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Covid-19 and Management: A Bibliometric Perspective of Research Outputs from India

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Covid-19 has disastrously affected all spheres of human life. India with world's second highest population and fifth largest economy has been severely affected by Covid-19. The impact of Covid-19 on 'business, economy and management' in India has largely been disruptive. In this backdrop, the present research through bibliometric analysis aims to find how new scientific knowledge on this topic is generated in India and contributed towards understandings of pandemic effected crisis. Scopus is used as source database. VOSviewers and Bibliometrix-R software are used for visualisation and mapping. The empirical results show how fairly individual research, authors and intuitions are doing their research. It indicates that collaborative research and networked strength play important roles in generating impact. Thematic map of the research topic is presented that may plausibly help researchers to find out future research directions and help policy makers in evidence-based policy-making decisions.

Keywords: *COVID-19, Impact, Management, Scientometrics, Biobliometrics*

1 INTRODUCTION

Sudden outbreak of Covid-19 virus and its pandemical nature caught the world by surprise that was woefully unprepared for it. States across the globe have been forced to take several preventive measures like lockdown, social distancing, isolation, etc. to contain the virus. India, the world's fifth largest economy called world's one of the longest lockdowns with around 1.4 billion of its population, impact of these measures as well as huge loss of human life have largely been disruptive. Researchers around the globe have put their tremendous efforts to understand different aspects of this pandemic crisis. As a consequence, there is an exponential rise in academic literature on Covid-19. Majority of this research literature emanated from biological and medical science disciplines that mainly

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focused on viruses, disease, clinical health care and preventive measures[1]. As this pandemic has affected all spheres of life, there is a rapid expansion of research activities from diverse disciplines to understand its effect on human life, society and environment at large. Since, managing this global crisis is of utmost interest, a large number of researches have been reported on this topic from across the globe. The literature coming out on this topic covered a wide spectrum of management like international cooperation, financial crisis, globalisation, cybersecurity and crimes, health emergency management system, digital transformation and academic entrepreneurship, health security, and other aspects[2].

Bibliometric analysis of a given discipline provides a comprehensive picture of the discipline. It delineates its evolution trajectory and underlying dynamics and thus precisely points out the current hotspot and future direction of research[3]. A considerable number of bibliometric studies on Covid-19 related literature have been carried out till date as "never before in the history of academic publishing such a great volume of research focused on a single topic"[4]. For instance, PubMed has listed 107 bibliometrics related literature studieson Covid-19 till the date of search (August 01, 2021) and the first publication came out in 2020. However, most of these bibliometric studies focused on medical, biological and public health related literatures. Only few bibliometric studies have been carried out till date that emphasized on publications that deal with Covid -19 impact on allied areas.

For instance, Usman and Ho have analysed publications on environmental studies related to Covid-19 and have provided visualization of research agenda in the field of environmental studies during this pandemic[5]. Similarly, Aristovnik et al. have carried out bibliometric analysis of Covid-19 literature across science and social science disciplines and concluded that though research in social science and humanities lag significantly in comparison to health science disciplines, there is a gradual increase in interdisciplinary research that includes non-health sciences disciplines also[6]. Bibliometric study also reveals quality of publications. Research has pointed out that sudden surge in research output on Covid-19 essentially brings down quality of the publications and therefore many low quality and uninformative publications are in active circulation[7].As research is cumulative by its nature, they advised researchers to exercise caution while interpreting new knowledge in light of earlier ones.

While some bibliometric studies as given above were conducted on Covid- 19 and allied areas, bibliometric analysis of business, management and economics related literature is very sparse and each study has its own set of limitation. Verma and Gustafsson's early bibliometric study on Covid-19 research trend on business and management focused on emerging research themes and they identified four main research themes and 18 sub-themes[8]. The bibliometric analysis of Covid-19 and disruption management has highlighted that publications in health-related discipline grew exponentially as opposed to those dealing with education, business, economics and management[9]. They also pointed that there is a clear lack of proper peer reviewed publications in this area. Covid-19 accompanied with globalisation and hyper connectivity has brought out new kinds of challenges like large- scale cyberattacks. Researchers[10] thus have undertook the study on enterprise risk

management and Covid 19 to understand it from bibliometric point of view and suggested that organisational resilience capabilities enable holistic risk management. Covid-19 has disastrous effect on economy especially economic consequences of the measures to contain Covid-19. The bibliometric analysis of Covid 19 and economy has highlighted how research topics have changed from initial phase of outbreak to later phase[11]. This study also observes that cooperation among researchers follows certain geographical distinction.

It is clearly evident from the above discussions that there is a real dearth of bibliometrics literature on Covid- 19 and management. Moreover, there is hardly any bibliometric research on this topic that analyses research outcomes of Indian researchers. This paper thus seeks to explore the contributions of researchers from India on the said topic and to reflect on dynamics and evolution of research on the subject by using bibliometric tools.

2 DATA AND METHODOLOGY

The present analysis is based on the relevant bibliographic data extracted from Scopus citation database of Elsevier. An array of alternative possible search terms on the topic 'Covid-19' are used in our search query to retrieve relevant literatures as completely as possible. The subject category is strictly confined to "Business, Management and Accounting" as per Scopus. As the objective of this study is to find the contributions of Indian researchers during this pandemic period, we have confined affiliated country only to 'India'. Since, most common publication sets are articles, review articles, and conference proceedings, all Scopus document types have been included for comprehensive coverage of the literature. The detailed search query is given below. Considering, the recent rapid growth of the topic, our search results have included the literature until the date of search (i.e., July 10, 2021).

Our final set of data includes 294 publications that are analysed using electronic spreadsheet. Further, VOSviewer software[12] https:// www.vosviewer.com/) and Bibliometrix -R software[13] are used for advanced bibliometric analysis and mapping.

Title ("Covid 19" or "2019 novel coronavirus" or "coronavirus 2019" or "coronavirus disease 2019" or "2019-novel CoV" or "2019 ncov" or covid 2019 or covid19 or "corona virus 2019" or ncov-2019 or ncov2019 or "nCoV 2019" or 2019-ncov or covid-19 or "Severe acute respiratory syndrome coronavirus 2" or "SARS-CoV-2") or KEY ("Covid 19" or "2019 novel coronavirus" or "coronavirus 2019" or "coronavirus disease 2019" or "2019-novel CoV" or "2019 ncov" orcovid 2019 or covid19 or "corona virus 2019" or ncov-2019 or ncov2019 or "nCoV 2019" or 2019- ncov or covid-19 or "Severe acute respiratory syndrome coronavirus 2" or "SARS-CoV-2") and (Limit-To (Affilcountry, "India")) and (Limit-To (Subjarea , "Busi"))

3 RESULTS AND DISCUSSIONS

31 PUBLICATION CHARACTERISTICS

On analysing the 284 total data on this theme by publication type, it is observed that journal articles(n=253, 86.05%)constitute the lion's share, followed by

conference proceedings (n=18, 6.12%), reviews (n=8, 2.72%) and other publication types, namely book chapters, notes, etc. form only 5.1% (n=15) share. Of the 294 records, 134 (45.58%) papers were published as open access publications and only 25 papers (8.5%) got research grants.It is no doubt that pandemic has pushed the research communications ecosystem toward greater openness[14] and there is substantial increase in open science[15]. However, the present data set reveals that open access publications by Indian researchers on this topic are not much encouraging.

32 SOURCE PUBLICATIONS

The analysis of source publications divulges that the total publications are scattered across 138 sources. Of these, 85 sources (61.59%) have published one article, 18 sources 2-3 articles and the remaining 17 sources (~12.32%) published 4 or more articles. The cumulative volume of 119 articles accounts for 40.48% of the total number of articles. Top ten sources that are most productive in terms of number of articles are given in Table 1.

Table 1. Ten Most Productive Sources

S.No.	Source Title	NP	ACC	H-Index
1	Journal of Industrial Integration and Management	18	8.17	9
2	Vision	14	0.29	1
3	Journal of Cleaner Production	10	2.90	4
4	FIIB Business Review	10	0.70	2
5	International Journal on Emerging Technologies	8	3.50	3
6	Global Business Review	7	6.00	3
7	Australasian Accounting, Business and Finance Journal	7	1.71	2
8	International Journal of Logistics Research and Applications	5	10.00	3
9	Cities	5	2.80	1
10	Tourism Recreation Research	5	4.00	3
NP=Number of publications; ACC=Average citation count				

NP=Number of publications; ACC=Average citation count

The above data depicts that some sources are highly preferable destination for publications, though they do not garner much attention from the research community as reflected by their average citations counts. To understand the impact of source publications, popular citation impact indices are taken into account. Table 2 indicates sources that have substantial impact on research community in terms of citations received by them.

Table 2. List of High Impact Source Publications

S. No.	Name of the Journal	HI	GI	TC	NP	CPP
1	Journal of Industrial Integration and Management	9	11	147	18	8.17
2	Journal of Cleaner Production	4	5	29	7	4.14
3	Global Business Review	3	5	42	5	8.40
4	International Journal of Logistics Research and Applications	3	4	50	4	12.5
5	International Journal on Emerging Technologies	3	4	28	8	3.50
6	Tourism Recreation Research	3	4	20	4	5.00
7	Annals of Data Science	2	2	15	2	7.50
8	Australasian Accounting, Business and Finance Journal	2	2	12	6	2.00
9	Current Issues in Tourism	2	3	9	3	3.00
10	FIIB Business Review	2	2	7	4	1.75
11	International Journal of Hospitality Management	2	2	34	2	17.0
12	International Journal of Mathematical, Engineering and Management Sciences	2	2	48	2	24.0
13	Journal of Business Research	2	2	51	2	25.5
14	Journal of Retailing and Consumer Services	2	2	59	2	29.5
15	Operations Management Research	2	2	14	2	7.00
16	Prabandhan: Indian Journal of Management	2	3	35	3	11.67
17	Technological Forecasting and Social Change	2	2	8	2	4.00
18	*TC=Total citations, NP= Number of publications; HI=h-Index, GI=g-Index, CPP= Citations per publication					

33 CITATION STRUCTURE

Of the total 294 documents, 135 documents get at least one citation with cumulative citations count of 943. Research has shown that author self-citations play an important role in the early years after publications[16]. Here, it is seen that author self-citations (n=134, 14.21%) don't contribute significantly in the total citation oeuvre of the examined dataset. Garnering high citations within a very short time span reveals the importance of the papers to the concerned research community. It is observed that twenty papers (Figure 1) have got 15 or more citations within a span of one and half year with a highest citation count of fifty-one. Investigation into these highly cited papers revealed that except one paper all are multi-author papers and eight papers (40%) emanated from international collaborative works where authors from United States contributed in five papers. Examination of author's affiliation in these papers also reveals that except four papers, all are multi-institute collaborative works and authors from sixty-five different institutes contributed among them. Of them, Jamia Millia Islamia University, New Delhi (4 papers) followed by Dr B R Ambedkar National Institute, of Technology, Jalandhar (3 papers) contributed most.

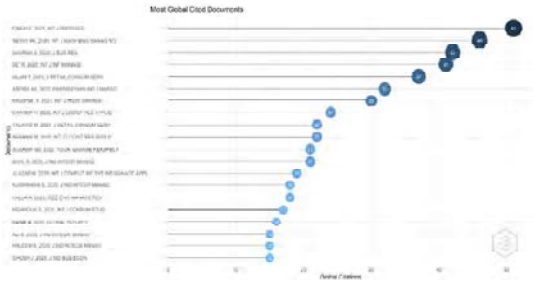

Figure 1. Top Twenty Cited Articles

34 AUTHORSHIP STRUCTURE AND CITATION PATTERN

The publication dataset includes 907 authors (with duplication) and a total of 783 unique authors (without duplication). Table 3 displays authorship nature of the publications. It is found that only 39 papers (~13.27%) are single authorship publications, whereas 255 papers (~86.73%) are the result of team effort. On an average, each paper is written by a team of 3.08 authors with a standard deviation 1.72. The maximum number of authors in a paper is 12. Research has also demonstrated that there is an increasing tendency of collaborative research publications in contemporary academic environment of 'publish or perish'[17]. It is often argued that physical proximity[18]and international mobility drives research collaboration and high impact publications. However, Covid-19 pandemic has drastically lessened probability of having these two research collaboration factors. High number of multi authored papers in the dataset thus plausibly indicates that rapid advancements in web-based communication system act as one of the major solutions to maintain collaboration with the lowest physical contacts during pandemic[19].

Prior research has shown that multi-authors papers have greater probability of getting cited as sharing of knowledge, ideas and experiences among increasing number of co-authors have a great potential to enhance the quality of the paper[20]. Table 3 also broadly indicates multi-authored papers are more likely to be better cited.

Table 3. Authorship Structure and Citation Pattern

Number of authors	NP*(% of TP)	NCP* (% of NP)	CPP*	Citation range
1A	39 (13.27%)	17 (43.59%)	4.29	0-15
2A	93 (31.63%)	38 (40.86%)	4.79	0-32
3A	71 (24.15%)	29 (40.85%)	6.86	0-42
4A	37 (12.59%)	22 (59.460%)	10.59	0-51
5A	28 (9.52%)	12 (42.86%)	8.83	0-24
6A	16 (5.44%)	10 (62.5%)	6.80	0-21
7A	4 (1.36%)	3 (75%)	23.33	0-37
8A+	6 (2.04%)	4 (66.67%)	3.00	0-4
NP= Number of publications; NCP=Number of cited papers; CPP= Citation per paper =Total citations/NCP				

35 INSTITUTIONAL PRODUCTIVITY

Institutional infrastructure and the academic environment of an institute have a great role in its research outcomes. Our dataset indicates that a total of 404 institutes have participated in the research publications. Of them, the top 15 most productive institutes with their respective citation-based impact are presented in Table 4. It broadly evinces that there exist three kinds of institutes, viz. (i) Institutes that publish high impact papers frequently: Jamia Millia Islamia, NIT-Jalandhar, NITIE-Mumbai, etc; (ii) Publications emanating from these kinds of institutes are of very high impact, but their frequency is relatively less: IIM-Ahmedabad, Indraprastha Apollo Hospital, etc. and (iii) Institutes that publish more frequently but their publications could not

generate much interest among contemporary researchers and thus have less citational impact. Symbiosis International, GLA University falls in this category. It is also seen in most of the cases, that the institutes having high international research collaboration network is more likely to produce high impact papers.

Table 4. Top 15 Most Productive Institutions

S.No	Name of the Institute	NP	TC	CPP	HI	ICP
1	JamiaMilia University, New Delhi	21	142	6.76	8	4
2	Symbiosis International (Deemed University), Nagpur	12	16	1.33	2	2
3	Dr B R Ambedkar National Institute, of Technology (NIT), Jalandhar	10	70	7.00	4	1
4	University of Delhi, Delhi	10	4	0.40	2	2
5	O. P. Jindal Global University, Haryana	9	9	1.00	1	6
6	Amity University, Noida	9	6	0.67	2	2
7	National Institute of Industrial Engineering (NITIE), Mumbai	8	78	9.75	2	4
8	I. K. Gujral Punjab Technical University, Hoshiarpur	8	59	7.38	3	2
9	Indian Institute of Management (IIM)Lucknow	8	13	1.63	2	2
10	Indraprastha Apollo Hospital, New Delhi	7	53	7.57	3	4
11	Lovely Professional University, India	7	13	1.86	2	Nil
12	GLA University, Mathura	6	2	0.33	1	Nil
13	Indian Institute of Management (IIM), Ahmedabad	5	55	11.00	3	2
14	Aligarh Muslim University, Aligarh	5	20	4.00	2	3
15	Indian Institute of Management (IIM), Raipur	5	18	3.60	2	1

*NP= Number of papers; TC=Total citations; CPP=Citations per paper; HI- h Index, ICP=International collaborative papers

36 TOPICS OF COVID-19 AND MANAGEMENT LITERATURE

The VOSviewer software is used to analyse the thematic content of the extracted publication set. The map (Figure 2A) is based on co-occurrence of positioning the nodes on the maps by taking keywords plus set from the complete publication set (n= 294) rather than the author keywords set only for better understanding. The minimum number of occurrences of keywords is 3; of the 1,548 keywords, 70 keywords met the threshold. For each of the 70 keywords, the total strength of the co occurrence links with other keywords was calculated. . The keywords with the greatest total link strength were selected for presentation in the map, Figure 2B is based on 70 most frequent keywords generated using Bibliometrix-R tool. According to the Figure 2A and 2B, major nodes are Covid- 19, corona virus, pandemic, epidemic, viruses, viral disease, social distancing, India.

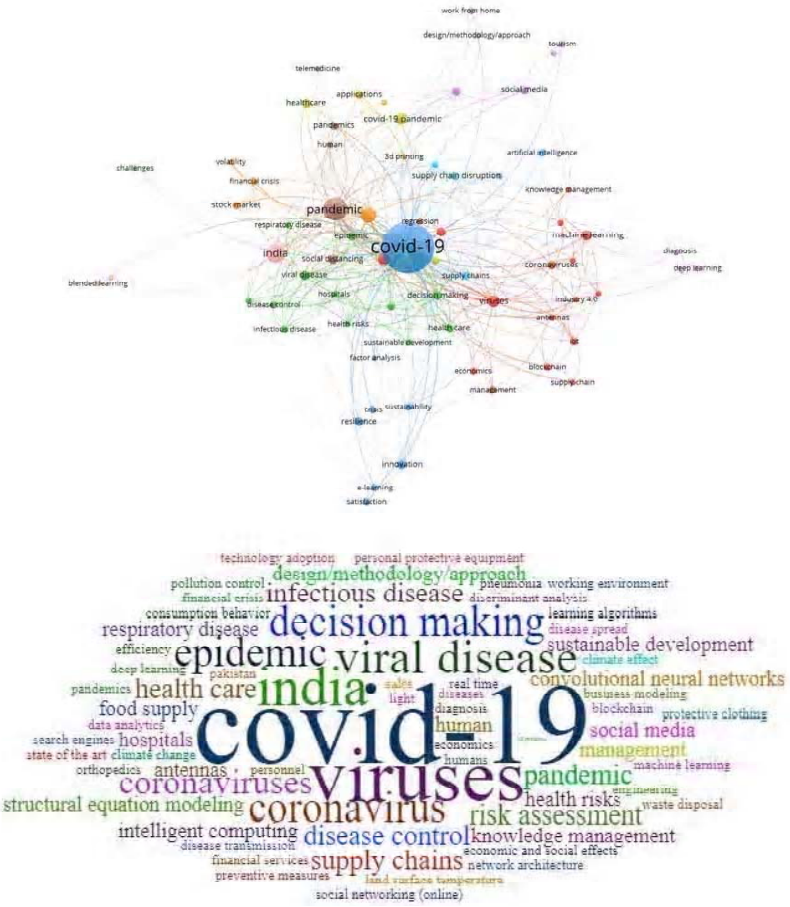

Figure 2A. Keyword co-occurrence map using VOSviewer

Figure 2B. Word Cloud based on Keyword Co-occurrence As these topics are core to any Covid -19 topic, we have categorised the major keywords into following four broad subject topics: (i) Disease aspects Covid- 19, corona virus, pandemic, epidemic, viruses, viral disease, hospital, disease control, infectious disease; (ii) Social and economic aspects - social distancing, social media, lockdown, resilience, human, online learning, blended learning, e-learning, economics, volatility, financial crisis, stock Market; (iii) Technological aspects - artificial intelligence, intelligent computing, machine learning, 3D printing, deep learning, Telemedicine and (iv) Management aspects - Decision making, supply chain, supply chain disruption, blockchain, innovation, structural equation modelling, risk assessment, crisis, management, sustainable development, sustainability, business modelling.

37 NETWORK, PRODUCTIVITY AND IMPACT

Co-authorship and country collaboration network has been carried out using VOSviewer software. Figure 3 represents the countries which have at least two joint publications with authors from India. Among the total 42 countries from which publications have emanated, 25 countries meet the threshold. In the map, largely cooperating countries are positioned closer to each other.

From the Figure 4, it is observed that there are seven clusters of co- authorship network. Among them, cluster 4 (red, right side) has two most productive authors Javaid M. and Haleem A. (15 papers each). They are from the same department of the institute and they jointly published 13 papers. When, we combine the Figure 4 with the data given in Table 5, it is found that some authors with minimum network linkage may publish high impact paper. However, prolific authors may plausibly require higher network strength to produce high impact papers of 39 items. The distance between two nodes indicates strength of co-authorship.

Co-authorship map presented in Figure 4 is based on the criteria that authors have jointly published at least two papers. It is found that 87 collaborations meet the threshold. However, all these 87 nodes are not connected each other. The largest set of connected nodes consists

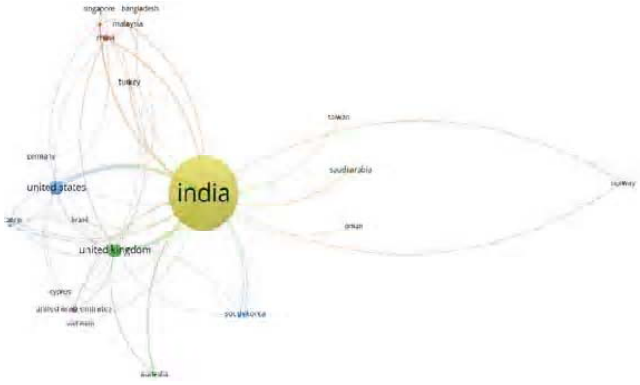

Figure 3 – Country Collaboration Map

Figure 4. Co-authorship Network

Table 5. Top 15 Authors - Productivity and Impact

Top 15 Authors as per number of publications				Top 15 Authors as per Impact per Publications			
Author	TP	CPP	NS	Author	CPP	TP	NS
Javaid, M.	15	8.73	46	Singh S	19.67	3	0
Haleem, A.	15	7.47	39	Suman R.	16.67	3	10
Gupta, S.	8	0.56	7	Sharma A.	12.75	4	0
Bahl, S.	8	7.38	32	Singh, R.P.	12	7	25
Kumar, S.	8	3.38	6	Javaid, M.	8.73	15	46
Singh, R.P.	7	12	25	Luthra, S.	8.5	4	3
Vaishya, R.	7	7.57	23	Vaishya, R.	7.57	7	23
Kumar, P.	7	1.43	4	Haleem, A.	7.47	15	39
Kumar, A.	6	5.17	10	Bahl, S.	7.38	8	32
Bagha, A.K.	5	4.60	19	Kumar, A.	5.17	6	10
Mor, R.S.	5	1.80	6	Vaish A.	5	3	10
Sharma, S.	5	1.00	4	Bagha, A.K.	4.6	5	19
Sharma, A.	4	12.75	2	Iyengar, K.P.	4.5	4	17
Luthra, S.	4	8.50	3	Kumar, S.	3.38	8	6
Iyengar, K.P.	4	4.50	17	Sharma D	2.67	3	0

NP- Number of Publications, IPP-Impact per publication, NS-Network strength as per VOS Viewer.

4 CONCLUSION

It is discussed that India is one of the worst Covid-19affected countries in the world. The pandemic has caused a huge disruption in its social, economic and business environment. Numerous researches have been carried out by Indian researchers to understand and inform the diverse effects of pandemic on people, society and business. Assessment of researches is thus essential to understand their impact and helped policy makers in informed decision making. Literature analysis through bibliometric tools played there an effective role. This bibliometric study aiming at analysing the literature on Covid 19 obtained from 'Economics, Business and Management' category of Scopus database that were originated from India. It brought out that some researches got excellent responses from fellow research communities. Analysis of productivity and impact of research publications indicates that high impact research is often collaborative works and authors who publish frequently high impact research papers are usually well connected. It is also observed that India has good collaborative works with other countries where United Kingdom and United States are preferable partners. Thematic mapping of research reveals that researches mainly discuss four broad aspects of the topic i.e., technology, disease, socio-economy and management related aspects.

It is worth to mention that actual impact of a research can't objectively be decided through citation counts within this very short span of time as many of these articles in this dataset originate in 2021 only and some of them are early cite articles

or article in press category. Thus, the impact analysis is thus indicative one and actual value of these researches may be obtained when a longer time frame be available for their study.

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