

Review Article

Exploring the Impact of Pandemic on Global Economy: Perspective from Literature Review

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ABSTRACT

The pandemic has caused several health issues and deaths and numerous severe devastations to the global economy. Due to the extreme impacts of the epidemics, it is crucial to investigate the pandemics and their pessimistically hidden influences to devise proper strategies. However, although this topic gains enormous recognition from scholars and researchers, there is still an inadequacy of a comprehensive literature review on the issues, and in-depth research on individual aspects of the world economy. Accordingly, the objective of this paper is to contribute a literature review that synthesises and evaluates prior research, to examine the current state of the pandemic impacts on the global economy, as well as become the requisite foundation for the practitioners to perceive how to respond to a pandemic in the future. A literature review is conducted, with 254 most relevant articles are analysed and classified based on the proposed framework. Thus, the findings of this study contribute diverse theoretical and practical insights concerning pandemics and the global economy.

The results of this paper indicate the current status of the literature review and discover future research directions. Additionally, this paper proposes an integrated framework of the most influenced industries, followed by some emerging solutions to the most suffering sectors. Future research directions are further suggested based on the identified research gaps and the analysis results.

Keywords: COVID-19, economics, global economy, literature review, pandemic

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INTRODUCTION

What is the global pandemic? A global pandemic can be defined as the widespread of a new disease in a community or worldwide (Shorey & Valerie, 2020). The likelihood of a pandemic has gone up during the past century because of the rise in integration, global travel and urbanisation, the shift in land use, and the greater extraction of the natural environment (Jones et al., 2008; Morse, 2001). Infectious diseases are some of the very few phenomena that comprehensively shape our history, societies, and cultures, along with the very basis of modern principles (Huremović, 2019). However, it has long been regarded as a potential threat and also a societal challenge. From the beginning of the twenty-first century, humanity has continuously witnessed and faced a series of threatening infectious diseases caused by viruses. It is the leading cause of death globally, accounting for a quarter to a third of total mortality (Verikios, 2020). Moreover, it has caused many severe impacts on human life and strode the evolution of the global economy, making it a recession. The most destructive of the five flu pandemics in more than 100 years was the 1918 pandemic, which killed 50 million to 100 million people in a global population with less than 2 billion. Nowadays, epidemics and pandemics are classified as emerging risks (Nguyen et al., 2021). The COVID-19 outbreak has also destroyed the world's economic giants, with a predicted loss of \$1 trillion in the year 2020 (Kabir et al., 2020).

Because of the rising likelihood of a pandemic occurring over the years (Gössling et al., 2020; Madhav et al., 2017) and the terrible effects of the epidemic on the global economy (Qiu et al., 2017; Shrestha et al., 2020), it is exceptionally imperative to keep studying on this topic to prepare practical strategies, along with helping scholars to determine which industries needed consideration to sustain the global economy. However, although there various studies about the pandemic, those papers concentrate only on the consequences of the pandemic on human life rather than the aspect of the global economy. Furthermore, there is a lack of a comprehensive literature review on the issues to better discern the turmoil impact on the global economy, along with a little in-depth literature about the effects of the pandemic on individual aspects of the world economy to provide timely solutions.

Therefore, the primary purpose of this literature review is to provide trustworthy sources of reference for experts, and become the quintessential foundation for practitioners to perceive how to respond to a pandemic in the future. The paper then provides an excellent overview of the literature review of the impacts of the pandemic on the global economy by summarising its influences on separate parts of the international economy, concentrating on three economic sectors: primary sectors, secondary sectors and tertiary sectors. Specifically, primary sectors are industries consisting of the exploitation of raw materials from natural sources, such as the agricultural industry and petroleum

& oil industry; secondary sectors include raw material treatment, all manufacturing, all types of construction, and supply of gas, water, and power, so it is referred as the manufacturing industry; and tertiary sectors involve in producing all services, as opposed to a tangible commodity, that meets immediate satisfaction to the customer such as the education industry; finance industry; healthcare and pharmaceutical industry; hospitality, tourism, and aviation; real estate and housing sector; sports industry; information technology, media, and R&D; food sector (Fisher, 1939; Nicola et al., 2020). Finally, the results of this paper indicate the status of the literature review and discover future research directions based on the identified research gaps and the analysis results. Furthermore, based on the study results, the research synthesises and suggests various potential solutions for the most emerging industry groups following the research trend.

The remaining structure of the paper continues with methodology, theoretical background and the proposed framework. Then the results of the literature review are presented, followed by an in-depth discussion of results and observations. Based on the discussion, implications of further research are suggested. The last section of the paper is the conclusion with a summary and relevant contributions.

METHODOLOGY, THEORETICAL BACKGROUND AND PROPOSED FRAMEWORK

Methodology

This study examines the current state and

research direction of the pandemic, focusing on studies over the past decades. The research methodology starts with the search process and the systematic review process (shown in Figure 1).

As the nature of research on the pandemic and the global economy in various databases, this paper builds the literature review from reliable academic sources, such as Science Direct, Emerald, Google Scholars. Different keywords such as “pandemic”, “coronavirus”, “COVID-19”, “global economy”, “economic factor”, and “literature review” are applied to search for articles from these reliable databases. Accordingly, the authors identify approximately 950 potentially relevant articles. Then, these articles are screened to select the relevant ones. This screening step, which helps to learn the general ideas about the parts of the paper and the paper itself (Keshav, 2007), is based on the title, abstracts, structure and a glance through the entire paper. However, the selection of articles for inclusion in the study was not based on the paper’s methodology because the main purpose of the authors was to provide a more comprehensive literature review on the issues to better discern the turmoil impact on the global economy by summarising its effects on particular parts of the global economy. Hence, selecting articles to be included in the study based on title, summary, structure, and overview will solve a large number of articles approved but still appropriate for the research objectives.

To avoid selection biases, all the authors of this paper terminate this screening and selection process independently and find the

consensus at the end. Finally, 254 articles are selected and analysed in detail.

In the systematic review process, selected articles would be analysed, classified and categorised into categories based on the integrated framework. Similar to the selection process, in case of deviation in classification and categorisation of the particular article, this article would be

discussed until a consensus is reached. After analysing, classifying and categorising the selected articles, the current state of literature is revealed. The research gaps are further identified for future research direction. In addition, the study also synthesises and suggests several potential solutions for the most emerging industry groups following research trends.

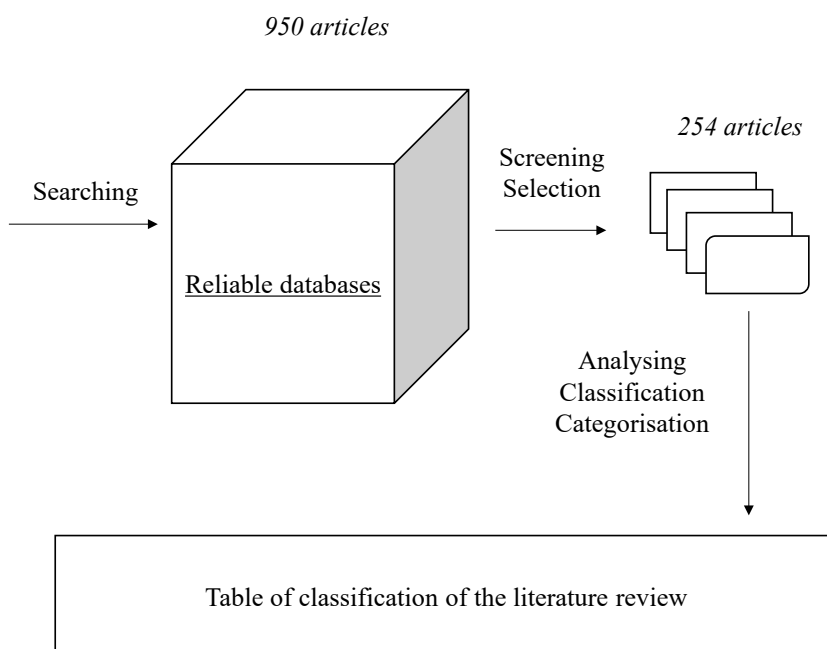


Figure 1. Literature search and systematic review process

Theoretical Background

In the attempt to explain the turmoil effect of a pandemic on the global economy, the foundation of this study relies on the “three-sector theory”, which divided the economy into three group sectors (Copertari, 2016; Haleem et al., 2020; Marjanović, 2010). The primary sector deals with the extraction

of raw materials, the secondary sector deals with manufacturing, and the tertiary sector deals with services. This theory is formulated by the conception of three economic sectors by Fisher (1939), later developed by Clark (1940) and Fourastié (1949) (Kwiatkowska, 2015; Schafran et al., 2018), which has caught the attention

of many scholars in studying the global economy. Furthermore, to apply the theory with the circumstance of the pandemic, one recent study by Nicola et al. (2020), which many researchers well adopt in explaining the key influences of coronavirus pandemic on the world economy, is integrated into the three-sector theory to build proposed integrated framework.

Proposed Framework

To guide further research, from the perspective of the three-sector theory and the study of Nicola et al. (2020), the authors introduce an integrated framework of the pandemic effects for surveying the literature.

This integrated framework will demonstrate the impacts of the pandemic on three sectors of the global economy with specific industries. The primary sector includes the agriculture industry and petroleum & oil industry. The secondary sector deals with the manufacturing industry. Finally, the tertiary sector comprises the education industry; finance industry; healthcare and pharmaceutical industry; hospitality, tourism and aviation; real estate and housing sector; sports industry; information technology, media and R&D; food sector. This proposed integrated framework is used to classify and categorize selected articles (shown in Figure 2).

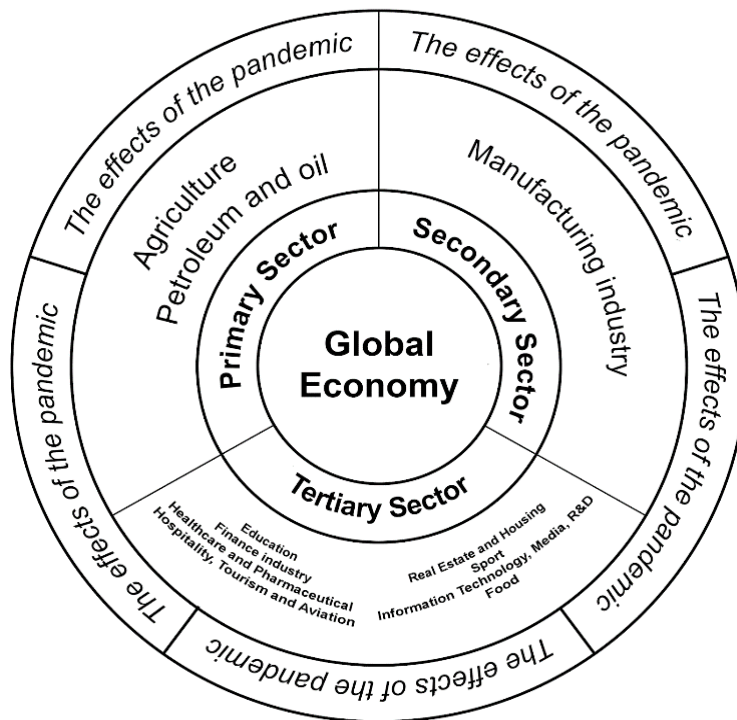


Figure 2. Integrated framework for the effects of the pandemic

RESULTS

All reviewed articles are categorised based on the proposed framework for research. A notation with three levels is applied to classify the articles to each sub-category: highly covered (X), moderately covered (o) and slightly covered (l). Highly covered (X) indicates that a paper mainly deals with a specific topic; moderately covered (o) is used in certain sections or paragraphs are about it; slightly covered (l) indicates that the paper only slightly mentions a topic. Using this notation can easily justify the degree of intensity among articles (Dam et al., 2019; Rickenberg et al., 2012). Table 1 shows the classification of this research.

The total and weighted total of the results are demonstrated in Figure 3. Based on the classification of the research, we had the following industry coverage data:

There are six industries with the highest weighted total: the healthcare and pharmaceutical sectors (278), principally focused on research as a central issue during a pandemic outbreak, followed by the finance industry (193). Hospitality, tourism and aviation industries (175) are the service industries, which account for the majority of economic value, the necessity of meeting the needs and the mobility of people. Otherwise, the manufacturing sector (141) is affected by import, export and distribution in the market. Additionally, education (107) and food (121) are the last sectors in the group of industries with high-covered, which cause several disruptions and difficulty for the citizens. Meanwhile, the remaining five

industries in the low-weighted entire section are considered to be less affected and not adequately studied: firstly, information technology, media and R&D (53), followed by agriculture (32), petroleum & oil (25), sports industry (17) and finally real estate and housing (14).

DISCUSSION

According to Figure 3, the study will focus on discussing the emerging industries group of six high-weighted total based on the analysis result. This paper then discusses the effects and solutions faced by these industries, and the urgency of these tremendous impacts on the global economy.

The primary sector includes agriculture and the petroleum & oil industry. In the meantime, according to Figure 3, the industries that received the least attention from researchers is such as agriculture industry (32) and petroleum & oil industry (25), real estate and housing (14), sports industry (17), and information technology, media and R&D (53), based on the rating scale. The above five sectors have the lowest-weighted at the time of doing the research. Hence, the study prioritises discussing the urgency of the tremendous impacts of the highest-weighted industries. Furthermore, there are not so many articles that are not thoroughly investigated related to the primary sector. Because of this, none of the industries belonging to the primary sectors is discovered.

As a result, the study indicates the state of the literature review and later identifies

Table 1
 Classification of the literature review

Author	Year	Title	Agriculture	Petroleum & oil	Manufacturing industry	Education industry	Finance industry	Healthcare and the pharmaceutical industry	Hospitality, tourism and aviation	Real estate and housing sector	Sport industry	Information technology, media and R&D	Food sector
Abi Younes, G., Ayoubi, C., Ballester, O., Cristelli, G., de Rassenfosse, G., Foray, D., Gaulé, P., Pellegrino, G., van den Heuvel, M., and Webster, E.	2020	COVID-19: Insights from innovation economists		o	X	X	X						
Abodunrin, O., Oloye, G., and Adesola, B.	2020	Coronavirus pandemic and its implication on global economy	X		o		X		o				X

Table 1 (Continued)

Abu-Rayash, A., and Dincer, I.	2020	Analysis of mobility trends during the COVID-19 Coronavirus Pandemic: Exploring the impacts on global aviation and travel in selected cities	X				X					X
Açikgöz, Ö., and Günay, A.	2020	The early impact of the Covid-19 pandemic on the global and Turkish economy		X	X	o	o					X
Acs, G., and Karpman, M.	2020	Employment, Income, and Unemployment Insurance during the COVID-19 Pandemic		X								
Akbar, Y. H., and Kisilowski, M.	2020	To bargain or not to bargain: Airlines, legitimacy and nonmarket strategy in a COVID-19 world								X		
Akseer, N., Kandru, G., Keats, E. C., and Bhutta, Z. A.	2020	COVID-19 pandemic and mitigation strategies: implications for maternal and child health and nutrition										X
Albulescu, C. T.	2021	COVID-19 and the United States financial markets' volatility					o	o				o
Alcántara-Ayala, I., Burton, I., Lavell, A., Mansilla, E., Maskrey, A., Oliver-Smith, A., and Ramírez-Gómez, F.	2021	Root causes and policy dilemmas of the COVID-19 pandemic global disaster										
Ali, M., Alam, N., and Rizvi, S. A. R.	2020	Coronavirus (COVID-19)–An epidemic or pandemic for financial markets						X				
Allam, Z.	2020	The Forceful Reevaluation of Cash-Based Transactions by COVID-19 and Its Opportunities to Transition to Cashless Systems in Digital Urban Networks								X		

Table 1 (Continued)

Almeida, B., Cohen, M. A., Stone, R. I., and Weller, C. E.	2020	The Demographics and Economics of Direct Care Staff Highlight Their Vulnerabilities Amidst the COVID-19 Pandemic						X	X
Alon, T. M., Doepke, M., Olmstead-Rumsey, J., and Tertilt, M.	2020	The impact of COVID-19 on gender equality		o					
Alsafi, Z., Abbas, A.-R., Hassan, A., and Ali, M. A.	2020	The Coronavirus Pandemic: Adaptations in Medical Education			X				
Al-Samarrai, S., Gangwar, M., and Gala, P.	2020	The Impact of the COVID-19 Pandemic on Education Financing			X				
Altig, D., Baker, S. R., Barrero, J. M., Bloom, N., Bunn, P., Chen, S., Davis, S. J., Leather, J., Meyer, B. H., and Mihaylov, E.	2020	Economic Uncertainty before and during the COVID-19 Pandemic					X		
Altuntas, F., and Gok, M. S.	2021	The effect of COVID-19 pandemic on domestic tourism: A DEMATEL method analysis on quarantine decisions						X	
Amponsah, R., and Frimpong, I. A.	2020	Ghana in the Face of COVID-19: Economic Impact of Coronavirus (2019-NCOV) Outbreak on Ghana					X		

Table 1 (Continued)

Anderson, R. M., Heesterbeek, H., Klinkenberg, D., and Hollingsworth, T. D.	2020	How will country-based mitigation measures influence the course of the COVID-19 epidemic?							X	
Arthi, V., and Parman, J.	2021	Disease, downturns, and wellbeing: Economic history and the long-run impacts of COVID-19								
Ashraf, B. N.	2020	Economic impact of government interventions during the COVID-19 pandemic: International evidence from financial markets						X		
Ashraf, B. N.	2020	Stock markets' reaction to COVID-19: cases or fatalities?						X		
Atalan, A.	2020	Is the lockdown important to prevent the COVID-19 pandemic? Effects on psychology, environment and economy-perspective								o
Atkeson, A.	2020	What will be the economic impact of covid-19 in the us? rough estimates of disease scenarios							o	o
Azimli, A.	2020	The impact of COVID-19 on the degree of dependence and structure of risk-return relationship: A quantile regression approach						X		
Bachman, D.	2020	The economic impact of COVID-19 (novel coronavirus)						X		
Bajardi, P., Poletto, C., Ramasco, J. J., Tizzoni, M., Colizza, V., and Vespignani, A.	2011	Human mobility networks, travel restrictions, and the global spread of 2009 H1N1 pandemic								X

Table 1 (Continued)

Baker, B. D., and Di Carlo, M.	2020	The Coronavirus Pandemic and K-12 Education Funding							X				
Baker, S. R., Bloom, N., Davis, S. J., Kost, K., Sammon, M., and Viratyosin, T.	2020	The unprecedented stock market reaction to COVID-19											
Baker, S. R., Farrokhnia, R. A., Meyer, S., Pagel, M., and Yannelis, C.	2020	How does household spending respond to an epidemic? consumption during the 2020 covid-19 pandemic								X			
Baldwin, R.	2020	The Greater Trade Collapse of 2020: Learnings from the 2008-09 Great Trade Collapse						X					
Baldwin, R., and Mauro, B. W. d.	2020	Economics in the Time of COVID-19							X	X			
Barichello, R.	2020	The COVID-19 pandemic: Anticipating its effects on Canada's agricultural trade							X				X
Barker, M., and Russell, J.	2020	Feeding the food insecure in Britain: learning from the 2020 COVID-19 crisis											X
Barrero, J. M., Bloom, N., and Davis, S. J.	2020	Covid-19 is also a reallocation shock								o			
Barro, R. J., Ursúa, J. F., and Weng, J.	2020	The coronavirus and the great influenza pandemic: Lessons from the "spanish flu" for the coronavirus's potential effects on mortality and economic activity											X

Table 1 (Continued)

Bartik, A. W., Bertrand, M., Cullen, Z., Glaeser, E. L., Luca, M., and Stanton, C.	2020	The impact of COVID-19 on small business outcomes and expectations	X							
Bartik, A. W., Bertrand, M., Cullen, Z. B., Glaeser, E. L., Luca, M., and Stanton, C. T.	2020	How are small businesses adjusting to covid-19? early evidence from a survey	X							
Bashir, M. F., Benjiang, M., and Shahzad, L.	2020	A brief review of socio-economic and environmental impact of Covid-19			o		o			
Baum, T., and Hai, N. T. T.	2020	Hospitality, tourism, human rights and the impact of COVID-19						X		
Béland, L.-P., Brodeur, A., and Wright, T.	2020	The short-term economic consequences of Covid-19: exposure to disease, remote work and government response	X							
Bentall, R., Lloyd, A., McKay, R., Mason, L., Murphy, J., McBride, O., Hartman, T. K., Miller, J. G., Levita, L., and Martinez, A. P.	2020	Pandemic buying: Testing a psychological model of over-purchasing and panic buying using data from the United Kingdom and the Republic of Ireland during the early phase of the COVID-19 pandemic								X

Table 1 (Continued)

Berchin, I. I., and de Andrade, J. B. S. O.	2020	GALIA 3.0: Effects of the Coronavirus Disease 2019 (COVID-19) outbreak on sustainable development and future perspectives	o									X
Bilecen, B.	2020	Commentary: COVID-19 Pandemic and Higher Education: International Mobility and Students' Social Protection			X							
Bonaccorsi, G., Pierri, F., Cinelli, M., Flori, A., Galeazzi, A., Porcelli, F., Schmidt, A. L., Valensise, C. M., Scala, A., and Quattrociochi, W.	2020	Economic and social consequences of human mobility restrictions under COVID-19										
Bonadio, B., Huo, Z., Levenko, A. A., and Pandalai-Nayar, N.	2020	Global supply chains in the pandemic					X					
Bong, C.-L., Brasher, C., Chikumba, E., McDougall, R., Mellin-Olsen, J., and Enright, A.	2020	The COVID-19 Pandemic: Effects on Low-and Middle-Income Countries						X		o		
Brammer, S., and Clark, T.	2020	COVID-19 and Management Education: Reflections on Challenges, Opportunities, and Potential Futures			X							

Table 1 (Continued)

Bräthen, S., and Hoff, K. L.	2020	Economic Impact Assessment of Regulatory Changes: A Case Study of a Proposed New ICAO Standard for Contaminated Runways							X			
Brew, G.	2020	COVID-19 and the Oil Price Crash: Twin Crises Impacting Saudi-Iran Relations	X									
Briand, S., Mounts, A., and Chamberland, M.	2011	Challenges of global surveillance during an influenza pandemic							X			
Bruñaerts, R., Voorspoels, W., Jansen, L., Kessler, R. C., Mortier, P., Vilagut, G., De Vocht, J., and Alonso, J.	2021	Suicidality among healthcare professionals during the first COVID-19 wave							X			
Brynjolfsson, E., Horton, J. J., Ozimek, A., Rock, D., Sharma, G., and TuYe, H.-Y.	2020	Covid-19 and remote work: An early look at us data						X				
Buheji, M., da Costa Cunha, K., Beka, G., Mavric, B., de Souza, Y., da Costa Silva, S. S., Hanafi, M., and Yein, T. C.	2020	The extent of covid-19 pandemic socio-economic impact on global poverty: a global integrative multidisciplinary review	X					X				X
Burgess, S., and Sievertsen, H. H.	2020	Schools, skills, and learning: The impact of COVID-19 on education									X	

Table 1 (Continued)

Cappelli, A., and Cini, E.	2020	Will the COVID-19 pandemic make us reconsider the relevance of short food supply chains and local productions?								o
Carlsson-Szlezak, P., Reeves, M., and Swartz, P.	2020	What coronavirus could mean for the global economy			X					
CART	2020	Take-off: Guidance for Air Travel through the COVID-19 Public Health Crisis					X			
Carter, P., Anderson, M., and Mossialos, E.	2020	Health system, public health, and economic implications of managing COVID-19 from a cardiovascular perspective					X			
Cavallo, J. J., and Forman, H. P.	2020	The economic impact of the COVID-19 pandemic on radiology practices							o	
Cerutti, P., Crivellaro, E., Reyes, G., and Sousa, L. D.	2019	Hit and Run? Income Shocks and School Dropouts in Latin America				X				
Chakraborty, I., and Maity, P.	2020	COVID-19 outbreak: Migration, effects on society, global environment and prevention						o		
Chang, V., Baudier, P., Zhang, H., Xu, Q., Zhang, J., and Arami, M.	2020	How Blockchain can impact financial services– The overview, challenges and recommendations from expert interviewees					X			
Charlebois, S., Sterling, B., Haratifar, S., and Naing, S. K.	2014	Comparison of global food traceability regulations and requirements								X

Table 1 (Continued)

Chaturvedi, S., Gupta, A., and Bhat, A. K.	2020	Design, usage and review of a cost effective and innovative face shield in a tertiary care teaching hospital during COVID-19 pandemic						X				
Chatziralli, I., Ventura, C. V., Touhami, S., Reynolds, R., Nassisi, M., Weinberg, T., Pakzad-Vaezi, K., Anaya, D., Mustapha, M., and Plant, A.	2020	Transforming ophthalmic education into virtual learning during COVID-19 pandemic: a global perspective					X					
Chen, S., Yang, J., Yang, W., Wang, C., and Bärnighausen, T.	2020	COVID-19 control in China during mass population movements at New Year							X			
Chetty, R., Friedman, J. N., Hendren, N., and Stepner, M.	2020	How did covid-19 and stabilization policies affect spending and employment? a new real-time economic tracker based on private sector data						X				
Chiolero, A.	2020	Covid-19: a digital epidemic										X
Chung, L. H.	2015	Impact of pandemic control over airport economics: Reconciling public health with airport business through a streamlined approach in pandemic control								X		
Coibion, O., Gorodnichenko, Y., and Weber, M.	2020	The cost of the covid-19 crisis: Lockdowns, macroeconomic expectations, and consumer spending				X					o	

Table 1 (Continued)

Conlon, T., Corbet, S., and McGee, R. J.	2020	Are Cryptocurrencies a Safe Haven for Equity Markets? An International Perspective from the COVID-19 Pandemic					X			
Contractor, F. J.	2021	The world economy will need even more globalisation in the post-pandemic 2021 decade				X				o
Corbet, S., Hou, Y., G., Hu, Y., Oxley, L., and Xu, D.	2021	Pandemic-related financial market volatility spillovers: Evidence from the Chinese COVID-19 epicentre					X			o
Corbet, S., Larkin, C., and Lucey, B.	2020	The contagion effects of the covid-19 pandemic: Evidence from gold and cryptocurrencies					X			
Costa Dias, M., Joyce, R., Postel-Vinay, F., and Xu, X.	2020	The challenges for labour market policy during the Covid-19 pandemic				X				
Dasgupta, P., and De, O.	2020	Sustainable recovery with Jobs and more: this is a pandemic, not a war				X				
De Georgeo, M. R., De Georgeo, J. M., Egan, T. M., Klee, K. P., Schwemm, M. S., Bye-Kollbaum, H., and Kinser, A. J.	2020	Containing SARS-CoV-2 in hospitals facing finite PPE, limited testing, and physical space variability: Navigating resource constrained enhanced traffic control bundling							X	
de Joode, K., Dumoulin, D., Engelen, V., Bloemendal, H., Verheij, M., van Laarhoven, H., Dingemans, I., Dingemans, A., and van der Veldt, A.	2020	Impact of the COVID-19 pandemic on cancer treatment: the patients' perspective							X	

Table 1 (Continued)

Farid, Y., Scheffino, M., Kapila, A., Hamdi, M., Cuyilits, N., Wauthy, P., and Ortiz, S.	2020	Decrease in surgical activity in the COVID-19 pandemic: an economic crisis									o							
Farooq, I., and Ali, S.	2020	COVID-19 outbreak and its monetary implications for dental practices, hospitals and healthcare workers									X							
Ferreira, F. H., and Schady, N.	2009	Aggregate economic shocks, child schooling, and child health								X								
Food and Drug Administration	2020	Best Practices for Retail Food Stores, Restaurants, and Food Pick-Up/Delivery Services During the COVID-19 Pandemic																X
Fotiadis, A., Polyzos, S., and Huan, T.-C. T.	2021	The good, the bad and the ugly on COVID-19 tourism recovery															X	
Fox, J. M., Promkhambut, A., and Yokying, P.	2020	Impact of COVID-19 on rice farmers in Southeast Asia							X									
Galanakis, C.	2020	The Food Systems in the Era of the Coronavirus (COVID-19) Pandemic Crisis. Foods 9, 523																X
Galanakis, C. M.	2020	The Food Systems in the Era of the Coronavirus (COVID-19) Pandemic Crisis																
Galea, S., and Keyes, K.	2020	Understanding the Covid-19 pandemic through the lens of population health science															X	
Gewin, V.	2020	Five tips for moving teaching online as COVID-19 takes hold															X	

Table 1 (Continued)

Guan, D., Wang, D., Hallegatte, S., Davis, S. J., Huo, J., Li, S., Bai, Y., Lei, T., Xue, Q., and Coffman, D. M.	2020	Global supply-chain effects of COVID-19 control measures	X							
Guerrieri, V., Lorenzoni, G., Straub, L., and Werning, I.	2020	Macroeconomic Implications of COVID-19: Can Negative Supply Shocks Cause Demand Shortages?	X							
Gupta, M., Abdelmaksoud, A., Jafferany, M., Lotti, T., Sadoughifar, R., and Goldust, M.	2020	COVID-19 and economy			o					
Gursoy, D., and Chi, C. G.	2020	Effects of COVID-19 pandemic on hospitality industry: review of the current situations and a research agenda							X	
Haleem, A., Javaid, M., and Vaishya, R.	2020	Effects of COVID 19 pandemic in daily life					X			
Hall, C. M., Scott, D., and Gössling, S.	2020	Pandemics, transformations and tourism: be careful what you wish for							X	
He, H., and Harris, L.	2020	The Impact of Covid-19 Pandemic on Corporate Social Responsibility and Marketing Philosophy			o				X	
Hevia, C., and Neumeier, A.	2020	A conceptual framework for analysing the economic impact of covid-19 and its policy implications	X				X			

Table 1 (Continued)

Hill, A., Wang, J., Levi, J., Heath, K., and Fortunak, J.	2020	Minimum costs to manufacture new treatments for COVID-19						X					
Hiscott, J., Alexandridi, M., Muscolini, M., Tassone, E., Palermo, E., Soultioti, M., and Zevini, A.	2020	The Global Impact of the Coronavirus Pandemic						X					
Hobbs, J. E.	2020	Food supply chains during the COVID-19 pandemic											X
Hofmann, B., Shim, I., and Shin, H. S.	2020	Emerging market economy exchange rates and local currency bond markets amid the Covid-19 pandemic						X					
Hollander, J. E., and Carr, B. G.	2020	Virtually perfect? Telemedicine for COVID-19						X					X
Hossain, M.	2021	The effect of the Covid-19 on sharing economy activities										X	
Hua, X., Gu, M., Zeng, F., Hu, H., Zhou, T., Zhang, Y., and Shi, C.	2020	Pharmacy administration and pharmaceutical care practice in a module hospital during the COVID-19 epidemic						X					
Huynh, T. L. D., Nasir, M. A., Vo, V. X., and Nguyen, T. T.	2020	“Small things matter most”: The Spillover effects in the cryptocurrency market and Gold as a silver bullet						X					

Table 1 (Continued)

Iacus, S. M., Natale, F., Santamaria, C., Spyrtatos, S., and Vespe, M.	2020	Estimating and projecting air passenger traffic during the COVID-19 coronavirus outbreak and its socio-economic impact							X				
International, A. C.	2020	Economic impact assessment of COVID-19 on the airport business							X				
Ivanov, D.	2020	Predicting the impacts of epidemic outbreaks on global supply chains: A simulation-based analysis on the coronavirus outbreak (COVID-19/SARS-CoV-2) case	X	X	X	X	X	X	X	X	X	X	o
Jamal, T., and Budke, C.	2020	Tourism in a world with pandemics: local-global responsibility and action											o
Jámbor, A., Czine, P., and Balogh, P.	2020	The Impact of the Coronavirus on Agriculture: First Evidence Based on Global Newspapers	X										
Jarquín, V. G., Callahan, D. B., Cohen, N. J., Balaban, V., Wang, R., Beato, R., Pordell, P., Oyervides, O., Huang, W.-T., and Lipman, H.	2011	Effect of school closure from pandemic (H1N1) 2009, Chicago, Illinois, USA								X			
Javaid, M., Haleem, A., Vaishya, R., Bahl, S., Suman, R., Vaish, A. J. D., Research, M. S. C., and Reviews	2020	Industry 4.0 technologies and their applications in fighting COVID-19 pandemic											o
													X

Table 1 (Continued)

Jena, P. R., Majhi, R., Kalli, R., Managi, S., and Majhi, B.	2021	Impact of COVID-19 on GDP of major economies: Application of the artificial neural network forecaster							
Jordà, Ò., Singh, S. R., and Taylor, A. M.	2020	Longer-run economic consequences of pandemics			X				
Kabir, M., Saqib, M. A. N., Zaid, M., Ahmed, H., and Afzal, M. S.	2020	COVID-19, economic impact and child mortality: A global concern					o		X
Karmaker, C. L., Ahmed, T., Ahmed, S., Ali, S. M., Moktadir, M. A., and Kabir, G.	2021	Improving supply chain sustainability in the context of COVID-19 pandemic in an emerging economy: exploring drivers using an integrated model		X					
Keogh-Brown, M. R., Smith, R. D., Edmunds, J. W., and Beutels, P.	2010	The macroeconomic impact of pandemic influenza: estimates from models of the United Kingdom, France, Belgium and The Netherlands			X		X	X	
Kerr, W. A.	2020	The COVID-19 pandemic and agriculture–Short and long run implications for international trade relations						o	o
Khalafallah, A. M., Lam, S., Gami, A., Dornbos, D. L., Sivakumar, W., Johnson, J. N., and Mukherjee, D.	2020	A national survey on the impact of the COVID-19 pandemic upon burnout and career satisfaction among neurosurgery residents						X	

Table 1 (Continued)

Khetrapal, S., and Bhatia, R.	2020	Impact of COVID-19 pandemic on health system & sustainable development goal 3							X				
Khoo, E. J., and Lantos, J. D.	2020	Lessons learned from the COVID-19 pandemic							X				
Khullar, D., Bond, A. M., and Schpero, W. L.	2020	COVID-19 and the Financial Health of US Hospitals							X				
Kickbusch, I., Leung, G. M., Bhutta, Z. A., Matsoso, M. P., Ihekweazu, C., and Abbasi, K.	2020	Covid-19: how a virus is turning the world upside down						X					
Kim, K., Kim, S., and Park, C.-Y.	2020	Food Security in Asia and the Pacific amid the COVID-19 Pandemic											X
Kimura, F., Thangavelu, S. M., Narjoko, D., and Findlay, C.	2020	Pandemic (COVID-19) Policy, Regional Cooperation and the Emerging Global Production Network					X			o			
Kraus, S., Claus, T., Breier, M., Gast, J., Zardini, A., and Tiberius, V.	2020	The economics of COVID-19: initial empirical evidence on how family firms in five European countries cope with the corona crisis					X						
Kumar, A., Gupta, P. K., Srivastava, A. J. D., Research, M. S. C., and Reviews	2020	A review of modern technologies for tackling COVID-19 pandemic								o	X		

Table 1 (Continued)

Kumar, M. S., Raut, R. D., Narwane, V. S., and Narkhede, B. E.	2020	Applications of industry 4.0 to overcome the COVID-19 operational challenges												X	
Kumar, P., and Rout, H. B.	2020	Impact assessment of Covid-19: In tourism perspective		X										X	o
Kumar, P., Singh, S., Pandey, A., Singh, R. K., Srivastava, P. K., Kumar, M., Dubey, S. K., Sah, U., Nandan, R., and Singh, S. K.	2021	Multi-level impacts of the COVID-19 lockdown on agricultural systems in India: The case of Uttar Pradesh	X												X
Kvedar, J., Coye, M. J., and Everett, W.	2014	Connected health: a review of technologies and strategies to improve patient care with telemedicine and telehealth											X		
Laborde, D., Martin, W., Swinnen, J., and Vos, R.	2020	COVID-19 risks to global food security													X
Lahmiri, S., and Bekiros, S.	2020	The impact of COVID-19 pandemic upon stability and sequential irregularity of equity and cryptocurrency markets											X		
Lal, R.	2020	Home gardening and urban agriculture for advancing food and nutritional security in response to the COVID-19 pandemic												X	
Lau, J., Yang, B. and Dasgupta, R.	2020	Will the coronavirus make online education go viral								X					

Table 1 (Continued)

Lea, R.	2020	The coronavirus crisis: recession and modest lockdown relaxation								X
Leach, M., MacGregor, H., Scoones, I. and Wilkinson, A.	2021	Post-pandemic transformations: How and why COVID-19 requires us to rethink development				X				
Leddy, A. M., Weiser, S. D., Palar, K. and Seligman, H.	2020	A conceptual model for understanding the rapid COVID-19-related increase in food insecurity and its impact on health and healthcare					X			X
Lee, J.	2020	Mental health effects of school closures during COVID-19				X				
Lee, K.	2020	Coronavirus: universities are shifting classes online—but it's not as easy as it sounds				X				
Lenzen, M., Li, M., Malik, A., Pomponi, F., Sun, Y.-Y., Wiedmann, T., Faturay, F., Fry, J., Gallego, B. and Geschke, A.	2020	Global socio-economic losses and environmental gains from the Coronavirus pandemic								o
Li, T., Liu, Y., Li, M., Qian, X. and Dai, S. Y.	2020	Mask or no mask for COVID-19: A public health and market study							X	
Li, X., Wang, B., Liu, C., Freiheit, T. and Epureanu, B. I.	2020	Intelligent Manufacturing Systems in COVID-19 Pandemic and Beyond: Framework and Impact Assessment				X				X
Lim, M.	2020	Educating despite the Covid-19 outbreak: Lessons from Singapore						X		

Table 1 (Continued)

Nafisah, S. B., Alameery, A. H., Al Nafesa, A., Aleid, B. and Brazanji, N. A.	2018	School closure during novel influenza: a systematic review								X
Narayan, P. K., Gong, Q. and aliahmed, H. J.	2021	Is there a pattern in how COVID-19 has affected Australia's stock returns?			X					
Nguyen, T. P. and Dao, T. B.	2020	Internal Rating System for Corporate Customers of Commercial Banks in Vietnam: Corona Pandemic Impact Adjusted			X					
Nichol, K. L., Margolis, K., Wuorenma, J. and Von Sternberg, T.	1994	The efficacy and cost effectiveness of vaccination against influenza among elderly persons living in the community						X		
Niewiadomski, P. J. T. G.	2020	COVID-19: from temporary de-globalisation to a re-discovery of tourism?						X		
Norouzi, N., de Rubens, G. Z., Choubanpishhezafar, S. and Enevoldsen, P.	2020	When pandemics impact economies and climate change: Exploring the impacts of COVID-19 on oil and electricity demand in China				X				
O'Connor, C. M., Anoushiravani, A. A., DiCaprio, M. R., Healy, W. L. and Iorio, R.	2020	Economic recovery after the COVID-19 pandemic: resuming elective orthopedic surgery and total joint arthroplasty							X	

Table 1 (Continued)

Oldekop, J. A., Horner, R., Hulme, D., Adhikari, R., Agarwal, B., Alford, M., Bakewell, O., Banks, N., Barrientos, S. and Bastia, T.	2020	COVID-19 and the case for global development			o	o				
Osterholm, M. T.	2005	Preparing for the next pandemic			X					
Paital, B., Das, K. and Parida, S. K. J. S. o. T. T. E.	2020	Inter nation social lockdown versus medical care against COVID-19, a mild environmental insight with special reference to India				o				
Pantano, E., Pizzi, G., Scarpì, D. and Dennis, C.	2020	Competing during a pandemic? Retailers' ups and downs during the COVID-19 outbreak				X	X	X		X
Pappas, N.	2021	COVID19: Holiday intentions during a pandemic					X			
Parnell, D., Widdop, P., Bond, A. and Wilson, R.	2020	COVID-19, networks and sport							o	
Paul, S. K. and Chowdhury, P.	2020	A production recovery plan in manufacturing supply chains for a high-demand item during COVID-19					X			
Peckham, R.	2013	Economies of contagion: financial crisis and pandemic						X		

Table 1 (Continued)

Peeri, N. C., Shrestha, N., Rahman, M. S., Zaki, R., Tan, Z., Bibi, S., Baghbazadeh, M., Aghamohammadi, N., Zhang, W. and Haque, U.	2020	The SARS, MERS and novel coronavirus (COVID-19) epidemics, the newest and biggest global health threats: what lessons have we learned?						X					
Pfefferbaum, B. and North, C. S.	2020	Mental health and the Covid-19 pandemic						X					
Phan, D. H. B. and Narayan, P. K.	2020	Country responses and the reaction of the stock market to COVID-19—A preliminary exposition					o	o	o				
Pimpalkhute, P. U. and Pimpalkhute, S.	2020	Putting Public Health into Housing and Town Planning—Opportunity Amidst Challenge for Real Estate Sector in Wake of COVID-19 Pandemic						X				X	
Pitman, R., Nagy, L. and Sculpher, M.	2013	Cost-effectiveness of childhood influenza vaccination in England and Wales: results from a dynamic transmission model						X					
Preaud, E., Durand, L., Macabeo, B., Farkas, N., Sloesen, B., Palache, A., Shupo, F. and Samson, S. I.	2014	Annual public health and economic benefits of seasonal influenza vaccination: a European estimate						X					
Prideaux, B., Thompson, M. and Pabel, A.	2020	Lessons from COVID-19 can prepare global tourism for the economic transformation needed to combat climate change										o	X

Table 1 (Continued)

Propper, C., Stoye, G. and Zaranko, B.	2020	The wider impacts of the coronavirus pandemic on the NHS				X			
Qiu, W., Rutherford, S., Mao, A. and Chu, C.	2017	The pandemic and its impacts		o		X	o	o	
Qiu, Y., Chen, X. and Shi, W.	2020	Impacts of social and economic factors on the transmission of coronavirus disease 2019 (COVID-19) in China				X			
Rajkumar, R. P.	2020	COVID-19 and mental health: A review of the existing literature				X			
Rashid, H., Ridda, I., King, C., Begun, M., Tekin, H., Wood, J. G. and Booy, R.	2015	Evidence compendium and advice on social distancing and other related measures for response to an influenza pandemic							X
Razzoli, M., Pearson, C., Crow, S. and Bartolomucci, A.	2017	Stress, overeating, and obesity: Insights from human studies and preclinical models							X
Rekatsina, M., Paladini, A., Moka, E., Yeam, C. T., Urits, I., Viswanath, O., Kaye, A. D., Morgan, J. A. and Varrassi, G.	2020	Healthcare at the time of COVID-19: A review of the current situation with emphasis on anesthesia providers				X			
Rizou, M., Galanakis, I. M., Aldawoud, T. M. and Galanakis, C. M.	2020	Safety of foods, food supply chain and environment within the COVID-19 pandemic							X

Table 1 (Continued)

Rubin, G. A., Biviano, A., Dizon, J., Yarmohammadi, H., Ehlert, F., Saluja, D., Rubin, D. A., Morrow, J. P., Waase, M. and Berman, J.	2020	Performance of electrophysiology procedures at an academic medical center amidst the 2020 coronavirus (COVID-19) pandemic						X				
Runde, D. F., Metzger, C. and Abdullah, H. F.	2020	Covid-19 Demands Innovative Ideas for Financing the SDGs					X					
Sahu, P.	2020	Closure of universities due to Coronavirus Disease 2019 (COVID-19): impact on education and mental health of students and academic staff				X			o			
Sansa, N. A.	2020	The Impact of the COVID-19 on the Financial Markets: Evidence from China and USA					X					
Sarkis, J., Cohen, M. J., Dewick, P. and Schröder, P.	2020	A brave new world: lessons from the COVID-19 pandemic for transitioning to sustainable supply and production				o	o	o			o	
Sasangohar, F., Jones, S. L., Masud, F. N., Vahidy, F. S. and Kash, B. A.	2020	Provider burnout and fatigue during the COVID-19 pandemic: lessons learned from a high-volume intensive care unit							X			
Schwarz, M., Scherrer, A., Hohmann, C., Heiberg, J., Brugger, A. and Nunez-Jimenez, A.	2020	COVID-19 and the academy: It is time for going digital						X				

Table 1 (Continued)

Tabah, A., Ramanan, M., Laupland, K. B., Buetti, N., Cortegiani, A., Mellinshoff, J., Morris, A. C., Camporota, L., Zappella, N. and Elhadi, M.	2020	Personal protective equipment and intensive care unit healthcare worker safety in the COVID-19 era (PPE-SAFE): An international survey						X					
Tanriverdi, G., Bakir, M. and Mertkert, R.	2020	What can we learn from the JATM literature for the future of aviation post Covid-19?-A bibliometric and visualization analysis						X					
Teräs, M., Suoranta, J., Teräs, H. and Curcher, M.	2020	Post-Covid-19 Education and Education Technology 'Solutionism': a Seller's Market					X						X
Thomson, S. and Evetovits, T.	2020	Strengthening the health financing response to COVID-19 in Europe					X	X					
Verikios, G.	2020	The dynamic effects of infectious disease outbreaks: The case of pandemic influenza and human coronavirus							o	X			
Verma, S. and Gustafsson, A.	2020	Investigating the emerging COVID-19 research trends in the field of business and management: A bibliometric analysis approach					X	X		X			X
Vidya, C., Prabheesh, K. and Trade	2020	Implications of COVID-19 Pandemic on the Global Trade Networks					X						
Vinod, P. P. and Sharma, D.	2021	COVID-19 Impact on the Sharing Economy Post-Pandemic								X			

Table 1 (Continued)

Wei, X. and Han, L.	2021	The impact of COVID-19 pandemic on transmission of monetary policy to financial markets						X					
Wenham, C., Smith, J. and Morgan, R.	2020	COVID-19: the gendered impacts of the outbreak											
Wosik, J., Fudim, M., Cameron, B., Gellad, Z. F., Cho, A., Phinney, D., Curtis, S., Roman, M., Poon, E. G. and Ferranti, J.	2020	Telehealth Transformation: COVID-19 and the rise of Virtual Care							X				
Xiong, J., Lipsitz, O., Nasri, F., Lui, L. M., Gill, H., Phan, L., Chen-Li, D., Iacobucci, M., Ho, R. and Majeed, A.	2020	Impact of COVID-19 Pandemic on Mental Health in the General Population: A Systematic Review											
Ying, W., Qian, Y. and Kun, Z.	2020	Drugs supply and pharmaceutical care management practices at a designated hospital during the COVID-19 epidemic								X			
Yoosefi Lebni, J., Abbas, J., Moradi, F., Salahshoor, M. R., Chaboksavar, F., Irandoost, S. F., Nezhaddadgar, N. and Ziapour, A.	2020	How the COVID-19 pandemic effected economic, social, political, and cultural factors: A lesson from Iran									o		X

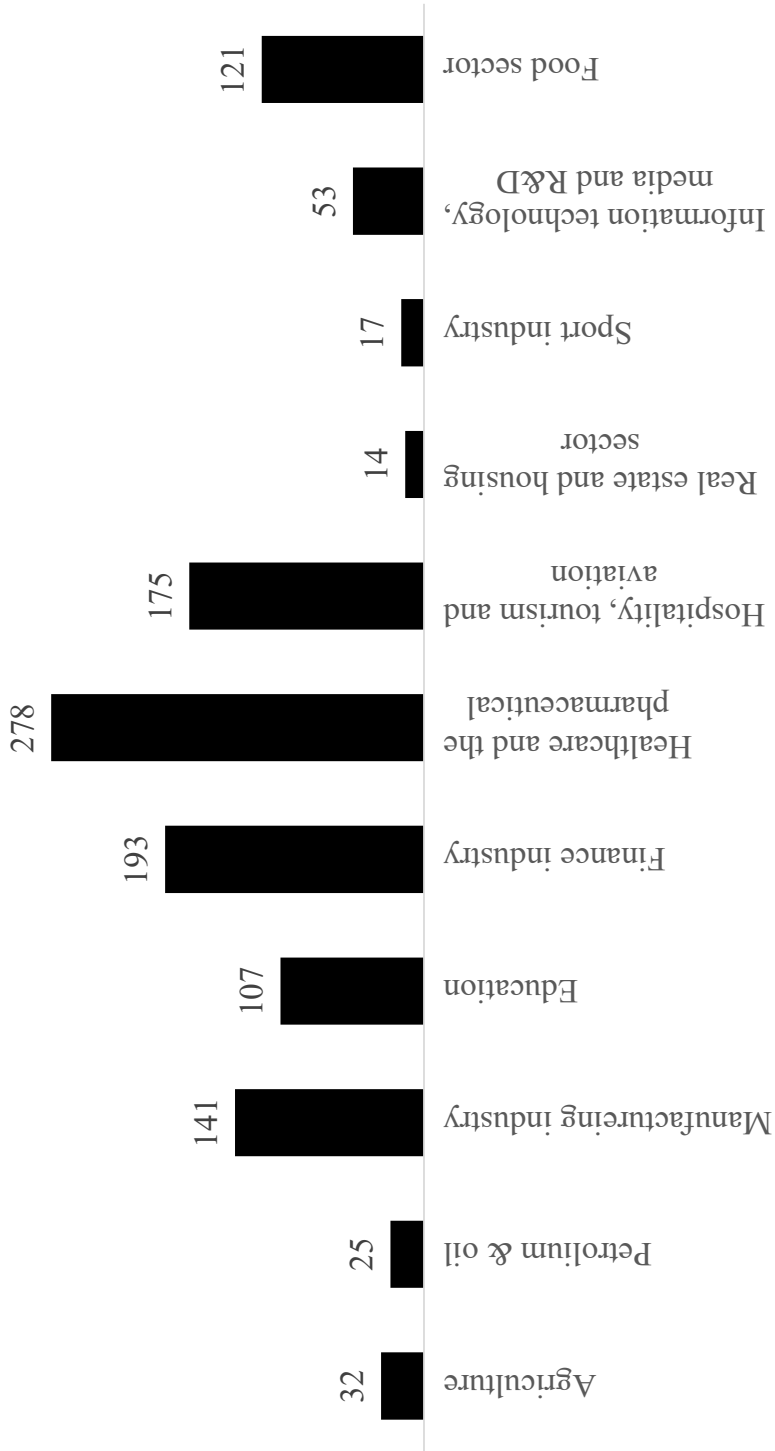


Figure 3. Total (weighted) in each category

future research directions discussed in the next section. According to Figure 3, there are six industries with the highest weighted total, which can be the research trend of scholars. Therefore, it can be interpreted that these industries might be the most affected industries by pandemics. Furthermore, the research also synthesises several emerging issues and suggests several potential solutions for these industries based on analysis results.

In the below, the paper will, later on, give a definite summary of the literature review about each industry with the highest weighted total, along with the prominent concerns and resolutions.

Manufacturing Industry

According to Sulistiyani (2020), manufacturing enterprises are the backbones of a country's industrial development. However, according to Baldwin and Di Mauro (2020), Bartik et al. (2020), Karmaker et al. (202), and Paul and Chowdhury (2020), it is remarkable that the manufacturing industry business is vigorously affected by the pandemic, yet two core effects are noticeable.

Firstly, the temporary shutdown of various firms, amplified by simultaneous supply chain disruptions, has affected the volume of raw materials supplied (Gupta et al., 2020). Accordingly, it will cause sharp declines in production and make the price of unprocessed supplies unstable (Gupta et al., 2020), leading to an urgent decline in the profits of various manufacturers and a slump in the countries' economies (Barham et al.,

1994). Furthermore, since the lockdown losses can be propagated through supply-chain networks, it can cause substantial effects directly on the country's importation issues (Baldwin & Mauro, 2020), which lead to enormous losses in the GDP of numerous regions. Therefore, finding redundant dual sourcing from multiple countries is decisive to alleviate excess dependence (Baldwin & Mauro, 2020), while collaborating with supply chain partners can increase the raw material supply (Paul & Chowdhury, 2020). However, although this approach can help stabilise the economy's growth (Paul & Chowdhury, 2020), it might raise a problem related to cooperation among countries. One other feasible solution is AI-enabled technologies, such as smart factories and driverless trucks. The maintenance of AI technologies can help to increase the reactivity and resilience of complex global digital supply networks (Kumar et al., 2020). Nevertheless, it might require the modern technological infrastructure, which can be a burden in the firms' finance since the advance of technology demands homogeneity.

Lastly, an economic contraction triggered can provoke thousands of manufacturing firms to bankruptcy for not having enough funds, leading to numerous employees being laid off (Sulistiyani, 2020) and demolishing income streams for millions of families. Unemployment leads to a sharp reduction in household spending, losses in the revenues of production firms, and a surge in national expenditure (Chetty et al., 2020). Therefore, wage support must be

accompanied to preserve low-wage workers and small firms to halt the damage (Acs & Karpman, 2020). One potential solution can be remote working or reallocate some workers by simplifying transitions to sectors (Stock, 2020). However, although these solutions can improve the unemployment rate and stabilise the workforce, there are issues related to the concern of effectiveness and concentration (Stock, 2020).

Education Industry

In the COVID-19 pandemic many countries have announced school closures, which disrupts the learning of at least 290.5 million students worldwide (UNESCO, 2020). In addition, these closures have had a widespread economic impact on the educational sector.

Firstly, the outbreak of the pandemic has shut down educational institutions across the globe. Due to the disruption, the schools have to switch from face-to-face to online classes (Gewin, 2020), which leaves them to face a budgetary crisis due to the requirements of technology infrastructure for teachers and students and the abandonment of existing assets as physical facilities (Baker et al., 2020). Furthermore, the epidemic has also caused severe losses in revenue since international students quit their studies or are prevented from studying abroad. UK universities estimate that they will lose £790 million in revenues in 2019 to 2020 and potentially £6.9 billion in 2020 to 2021 if international students, who are the vital factors for the sector, fail to enrol (Ahlburg, 2020). Therefore, financial responses

from government policies are needed for educational institutions

Secondly, the financial burden affects not only educational institutions but also households with limited incomes. In the pandemic, a decline in household incomes can cause a lack of funding for schools, which is challenging for families to spend on their children's education investments (Al-Samarrai et al., 2020). These problems further influence productivity and provoke losses in the countries' GDP due to a large number of future unskilled workers (Dorn et al., 2020). In other words, long-term consequences for education sector funds and expenditures are surfacing, which require total solutions in pandemic outbreaks. The government can reduce the financial burden on households by providing additional funding for the children. Additionally, educational institutions can reallocate resources from other budget parts, such as postponing expansion plans, reducing other planned capital investments, reducing training and supervision budgets, or temporarily shifting resources from unnecessary services (Al-Samarrai et al., 2020).

Thirdly, each country's education tends to depend predominantly on government funds. In low and middle-income countries, the pandemic causes a reduction in spending on educational institutions (International-Monetary-Fund, 2019). In addition, the impact of the pandemic draws attention to many other areas that reduce education spending (International-Monetary-Fund, 2020). These issues are needed to be

handled by revising the spending portfolio of pandemic funding, especially from government policies. For the countries with the financial space to tackle pandemics, it is crucial to allocate expenditure that includes funds to cover education in the pandemic (Baker & Di Carlo, 2020). For countries where governments cannot protect their overall spending levels, new methods to reallocate pandemic resources and overall budgets to provide priority sectors funding is needed, including education (Al-Samarrai et al., 2020). Developing countries' governments should also consider several actions that supplement resources from non-traditional sources to support investment in the education sector (Al-Samarrai et al., 2020). Overall, these solutions are timely and rapidly stabilising education in almost all countries, including budget deficit countries. However, it is vital to get globalisation from international partners to call for development cooperation between countries for a long-term, profitable investment in education.

Finance Industry

It is noticeable that many economic aspects are concerned when the pandemics happen, and the finance industry is one of the industries that roughly suffer the pessimistic forces of the outbreak. After researching and observing the fluctuations of global economies, economic experts identify three main problems in the finance industry: the depression of the finance market, the banking system, and the safety of cryptocurrencies.

In the first place, the pandemic shock can influence the stock markets via two substantial channels. Firstly, the value of common stocks, theoretically, equals the present value of expected cash-flows. However, due to the spreading patterns of pandemics and the mortality rate, the future economic and policy outcomes are highly uncertain, which has made the future cash flow of corporations highly unpredictable. Secondly, the heightened uncertainty affects investors' required rate of return and thus the current market value of stocks. Some industries have halted (e.g. transportation, hotels and restaurants) while others still operate to meet basic needs (e.g. communication, healthcare and pharmaceutical). As a result, there is a sudden shift in investment and consumption patterns. Some of the losses are due to the rational assessment of investors that firms' profits might decline because of the consequences of the pandemic (Azimli, 2020; Shehzad et al., 2020). Many research informs that the stock markets have had negative average returns during the COVID-19 era, and the chances of losses are in height (Ali et al., 2020).

In the second place, the pandemic may have a wide-ranging impact on the financial sector, including banking, since market volatility spiked and borrowing costs surged on expectations of widespread defaults (Gong et al., 2020). The elevated systemic risk of the banking system is due to three reasons. First, the liquidity risk that arises from economic downturns, financial forbearance, and limited access to

capital markets in the event of a possible credit rating downgrade (Mohammad et al., 2020). Second is the loss of middle income caused by regulatory and policy responses including loan payment reprieves and the availability of government-guaranteed loans at ultra-low interest rates. Although these measures help restrain immediate default risk, a notable rise in nonperforming loans is unavoidable (Altavilla et al., 2018). Finally, a severe decline in intermediation business can pessimistically influence the ability to finance operations and funding costs of financial institutions.

In the third place, cryptocurrencies have emerged as a new financial instrument both in terms of time and their nature, accordingly makes it vague about their final status (Ashraf, 2020). For example, during the COVID-19 pandemic period, the level of stability in cryptocurrency markets has significantly diminished, while the irregularity level significantly augments and the cryptocurrencies become volatile. Thus, from an informational efficiency perspective, investing in digital assets during big crises, such as the COVID-19 pandemic, can be considered riskier than equities (Lahmiri & Bekiros, 2020).

Accordingly, the policy measures introduced by policymakers around the world to cope with the global recession should consist of monetary, fiscal and investing measures, along with public health and human control measures (Ashraf, 2020; Funke & Tsang, 2020; Gong et al., 2020; Shehzad et al., 2020).

Healthcare and Pharmaceutical

Pandemic outbreaks have caused disruptions in various supply chains, especially in the healthcare supply chain (Govindan et al., 2020). Healthcare systems are universally being handled at the highest capacity, while healthcare workers face tremendous pressures. Therefore, it leads to a decline in availability and increased in stress (Rekatsina et al., 2020). Based on the literature review, there are two main emerging effects, namely the public health systems and the financial pressure of hospitals.

Firstly, the world is facing unprecedented challenges in the public health system from COVID-19. The potential consequences of the pandemic on local, national and global health systems are noticeable. Many times and resources have been contributed to examine public health aspects, such as emergency preparedness, pandemic planning committees and scientific research that worked for vaccine development (Ly et al., 2009). Vaccines are considered to be one of the most cost-effective public health interventions. However, in some countries, providing vaccines for citizens might require considerable minimum investments for using existing infrastructure (Preaud et al., 2014). Besides, innovating new vaccines (and drugs) is subject to a time consistency obstacle to meet the enormous demand in patients, along with the high fixed costs for research. In short, the effectiveness of vaccines can be a reduction in the number of public healthcare costs and cost-saving production for nations in a pandemic. Finally, the vaccination for COVID-19 is

released into the market with significant vaccine efficiency from the feedback of people in Brazil, South Africa, and the UK (Voysey et al., 2021).

Secondly, pandemic outbreaks have caused hospitals and healthcare workers to face severe financial implications (Farooq & Ali, 2020). Almost all hospitals will experience financial difficulties, as numerous institutions cannot have sufficient cash on hand to cover the costs of uncompensated care and bed shortages (Matheny et al., 2007). Therefore, healthcare systems require immediate injections of public funds to purchase equipment, pay extra staff, and build temporary hospitals to overcome the difficulties. One standout solution is mobilising additional public funds for health. However, although this solution can support the hospitals to overcome the pandemic temporarily, there are distinct barriers in government rules for funding in every separate nation. Accordingly, these funds should be considered carefully before performing in reality.

Aviation, Tourism and Hospitality

Aviation. In the pandemic outbreak, most countries have put restrictions to control the disease and narrow the spread of the virus. However, it also causes international air travel to become more challenging because of a sudden increase in flight cancellations and a significant drop in demand. For example, April 2020 indicates that the number of flights went down by almost 80% globally and more than 90% in Europe compared to 2019 (Akbar & Kisilowski,

2020). As a result, by May 2020, some commercial airlines have gone bankrupt (Akbar & Kisilowski, 2020).

Since transportation and mobility are some of the fundamentally necessary services of any city, there must be timely solutions to recover the airline industry. Firstly, one possible solution is calling for a bailout from the government to have enough capital for keeping enterprises from the shutdown. However, it tends to be a temporary measure rather than a long-term solution. Secondly, to create a trust for customers in the airline service, it is vital to invest in medical equipment for aviation, such as installing the In-flight Temperature Tracking system on the CrewTablet. This measure implies that new health control measures will be imposed to detect infected people as soon as possible to create a sense of security for customers. However, one of its limitations is that the airline industry requires investing additional capital in installing equipment, which leads to high prices for customers (Suau-Sanchez et al., 2020). Lastly, to rehabilitate the economy of aviation and finalise growth, expanding the fleet after the pandemic is essential, regarded as a lucrative opportunity and increasing profits. Again, however, it is a requirement to call for massive capital investment for implementation.

Tourism. In the context of the pandemic, stay-at-home orders and global travel restrictions result in the most severe interruptions of the global economy in general and the tourism industry in particular.

This tendency has caused a significant drop in tourist arrivals, with the percentage of international travellers going down by 57% in March and tending to drop 78% in the future (Baum & Hai, 2020). Accordingly, this tendency forecasts a severe effect on the income stream when facing a loss of 850 million to 1.1 billion international arrivals and loss of US\$ 910 billion to US\$ 1.2 trillion in export revenues of tourism in 2020 (World-Tourism-Organization, 2020).

Therefore, to handle this damage, a technological revolution is one of the core resolutions against the COVID-19, along with reopening tourism and the economy. With the method of travel from home to restrict movement, it is critical to transforming into the e-tourism model by virtual reality experiences (Gretzel et al., 2020). Due to this measure, citizens can restrict gatherings, which manages to avoid spreading the virus. Nevertheless, e-tourism does not maximise traveling efficiency since it is unreal and does not give travellers the feeling of reality. In terms of direct travel in tourist sites, technological innovations such as movement tracking apps, touchless service delivery by robotised AI, humanoid robots, disinfection service in public places, measuring body temperature (Sigala, 2020). This approach can help reduce human communication and increase productivity for enterprises. However, it can bring higher costs for the travel agency and their clients and potential job losses when robots can replace low-skilled workers. Besides, we can refer to the European resolution, which includes temporary state assistance to tourism from national governments, and

fast and straightforward access to short and medium-term loans to overcome the lack of liquidity (Nicola et al., 2020).

Hospitality. Generally, the hospitality industry is facing a severe crisis by the pandemic. With most hotels being closed or experiencing enormously lower tourism numbers because of booking cancellations and reducing demand, small and medium-sized enterprises have been most greatly hit. According to STR, in the first week of May 2020, the average occupancy rates of many countries remained lower than 30% (OECD, 2020). In 2020, US hotel revenues for each available room were estimated to decline by 50.6% (Gössling et al., 2020). By 30 March, bars and restaurants had closed in most EU Member States except Sweden (Niestadt, 2020).

Therefore, the hospitality industry should take certain steps to be able to restart. The use of several technologies in service delivery to minimise human-to-human contact can limit the spread of the virus, such as service robots, contactless payment such as payment by bank transfer, digital menus that can be ordered on individual mobile devices through QR code (Gursoy & Chi, 2020), automatic check-in/out kiosks in hotels, attractions, and transport terminals (OECD, 2020). However, it requires enterprises an enormous amount of capital. Meanwhile, automation does not self-handle problems beyond its control. Furthermore, seeking a bailout from the government to maintain companies is a vital action.

Food Sector

The food sector is an essential industry that meets the nutritional needs of people, including the distribution and retail of food. However, during a pandemic outbreak, the food sector is under tension due to the panic of buying and the pill-up storage of food, along with food insecurity (Loopstra, 2020).

Firstly, the consequences of the pandemic on the food industry have critical impacts on people's spending also fluctuate the total GDP of each country. In addition, food supply chains have been disrupted because of closures and social dislocations (Zuber & Brüssow, 2020). By facing these concerns, many governments have increased costs to provide certain groups of people with unemployment benefits to compensate for declining income and improve the demand for food. However, since government support is insufficient due to budget limitations, in the short term, companies and firms must self-adjust the quantities and the stable supply of the original cost, therefore providing consumers with an efficient source of food without economic impact.

Secondly, the purchasing panic has increased the value of food. Behavioural responses have affected the prices and availability of food. There is price competition between food companies and businesses, or even local retailers (Ménard & Valceschini, 2005). Therefore, governments of many countries have proposed policies to stabilise prices in the market to eliminate price competition (Swinburn et al., 2011). Although this measure can help stabilise the

food market, it requires strict supervision on a large scale, from retailers to supermarkets, to ensure product pricing. Additionally, there are concerns about food depletion and residents' inability to pay for meals with their income. Therefore, several governments have also increased expenses to provide certain people with free food packages and meals to take home (Barker & Russell, 2020).

Thirdly, trade-offs have emerged between the need to contain the virus and the urge to avoid disastrous economic and food security crises, which hurt the poor and hungry people most. Food markets are facing disruptions because of labour shortages created by restrictions on people's movements and shifts in food demand. In addition, export restrictions imposed by some countries have disrupted trade flows for staple foods such as wheat and rice (Laborde et al., 2020). Accordingly, one of the most crucial aspects of the food industry is to ensure that food can reach consumers safely and ensure quality during any process. Supervising employees is a strict and mandatory process at food retail and distribution points (Food and Drug Administration, 2020). Additionally, expanding the form of online stores to allow buying and door-to-door delivery, which limits community exposure levels, is decisive. This tendency can advance the online delivery sector and the prioritisation of "local" food supply chains (Hobbs, 2020). However, a large budget is required for this kind of readiness and the technology development in each country to be effective.

IMPLICATIONS FOR FUTURE RESEARCH DIRECTION

The proposed framework is developed based on “three-sector theory” and the study of Nicola et al. (2020), which examines the impacts of the COVID-19 pandemic to three sectors of the global economy, including the primary, second and tertiary sectors. Respectively, it may overlook certain industries that do not include in this study, such as the mining, construction, and event service industry, despite being additionally influenced by the pandemic. By doing a literature review from 254 articles, six industries are heavily affected by the pandemic, along with being mentioned the most by scientists, namely manufacturing industry, education, finance industry, healthcare and pharmaceutical, hospitality, tourism and aviation, and food. Other industries with a lower research rate are excluded in this paper: agriculture, petroleum and oil, real estate and housing, sports and information technology, media, research and development.

In terms of petroleum and oil, to preclude the spread of the virus, global governments impose several policies such as lockdown and travel prohibition, which has halted economic activity and led to a reduction in the oil demand, recording the disadvantageous prices for the first time in history (Devpura & Narayan, 2020). In the macroeconomics literature, the crude oil price volatility has been shown to influence global industrial production adversely, therefore understanding the evolution of oil price, particularly at its lowest point

in history, is imperative. Additionally, agriculture tends not to endure numerous severe consequences in the short run. However, in the long run, the pandemic can harmfully affect international trade and supply chain disruptions, which then cause a drop in the price of agricultural commodities (Nicola et al., 2020). In the future, to conduct further research, from the perspective of the three-sector theory and the study of Nicola et al. (2020), scientists should research these industries more profoundly, as they may suffer a rough crisis but not being reported recently. Accordingly, nations can hold a comprehensive insight into how pandemics transform economies.

Besides, since the pandemic has invariably occurred at separate phases, their impacts on the global economy are distinctive. However, history has shown that pandemics occur in cycles, albeit unpredictable ones (Saunders-Hastings & Krewski, 2016). Therefore, to appropriately adapt and take immediate response measures for future pandemics, researchers can analyse the responses of each industry and the effects of each level of the pandemic on them. This method will help governments, organisations and individuals identify which approaches can respond appropriately and effectively to future epidemics.

CONCLUSION

The research has investigated in detail 254 articles with the proposed research framework for the effects of the pandemic on the global economy, which can summarise into a variety of dominant influences.

The research also reveals the status of the literature review of the pandemic and discovers future research directions based on the identified research gaps. Besides, following the analysis result, the degree of influences on the global economy emphasises mainly on six industries that are highly appreciated in the total weight, namely manufacturing, education, finance, healthcare & pharmaceutical, aviation, tourism & hospitality, and food. Furthermore, we highlight the emerging issues and proposed urgent mediums for each industry to re-balance and revitalise the economy after the recession. Therefore, the research gives the government a precise overview of the economic situation, and they yet can implement the appropriate policies to respond timely to the circumstances. However, it is also prudent that governments, financial institutions, researchers, and scholars continuously analyse and evaluate the state of the pandemic in the future. Accordingly, we determine uncovered gaps in pre-existing studies, then formulate and expand the theoretical basis for the impacts of the pandemic on the global economy. So, we formulate the theoretical framework synthesised that can help navigate the following research directions by practitioners, fill the crucial gaps in the research and regularly develop the limited shortcomings in the research.

However, since it is inevitable to avoid shortages in research, there are several undeniable limitations in this research. Firstly, since the keywords appear not to be systematised logically, this shortcoming

can lead to the lack of some articles in the research process. Furthermore, although there is a statistical benchmark, it is unachievable to avoid subjectivity in evaluating the scores of the journals. Thus, the upcoming research will be codified by associating these keywords and systematising the articles more effectively. Secondly, the research is mainly based on the foundation of the “three-sector theory” that is integrated into the analysis result of Nicola et al. (2020), which is applied by many researchers in explaining the major effects of the coronavirus pandemic on the world economy, to build the proposed integration framework. However, this article might not cover all the sectors affecting the global economy, which can cause the deficiency of numerous notable sectors. Lastly, our research has consulted 950 articles, which cannot contain enough resources. Accordingly, future studies should consider expanding the research scale with larger input sources and a more logical combination of keywords.

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