COVID-19 crisis, digital technologies, like the Internet of things, AI, and blockchain are becoming essential for economic and social functioning (Huynh, 2020). Drones can be used for surveillance to ensure safety guidelines are being followed and to spray disinfectants on affected areas (Leite et al., 2020). AI-powered tools could be used to obviate the need for manual temperature checks and distance analysis Panigutti et al., 2020). Data-driven insights have the potential to facilitate accurate prediction of impacts and can make the difference between a misstep and a strong continuity response in these

uncertain times (Hancox, 2020). Although these emerging technologies have immense potential as equalizers, without the right governance, they could intensify the digital divide in society. Further, these technologies are associated with critical privacy and security issues and urgently require a global baseline consensus on security (Panigutti et al., 2020). The right information related to the pandemic is key for the success of mitigation measures, but the infodemic has exacerbated the crisis, propagating misinformation through social media platforms and other channels (Huynh, 2020). It should not be doubted that the COVID-19 pandemic has affected relationships within socio-technical systems at the landscape and regime levels. Global stabilization agents, such as the WTO, World Bank, and United Nations, can help to create checks and balances and attempt to ensure a return to business as usual (Sendak et al., 2020). Based on this, we propose the following:

Proposition 2a: The COVID-19 crisis indicates the acute necessity of the implementation of advanced technologies across different sectors.

Proposition 2b: Resisting the social-technical meta-transition is essential in the COVID-19 crisis.

5.3. Cluster 3: COVID 19 & supply chain management

This sudden shift in the global production system has raised questions about the resilience of global and local value chains and has caused firms to rethink and transform their overall approach to manufacturing and the supply chain model. Companies should launch strategic initiatives to create more resilient supply chains. The operation model should be adjusted to enable more flexible and decentralized manufacturing with a consistent risk management system. Also, cross-industry collaboration models need to be redefined, and product portfolios require thorough reviews to reduce complexity. Based on this, we propose the following:

Proposition 3a: The COVID-19 crisis demands resilient strategies to reduce manufacturing complexities.

Proposition 3b: Modification of existing supply chain measures is required to ensure business continuity while dealing with the COVID-19 crisis.

5.4. Cluster 4: COVID 19 & the service industry

The COVID-19 pandemic will have a long-lasting effect on international tourism due to travel restrictions and changes in people's risk perception of overseas travel. This global epidemic has impacted tourist destinations, leading hotels, restaurants and bars, theme parks, museums, trade fairs, and cultural and sports events to be deserted (Boulos & Geraghty, 2020). The authorities responsible for providing different services should provide clear and consistent guidance to workers to ensure compliance (Frazer et al., 2020). In the education sector, sudden switching of teaching styles is creating several challenges, like changes to learning plans, acclimatization issues with new online platforms, and conversion of lessons and hands-on learning materials to remote learning and communication (Zhang et al., 2020). Along with these technical challenges, many students and parents do not have access to the proper technologies for distance learning, like the Internet and digital devices, or the necessary skills to handle them. Based on this, we propose the following:

Proposition 4a: The COVID-19 crisis requires robust strategies in different service industries to ensure compliance.

Proposition 4b: Switching from existing teaching styles is required to reduce the challenges of learning while dealing with the COVID-19 crisis.

6. Implications

6.1. Academic implications

The objective of this paper was to explore emerging research trends regarding the impacts of COVID-19 on business and management using bibliometric and science mapping approaches. This article contributes to research on COVID-19 by elucidating the theoretical evolution of COVID-19 research and its linkages with multiple economic, social, and technological factors. Broadly, the findings and propositions of this article contribute to the epistemological discourse on collective knowledge about the impact of COVID-19 on business and management by examining the most productive authors. In addition, the results show how knowledge is evolving over time based on the use of keywords. Importantly, an understanding of the contributions of the most productive scholars and their research helps other researchers build on their work by choosing and following a line of inquiry. Ivanov, the most productive researcher in this area, has mainly focused on the short- and long-term impacts of epidemic outbreaks on global supply chains and intertwined supply networks' resilience. Ivanov's publications help identify different elements of risk preparedness, mitigation, and recovery policies.

This study outlines several research propositions that can serve as a foundation for future research in the area of COVID-19. There are several theoretical, conceptual, and empirical research opportunities to understand the development of a new paradigm and advancement of existing theories within the business domain due to the disruption caused by the COVID-19 pandemic. Additional empirical research opportunities have been created by the emergence of a body of knowledge regarding COVID-19 and subsequent modifications to this knowledge. This is the first academic work to recommend a set of propositions for future research work intended to advance this body of knowledge.

6.2. Managerial implications

This study could benefit managers interested in adopting a proactive approach to understand which changes in strategies, services, and products are required to meet unprecedented demands and develop

sustainable business practices. A major practical lesson is that the COVID-19 crisis is quite complex and has caused not only changes in existing business models but also a need to understand and observe transitions in the economy, business, and society. The propositions discussed above suggest that, to mitigate the COVID-19 crisis, managers require forward thinking, new strategies, and re-planning on several fronts. The propositions give managers and decision-makers a variety of practical insights into the challenges posed by COVID-19 and actions and reforms that must be carried out at the economic, social, and technological levels. The propositions also help managers to predict the need for advanced technologies, supply chain resilience, and organizational agility to achieve the right growth trajectory for growth.

6.3. Policy implications

The economic consequences of the COVID-19 crisis require urgent policy responses from the government to support individuals and businesses alike. Properly designed policy reforms are critical for reducing global market distortions. Governmental and industrial policy-makers play a paramount role in formulating short-, medium-, and long-term plans. Governments must be adaptable as the circumstances of the COVID-19 crisis evolve. The findings and propositions of this study demonstrate that governments should reform existing economic policies to meet individuals' immediate health, food, and other basic needs; maintain political and economic stability; and protect social cohesion. The propositions could help governments and policy-makers to respond effectively to future crises by reevaluating rules and regulations, increasing their digital footprint, and revisiting supply chains. The propositions could also help government agencies identify potential changes to policy tools to resolve medical and economic issues and restore shuttered services, like education, trade, hospitality, and travel and tourism.

7. Conclusion

Tables 1 and 2 provide synopses of the new research sub-areas related to COVID-19 and business management. These synopses should provide a solid basis for advancing research in these domains. The evolution of the COVID-19 literature in the business domain exhibits a distinct pattern. First, the diversity of topics and sub-topics addressed by scholars related to the COVID-19 crisis is exponentially increasing, indicating that the virus has impacted our present and future way of life on various fronts. The impact of COVID-19 on business and management is continuously attracting researchers, who are bringing new perspectives on research. Second, while the diversity of research areas is increasing, a few broad research sub-topics are emerging more significantly. These core topics include the impacts of COVID-19 on the economy, value chain, supply chain management, innovation, service industry, and employment. Thus, the bibliometric results of this study provide evidence that COVID-19 is gradually emerging as a discourse in the business area. The identified core topics serve as pathways for practitioners and academicians aiming to conduct future research.

This bibliometric study revealed that, in a short time span (four and a half months), 107 unique documents were published in Scopus and WoS from 71 different journals, 272 different institutes, and 61 different countries. The findings identify the most active authors and sub-areas of research on business aspects related to COVID-19. Thus, this study has helped identify potential COVID-19 knowledge domains in the field of business and management. Lastly, co-word analysis based on keywords provided insights into the main research themes/sub-areas related to the impact of COVID-19. The COVID-19 crisis will have short-, medium-, and long-term effects on various aspects of society and businesses. This study is an early attempt to gain perceptive insights into the intellectual structure of COVID-19 research in the arena of business using bibliometric analysis. The findings of this study complement existing subjective and evaluative literature reviews on COVID-19 research.

Journals covered in the Scopus and WoS databases are published and reviewed each year to ensure their high quality. This bibliometric study utilized only these databases to collect data, but the absence of other databases, like Google Scholar, EBSCO, and PubMed, may have influenced the data representation. Therefore, future studies need to amply cover these databases in order to collect more comprehensive data and avoid bias.

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Figures:

Figure 1: Research design for the bibliometric study

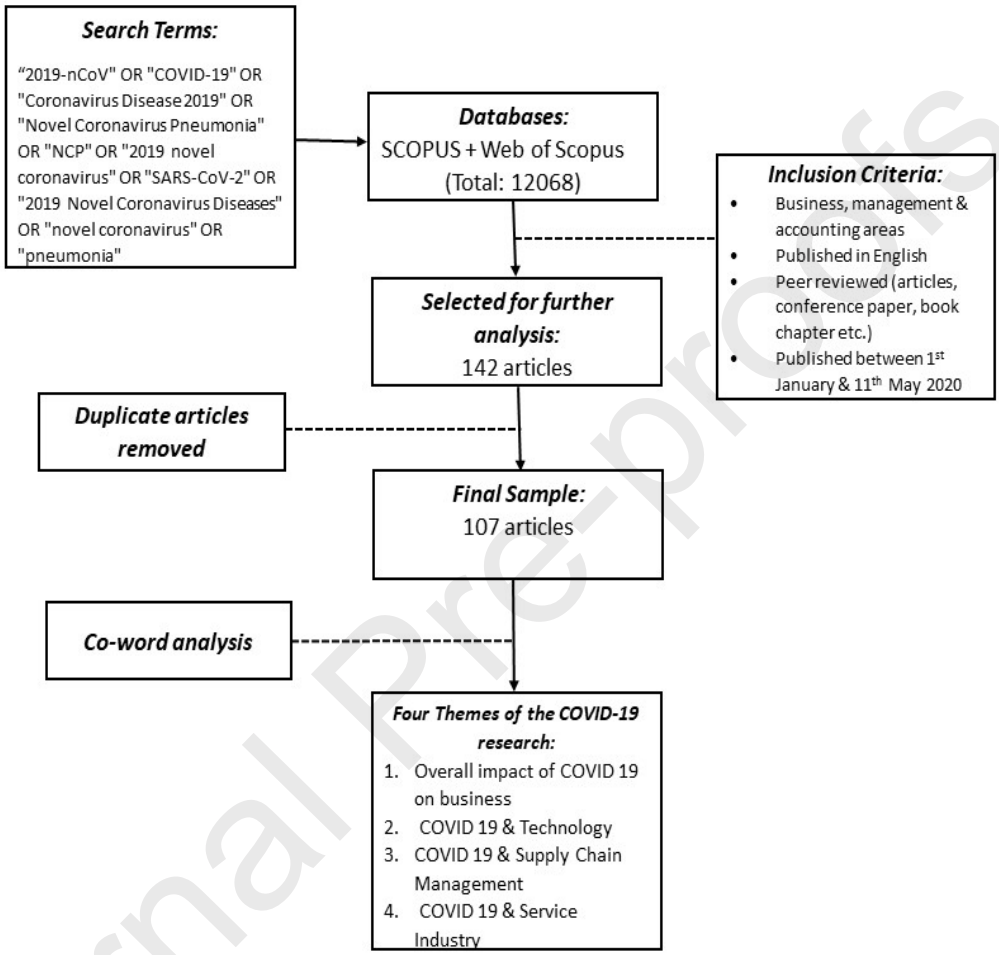

Figure 2: Co-word network of COVID-19 literature in the business and management area

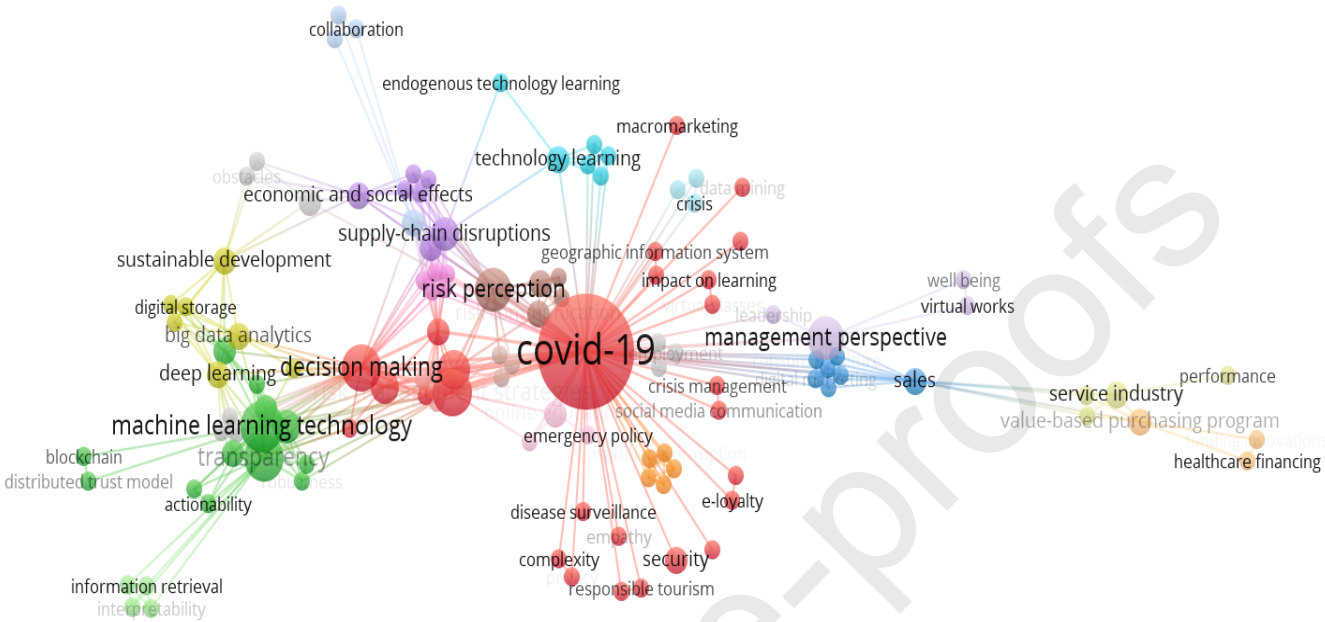

Table:

Table 1: Themes, sub-themes, and keywords related to COVID-19 research

Themes	Sub-themes	Keywords
Overall impact of COVID-19 on business	*Impact of COVID-19 on Business*	COVID-19; Decision Making; Risk Management Strategies; Risk Assessment; Supply Chain Dynamics; Predictive Performance; Complexity; Crisis Management; E-Loyalty; Geographic Information System; Impact On Learning; Privacy; Real Time; Responsible Tourism; Social Media Communication; Social Presence; Social Tourism; Virtual Classes; Data Mining; Disease Surveillance; Empathy; Human Behavior; Macromarketing; Price Volatility; Security
	Impact of COVID-19 on Value Chain	Management Perspective; Sales; Consumer Culture; Corporate Culture; Digital Marketing; Digital Sales; Digital Transformation; E-Commerce; Leadership; Virtual Works; Well Being
	COVID-19 and Start-ups	Entrepreneurship; Crisis; Policy
	Impact of COVID-19 on Trade	Trade Policy; Obstacles; Stakeholders
	Impact of COVID-19 on Employment	Employment; Underemployment; Unemployment
	COVID-19 & Risk Communication	Risk Perception; Risk Communication; Misinformation; Trust; Uncertainty
COVID 19 & Technology	*COVID-19, Big Data, & Advanced Analytics*	Deep Learning; Forecasting; Big Data Analytics; Sustainable Development; Digital Storage; Personnel Training; Sustainable Operations; Computational Capacity; Business Analytics
	COVID-19 & Data-driven Decision-making	Real-World Datasets; Actionability; Local Decisions
	COVID-19 & Emerging Technologies	Machine Learning Technology; Transparency; Artificial Intelligence; Healthcare Analytics; Ethics; Robustness; Standard Practices; Blockchain; Distributed Trust Model
	COVID-19 & Digital Healthcare	Technology Learning; Apps; E-Healthcare; Healthcare System; Legislation; Endogenous Technology Learning
	COVID-19 & Infodemic	Information Retrieval; Interpretability, Search Engines; Latent Intention
	COVID-19 & Socio-technical transitions	Minimize Disruption, Professional Expertise; Socio-technical Systems

COVID 19 & Supply Chain Management	*Impact of COVID-19 on Inventory Management*	Supply-Chain Disruptions; Supply Chain Risk Management; Economic and Social Effects; Inventory Control; Inventory Management; Optimal Ordering Policy; Ripple Effect
	Impact of COVID-19 on Supply Chain Management	Computer Simulation; Digital Twin; Economic Impact; Resilience; Supply Chain Management
	Impact of COVID-19 on Supply Chain Resilience	Intertwined Supply Network; Supplier Roles; Supply Chain Resilience; Survival; Viability
COVID 19 & Service Industry	*Impact of COVID-19 on Travel & Tourism*	Mobility Service; Tourism Industry; Collaboration; Responsibility; Uncertainty
	Impact of COVID-19 on Education	Online Education; Information Technology; Emergency Policy
	COVID-19 & Essential Services	Service Industry; Healthcare Policy; Improved Performance

Table 2: Summary of propositions for future studies that emerged in each theme

Themes	**Propositions**
Overall impact of COVID-19 on business	*Proposition 1a: The COVID-19 crisis not only requires short-, medium-, and long-term plans to rebalance the economy but also raises a clarion call for robust and sustainable business strategies across every sector.* *Proposition 1b: The COVID-19 crisis demands new operating models to meet changing demand patterns and remain agile and productive.* *Proposition 1c: Reforms in trade policies are required to reduce the negative impact of the COVID-19 crisis.* *Proposition 1d: Changes in existing labor policies are needed to boost the demand for labor.*
COVID-19 & Technology	*Proposition 2a: The COVID-19 crisis indicates the acute necessity of the implementation of advanced technologies across different sectors.*

	Proposition 2b: Resisting the social-technical meta-transition is essential in the COVID-19 crisis.
COVID-19 & Supply Chain Management	*Proposition 3a: The COVID-19 crisis demands resilient strategies to reduce manufacturing complexities.* *Proposition 3b: Modification of existing supply chain measures is required to ensure business continuity while dealing with the COVID-19 crisis.*
COVID-19 & Service Industry	*Proposition 4a: The COVID-19 crisis requires robust strategies in different service industries to ensure compliance.* *Proposition 4b: Switching from existing teaching styles is required to reduce the challenges of learning while dealing with the COVID-19 crisis.*

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