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The main focus of the journal is to provide a platform to the academicians and practitioners to discuss innovations and their implications on business management and processes. It focuses on bridging the gap between academia and industry for cross fertilization of ideas leading to effective dissemination of innovative solutions in emerging areas. The journal features research papers across function areas on topics such as customer relationship management (CRM); market segmentation; supply chain management; data mining tools & techniques; block chain; artificial intelligence (AI); internet of things (IoT); customer lifetime value (CLV); economics of information technology; cloud applications; cyber security; mobile computing; geographic information systems (GIS); information systems and ethics; sustainability; green computing; digital marketing; social media; social analytics; supplier relationship management; enterprise solutions; virtualization; cognitive science; governance; entrepreneurship; design thinking; VR or augmented based learning and development; HRMS and HR score card; people analytics; automation in performance management; algorithm trading; RegTech; and FinTech.

The journal is primarily an application-oriented journal and therefore invites research papers that are based on evidence and produce findings that are implementable. The journal is impartial towards methodology used as long as it is robust and relevant.

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IMIB Journal of Innovation and Management offers a platform for interface between emerging business management problems and evolving innovative techno-management solutions. It serves as a platform for seamless integration of methodological, technological and disruptive developments, and their business applications. We publish articles which address research in technology, techniques, processes and applications in business. The journal, therefore, bridges the gap between academia and industry for cross fertilization of ideas leading to effective dissemination of developments in emerging areas.

IMIB Journal of Innovation and Management is an interdisciplinary journal in the area of business management which captures developments in technology to facilitate application in business. The journal facilitates dissemination of knowledge on shifting techno-management paradigms and maps its cascading consequences on various facets of business (Marketing, Finance, OB HR, Operations, Strategy, Entrepreneurship, etc.). We encourage research that investigates the impact of innovations on various stakeholders such as customers, vendors, partners, etc. In pursuit of this endeavor, we publish scholarly research as well as practice papers offering unique insights.

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Article

Exploring the Phases and Measuring the Effectiveness of Social Innovations Waved During Coronavirus (COVID-19) Pandemic: Implications from India

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Esrafil Ali[1], Madhusmita Malik[2] and Sharvani Satpathy[3]

Abstract

Drawing on the social innovation process adapted by Van de Ven et al. (2008), we studied the different phases of social innovations in terms of ideation, development and scaling that waved during the pandemic of COVID-19. We also measured the effectiveness of the innovations on different parameters in fighting the Coronavirus when it was at its peak in the first wave. In this article, we also postulated how the various innovations impacted social life. A total of 24 innovations were explored and studied using the qualitative content analysis method. Data were analyzed using the Maxqda software (version Pro 2020). Results revealed that most of the innovations were implemented with new and latest technologies and they had developed using optimum resources. Further, it was noticed that most of the innovations had achieved the scaling and implementation phase in managing the COVID crisis.

Keywords

COVID-19, global pandemic, social innovations, societal benefits, innovation phases

[1]Indian Institute of Management Visakhapatnam, Andhra Pradesh, India
[2]Department of Business Administration, Sambalpur University, Sambalpur, Odisha, India
[3]Hindalco Industries Ltd. Hirakud, Odisha

Corresponding author:
Esrafil Ali, Indian Institute of Management Visakhapatnam, Andhra Pradesh, India.
E-mail: esrafil.ali2016@gmail.com

Introduction

COVID-19 entered India in December 2019. According to an official data, about 215 countries were affected by this deadly disease. In the first wave of the pandemic, a million people got infected and the cases were still growing until the second and third waves. Due to this effect, social life was thoroughly disturbed and distorted. However, at the same time, various social innovations took place to fight this disease. The pandemic started in March 2020, and in response, research institutions, organizations, social entrepreneurs and government in the early efforts made various strategies to reduce the transmission rate of the virus. They introduced many innovative products to control the disease and resolve health issues in society. The intervention of the Indian government in terms of social innovation in preventing the disease was immense. Under the dynamic leadership of Hon'ble Prime Minister Shri. Modi Ji, dealing with the social and economic crisis issues was controlled. Though the pandemic coined a situation constraining in India, it also created a space for social innovation during COVID-19.

Many new ideas and thoughts were developed to reduce the transmission rates and control the impact of the virus. This paved the way for social innovations' development and contribution, leading to societal benefits. Social innovations are proved to be an effective and efficient tool in managing crises. They are gaining momentum and acknowledgement due to their increased role in sustainability, social issues and addressing global pandemics. In this study, we brought out the part of social innovations in managing the pandemic. The research objective of this study is to investigate the effectiveness of the innovations on different parameters in fighting the Coronavirus.

Following the above introduction, the article is organized as follows: first, the theoretical background of the social innovations is discussed, which provides a crystal picture for understanding the innovations that happened in India. Further, the literature on social innovation is studied to focus on how it has increased its importance in dealing with global pandemics like COVID-19. Next, the research context of the selected social innovations is stated. The analysis part focuses on the measurement of the effectiveness of social innovations. The article highlights the research findings and discusses practical implications for social practitioners, entrepreneurs, innovators and researchers.

Literature Review

Social Innovation—A Theoretical Background

Social innovation refers to new ideas and thoughts that meet social problems. In other words, social innovation may be defined as innovative activities motivated by accomplishing societal goals and objectives. In this sense, it is understood that social innovation paves the way for development and growth, leading to societal benefits. On an allied note, innovation is not only about the discovery of

leading-edge technologies but also about solving social issues and challenges (Priestley, 2020). To Roome (2013), social innovation is that supremacy which can change the economy and society of any country. Social innovations are essential to bringing social changes and developing mechanisms to address social problems (Butkeviciene, 2009). Meanwhile, the Social Innovation Review editors believe social innovation is a unique solution to social issues that are effective, efficient, sustainable and value-based primarily to society rather than private individuals (Phills et al., 2009, p. 36).

As outlined by the World Economic Forum (2016), social innovation is:

> *The application of innovative, practical, sustainable, market-based approaches to benefit society in general and low income or underserved populations in particular*.

Social innovation follows a process model. Past studies have indeed shown that there are many process models to illustrate innovation development. There are many views regarding the process. In a related vein, Van de Ven et al. (2008) propose three essential phases in social innovation: idea generation, development and implementation (scaling). The first phase discusses about developing new ideas or thoughts for solving social issues. The second phase focuses on idea testing and the feasibility of exploring the thoughts. In the third phase, the developed ideas are scaled and implemented for the benefit of society. Figure 1 portrays the social innovation phases. This article builds on the literature on the social innovation process to show the effect of various innovations in managing the crisis of COVID-19 in India. The disease affected every aspect of life around the globe, from individual to institutional operations. Governments worldwide were struggling to fight the disease. In this setting, the role of social innovation was essential to help overcome this crisis. Many innovative ideas and thoughts were translated into innovations to fight the current situation.

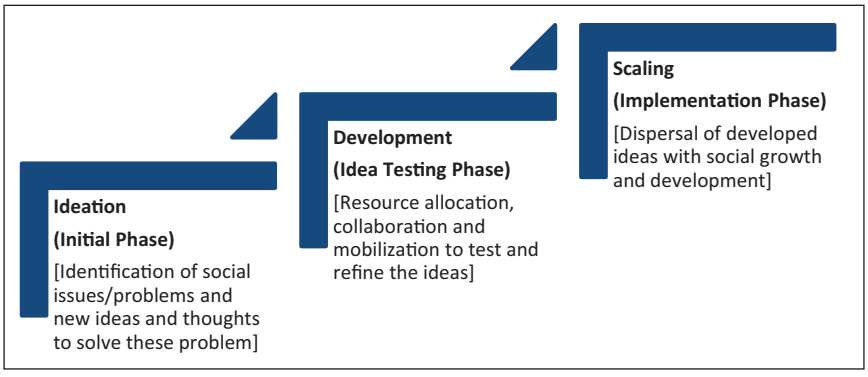

Figure 1. Phases of Social Innovation.

Source: Adopted from Van de Ven et al. (2008).

Social Innovation and COVID-19: Global Context

In an interview, an entrepreneur and author of 'Today's Innovator' Proietti (2020) alleged that they do not have to wait for someone to help them move on. They should take their cross and move towards the goal of how complex their future is. They also advocate that this COVID-19 pandemic creates an 'Isolation Economy' where they can embrace the disruption and innovation that provide a solution for a better life in the world. However, it involves high risk. It is also advocated that they must focus on how to proceed safely within their regular production model. HIV/AIDS had been a pandemic in Africa. The need for promoting scientific innovation and how the social and cultural aspects influence the pandemic situation of HIV/AIDS in Kenya and Zimbabwe (Susan & Mugwagwa, 2009).

Similarly, Gene Quinn (2020) emphasizes that 'the U.S. innovation policy should be proactive to tackle the next pandemic.' It was also discussed in the article 'Lesson from COVID-19' those medical diagnostics are not patentable in the US, which leads to de-emphasizing medical diagnostics and owing to this, investors are uninterested in investing in their research and development activities. Moreover, fundraising, the lifeblood of research and development, is also closing. And all those activities cause to lack testing and innovation. Stressing the innovation aspects, Park (2020), in the article 'Preventing the next pandemic,' focuses on how public health can be a pivotal point in using new technology to be one step ahead of a future outbreak. The article also enlightened some of the technological advancements used for catching cases in the early hours to minimize the effect of the pandemic so that the health system would be less exaggerated. Advanced innovations like Artificial Intelligence, Telehealth App like MaNaDr (Singapore), Google Project, Remote monitoring, Chatbots and Call centres are helping to trace contact details, monitor patients across distances and counsel patients from home. Due to the COVID-19 pandemic, internet use became more crucial as we all live in the virtual world. According to Cerf (2020), this pandemic has taught us how virtually we can come into existence. The internet, web, videoconferencing, collaboration tools, email and social media are now primary avenues for business, social interaction and entertainment. We are all devoting our time and money to it. Our work life has also changed with the use of technology and innovations. The article also highlighted that it becomes our responsibility to play a prominent role in shaping our post-COVID-19 society. When there is a necessity, there is an invention. But this invention must give benefits to the community. West Michigan has proved this thing. Andel (2020) enlightens that in this COVID crisis, West Michigan showed its vivid side to the world with its generosity and adaptability to scientific innovation. Moreover, its manufacturing sectors stepped up to produce protective masks and gloves for health care workers, as well as critical parts for ventilators.

Similarly, Handforth (2020) has discussed some of its organization's initiatives taken during this COVID-19 pandemic. Likewise, UNDP (United Nations Development Programme) and Hacker, the most significant online open-source

hardware community, partnered with the world's biggest names in technology and launched the COVID-19 Detect and Protect challenge. The terms are Amazon Web Services, Arduino, Arm, Avnet, Edge Impulse, Google, Microsoft, NVIDIA, NVP, Nordic Semiconductor, Soracom and The Things Industries. Its main aim is to create a global platform of open-source solutions that can detect COVID-19 cases, prevent disease spread and protect individuals and society.

Moreover, the UNDP was also calling on all hardware and software developers, product designers, scientists, hackers, makers, innovators and inventors to come together and help those who could be most affected by these pandemics. The UNDP not only focuses on providing a platform for open-source solutions but also aims to identify and mobilize promising ideas wherever they may be found. Most importantly, they universally spread a message of 'Together We Can.'

Express Computer (2020) surveyed different countries with combat policies and tried to defeat them with innovative technologies. Some countries have done a better job than Italy and Spain, South Korea and Singapore. In the same way, India, Australia, China and other countries are doing their best to sustain this pandemic. They have invented various digital apps that help trace contacts, detect positive patients and provide precious information about prevention. Other than this, these countries also engaged in the production of PPE-Kit, Sanitizer and Sanitizer Tunnels, etc., for the COVID-Warriors as well as for the public. World Health Organization (WHO) Africa (2020) showcased those African innovators are leading the COVID-19 crisis through home-grown creative solutions to address critical gaps in response to COVID-19 in collaboration with WHO. Various innovations have been developed. These are ballparked from interactive public transport, contact tracing apps and dynamics data analysis systems to rapid diagnostic testing kits, mobile testing booths and soft coat critical care beds. Moreover, eight innovators from Ghana, South Africa, Guinea and Kenya presented their solutions already being implemented in their respective countries. WHO believes that providing ongoing support and a regular platform to African innovators may bring more prosperous to this pandemic.

After the outbreak of COVID-19 in China, it captured more than six countries within a month and in a few months, the pandemic reached over 100 countries with no sign of a vaccine. This pandemic affected both the health care sector and the economy. Farrugia et al. (2020) claimed that the COVID-19 crisis taught the world a lesson about innovation and coordination. They advocated that this pandemic taught them 'how to be together' as the public, private and government collaborated to fight against this pandemic. The private industries, academic institutions and start-ups such as Mayo Clinic, the University of California Health Care system, Amazon Web Series and Microsoft come together, which is called cross-sector partnership, to fight against it. This cross-sector partnership brings many benefits such as a telehealth program, fast-tracking applications process, and so on. In the US, collaboration among health care institutions and industries facilitate speedy access to experimental treatments. It shows we are not only experiencing

cross-sector partnerships but innovation and the use of new technology as well. Collaboration with investors across the county initiates a national effort to produce convalescent plasma from eligible donors who have recuperated from COVID-19. Also, the US-based clinician Mayo Clinic has developed a serology test that would be the following critical tool for health care providers.

Moreover, the Mayo Clinic has expanded virtual services to patients. Besides, collaboration brings opportunities to apply artificial intelligence and machine learning to new medical problems. Therefore, while the COVID-19 pandemic created a negative wave, it also opened up the possibilities for innovations in the world.

Social Innovation and COVID-19: Implications from India

Today, it is hard to imagine that the year 2020 would always be remembered as a disaster due to the deadly virus that spread to almost all parts of the world. The WHO named this virus a novel and declared as a big pandemic in history. Looking back at the account, we could find various pandemics and epidemics badly influenced millions of populations and severely impacted social life. A crisis such as HIV/AIDS, MERS, Ebola, SARS, and so on, to name a few. The gravity of the crisis caused by COVID-19 is compared to other global diseases. As per the WHO report, this virus has impacted several countries such as America, Brazil, India, Korea, Malaysia, Singapore, Japan, China, and so on. This disease has posed significant challenges to the worldwide economy and people's daily lives. In India, the disease has been worsened to 17 lakhs.

In the immediate response to the COVID-19, India tried to make the fight against COVID-19 a people's movement. According to an official Ministry of Health and Family Welfare (MoHFW) report, the Government of India provided medical assistance to more than 150 countries worldwide. The government announced an economic package of over ₹20 lakh crore to help the country fight this pandemic. The vision of *Atma Nirbhar Bharat* was established among the countrymen. Upon the announcement of the lockdown in the entire country, the government announced a food security package for 813 million citizens in India which benefitted about 700 million people. Prime Minister Modi Ji urged *Do Gaj Doori* to follow to maintain social distance and stressed using the Aarogya Setu App. Furthermore, the government focused more on the health care sector and provided the license to 165 distilleries and 963 independent manufacturers to produce hand sanitizers for mass.

India started producing PPEs and N-95 masks in large numbers to address the challenges. During this time, a public charitable trust, 'PM Cares Fund,' emerged to collect funds from the public to deal with a kind of emergency or distress situation. After a period of panic, India was allowed to export HCQ medicines to USA and Brazil. This medicine was provided to other countries, such as Afghanistan, Israel and Africa. Due to the COVID-19 pandemic, the government stressed more virtual work, wearing masks and gloves, working from home, etc.

This situation also created many issues such as problems of migrant labors, distribution of food to the needy, dealing with essential commodities, management of infections, resource mobilizations and human resources mobilizations. Looking into the long-term issues, COVID-19 cropped up challenges such as reinstating the Indian economy, digital empowerment in India, improving the health care sector, medical infrastructure, and so on. India, being a densely populated country, faced severe effects of COVID-19. Many organizations, individuals and society have come forward to deal with the post-pandemic challenges. The crisis became a strong driver of innovation, research and creativity.

Further, abundant creativity and innovation emerged at the national, institutional, organizational and individual levels to fight this pandemic. Many of the inventions and social innovations stressed the need for time and effort to solve the societal issues and problems posed by the pandemic. In India, several social innovations emerged in the fight against COVID-19 (MoHFW Report, 2020).

Various organizations in India, such as Central Government, State Government, DRDO, IITs, IIMs, NITs, Central Universities, Indian Navy, Indian Army, Police Administrations, Municipal Corporations, and so on, came forward to fight this crisis through innovations and creativities. The virus affected the environment, food system, urban politics, social norms, body and soul, etc. This virus forced socially innovative initiatives, expanding resources and thinking of new ways and instruments to survive this situation. In its efforts to limit the virus, India emerged with various social innovations such as Asimov robotics, Aarogya Setu, Nocca robotics, Qkoy, Marut drone tech, digital stethoscope, Automatic mask machine, Jeevan setu ventilator, covisafe, and so on, to name some few (MoHFW Report, 2020). Appendix I describes the social innovations in India during the COVID-19 period. These innovations are helping to overcome this pandemic even now also. Thus, this article focuses on social innovations in the crisis as a way of measures to solve the societal issues in India. Therefore, this article explores the phases of social innovation in India and their effectiveness in achieving control over the crisis. The research questions for this study are as under:

> RQ_1: What are the various phases of the social innovations that waved during the COVID-19 period in India?

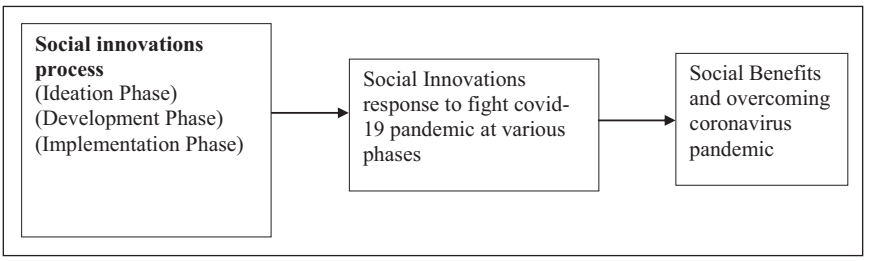

Figure 2. Conceptual Framework of the Study.

Source: Researcher's framework.

RQ_2: How social innovations in India are helping in managing the crisis of COVID-19?

Based on the above RQ1 and RQ2, we proposed the conceptual model for our study, as depicted in Figure 2.

Methodological Context

Research Design and Approach for the Study

This study considered the exploratory nature of the research work and the importance of ensuring an in-depth analysis of the phenomenon from different perspectives. Thus, we adopted the case study analysis approach to seek more meaningful interpretations of the qualitative results. The research was conducted using qualitative content analysis. The Indian social innovations cases were analyzed during the COVID-19 period to achieve these goals.

Sample Choice and Data Collection

The twenty-four case studies of innovations were analyzed to study the phases and effectiveness of social innovations. We considered those social innovation cases that directly impacted the management of the COVID-19 crisis. To meet the requirement of the research study, we used criteria and convenient sampling. We deduced the study's contents from various newspapers, websites, public reports, etc. We traced the relevant content from public sources based on our requirements. We identified five important domains for gathering the case information. They were the foundation of the innovation, objectives, development, technology used and effectiveness in managing crises.

To collect the data, we searched the case information published by various national newspapers, websites of government organizations about COVID-19, documents on COVID which were publicly available, etc. The data were collected during the first wave of COVID from March 2020–December 2020, as most of the innovations and improvements in dealing with the crisis evolved during this time.

Measures

Nine critical factors were selected to assess the relevance and effectiveness of social innovations in various spheres. To do this, an in-depth literature review was done considering the available definitions and propositions. Initially, 24 factors were identified and finally, nine factors were retained by considering the views of a group of competent experts opinions from management and the organization. Table 1 depicts the nine factors and their measurement extents. The phases of the social innovations were analyzed using the Social Innovation Process model borrowed from Van de Ven et al. (2008), as summarized in Figure 1.

Table 1. Measurement Parameters of the Social Innovations in India During COVID-19.

Parameters	Measurement Extents of Innovations
Standard of human life	Human life, the standard of living,
Sustainable development	Overall societal growth and development
Social formation and participation	Groups, coordination and participation
Opportunities with limited resources	Best use of resources in time
Noble idea development	Ideas and thoughts leading to innovation
New technology and innovation	Implementation of new technology
Change in social norms and values	Social values, norms and beliefs
Development of a healthy economy	National development
Quality of community life	Improvement of community life

Source: Research data.

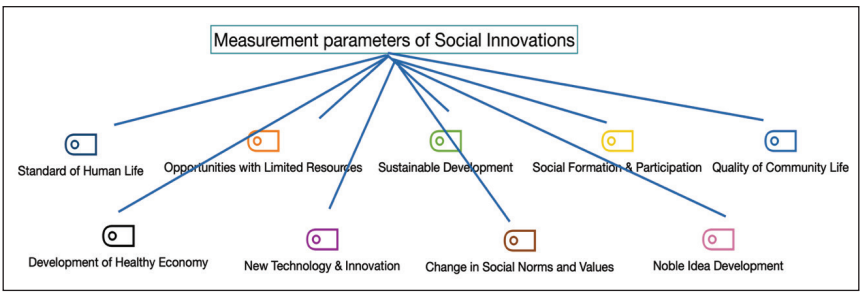

Figure 3. Coding of Measurement Parameters in Maxquda.

Note: For reference to color in this figure, please refer to the web version of the article.

Data Analysis Using the Maxqda Software

Maxqda is a software designed and developed for analyzing qualitative data and quantitative data. This is a very innovative analysis software embedded with graphics and objects. We used this software for data analysis.

We followed the nine measurement parameters and the social innovation process model depicted in Figure 1 to analyze the innovation phases (ideation, development and implementation) and their effectiveness in fighting COVID-19. The content analysis was done with Maxqda Analytics Pro 2020. In all 24 cases, information collected from various published sources was imported into the software for analysis. There were different steps followed to treat the data in the software. They were:

- The data (document) were imported into the software under the document system.

- The coding was done for the code system's nine selected measurement parameters. Please see Figure 3 for details.
- The content analysis was done for each document after an in-depth study.
- The codification was done for all the documents based on the parameters.

Coding of Measures for Content Analysis

Code was assigned to all nine measurement parameters to analyze the social innovations in the software. Further, the cases were investigated and codified for content analysis. Table 2 shows the overview of codes and codification of all the cases. As depicted in the table, a total of nine codes were used for the segmentation of the cases.

Categorized Survey Data Analysis to Ascertain the Description of Social Innovations

The data about the social innovation cases were collected using an internet search (Please see Figure 4). Further, the surveyed data were explored and imported into the software. To get a comprehensive picture, each case is analyzed individually and then the respective measurement codes were systematized and described for the cases. This analysis categorized each social innovation case into different measurement parameters based on the in-depth study and content analysis. Appendix I shows the detailed categorized analysis of each case for comprehensive understanding.

Table 2. Coding Features of the Measurement Parameters.

Code	Parameters for Measuring Social Innovations	Code Segments	% Code Segments	Social Innovation Cases
●	Change in social norms and values	15	1.96	10
●	Development of a healthy economy	25	3.27	17
●	Social formation and participation	29	3.80	16
●	Standard of human life	35	4.58	18
●	Quality of community life	36	4.71	19
●	Sustainable development	54	7.07	24
●	Opportunities with limited resources	60	7.85	26
●	New technology and innovation	75	9.82	27
●	Noble idea development	224	29.32	28

Source: Researcher's results.

Note: For reference to color in this figure, please refer to the web version of the article.

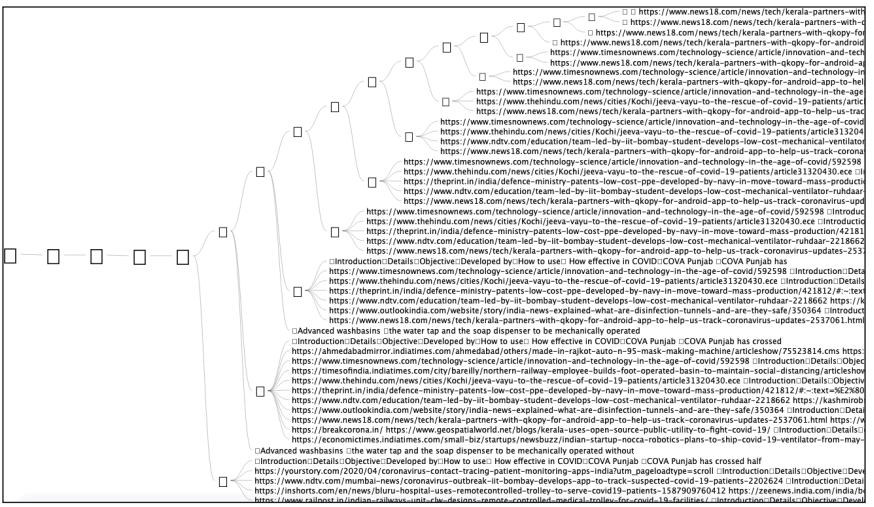

Figure 4. The Various Internet Sources from Where Data About the Social Innovation Cases were Collected During the First Wave of COVID.

Source: Researcher's results.

Table 3. Descriptive Statistics of the Content Analysis for the Social Innovations During COVID-19.

	Contextual Components		
Measurement Parameters	Frequency	Percentage	Percentage (valid)
Noble idea development	28	100.00	100.00
New technology and innovation	27	96.43	96.43
Opportunities with limited resources	26	92.86	92.86
Sustainable development	24	85.71	85.71
Quality of community life	19	67.86	67.86
Standard of human life	18	64.29	64.29
Development of a healthy economy	17	60.71	60.71
Social formation and participation	16	57.14	57.14
Change in social norms and values	10	35.71	35.71

Source: Researcher's results.

Code Frequency Analysis to Measure the Impact of Social Innovations

The code frequency analysis was done to ascertain how often the measurement parameters were assigned to each social innovation case. The reflection of the frequency distribution of all the cases is shown in Table 3. This analysis

Table 4. Grid Relationship Between Social Innovations and Measurement Parameters.

Measurement Parameters/ Innovations >	Asimov Robotic	AarogyaSetu	KlinicApp and Practo	Nocca Robotics, Aerobiosys Innovations,	Digital stethoscope	Infection-proof fabric	BreakCorona and Coronasafe-network	Marut-Dronetech	QKopy	Sanitiser Tunnels	Safe swab Phone booth testi	Ruhdaar The low-cost frugal innovator	Low-cost PPEs The Navy's innova	Jeeva Setu ventilators	Feet-operated handwash machine and Advance	COVISAFE	Automatic mask machines	Microbiome test	Coronavirus Disinfectant Tun	WhatsApp Chatbot For Coro	corona kavacha	Ultra-violet C Light-based sanitisation box	Contactless Sanitizer dispenser	Remote-controlled trolley	SUM
Change in Social Norms and Values	0	0	0	2	0	0	1	1	2	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	**9**
Development of Healthy Economy	1	0	2	2	1	2	2	1	0	1	1	2	1	0	0	1	3	0	0	1	2	0	0	0	**23**
New Technology and Innovation	1	1	0	1	3	2	2	6	3	3	2	2	1	2	5	2	4	1	7	2	3	4	8	2	**6-7**
Noble Idea Development	9	7	10	8	6	5	5	10	4	16	9	6	6	3	8	3	10	6	22	10	9	8	21	6	**207**
Opportunities with Limited Resources	2	0	2	2	1	1	2	2	2	7	3	2	1	2	1	0	5	3	5	2	1	1	6	3	**56**
Quality of Community Life	0	1	1	0	3	2	1	4	1	0	2	1	3	1	4	0	0	0	3	2	3	0	0	0	**32**
Social Formation and Participation	1	1	1	2	0	0	0	0	0	4	1	0	2	0	0	0	1	1	5	3	1	0	3	1	**27**
Standard of Human Life	1	1	1	2	2	1	1	3	1	0	1	0	0	0	1	1	2	1	4	5	0	0	5	2	**35**
Sustainable Development	0	3	2	2	2	1	1	1	2	1	2	2	1	1	4	1	3	2	4	6	2	1	6	3	**53**
SUM	15	14	19	21	18	14	15	28	15	32	21	17	15	9	24	8	28	14	50	31	21	14	49	17	**509**

Source: Researcher's results.

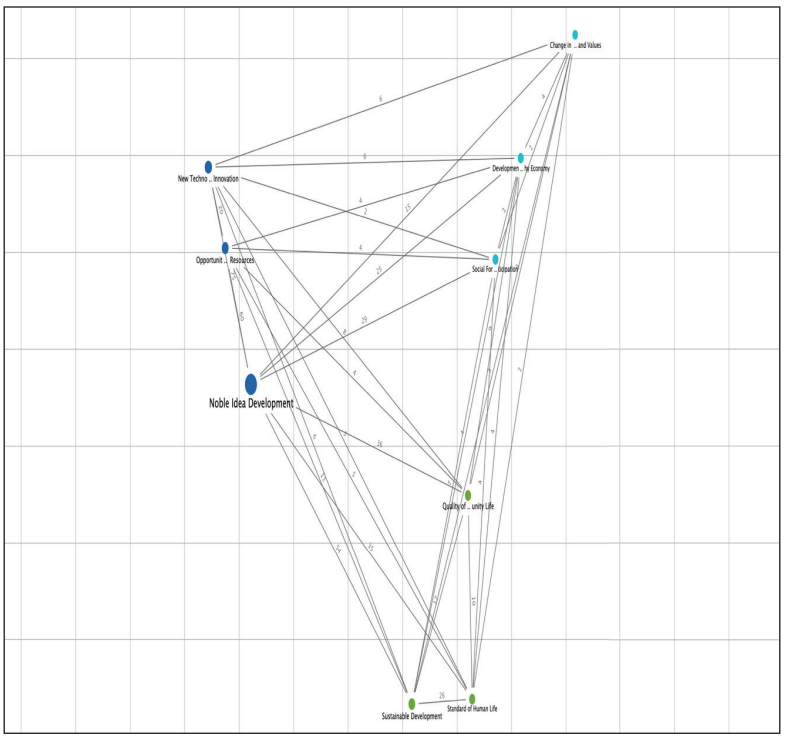

Figure 5. Analyzed Relations of Codes and Codes Occurrence (measurement parameters) in the Documents (social innovations).

Note: For reference to color in this figure, please refer to the web version of the article.

helps indicate the effectiveness of the social innovations in terms of occurrence on the number of times the measurement code is assigned during content analysis.

The above table shows that the maximum frequency is assigned to the factor 'noble idea development,' whereas the minimum is to 'change social norms and values'. Notably, most social innovation cases were of new thoughts and ideas.

Code Mapping Analysis to Identify the Collinearity of the Measurement Parameters

The code mapping was done to define connections and relationships between various measurement parameters and with the social innovations (Please see Figure 5). The map presents the interconnection between different coded measures, representing the additional facts and phenomena in our research work. As we can

see, the measure 'noble idea development' has been coded frequently for the various social innovations (the code circle is larger). Similarly, we can note that 'new technology and innovation' and 'opportunities with limited resources' have also been used more frequently on the map. Further, the map shows that the factors 'sustainable development' and 'standard of human life' have more collinearity in the social innovation effectiveness (the two factors are placed closer on the map). It is interesting to note that all the parameters are highly connected in measuring the performance of social innovations.

Grid Analysis to Study Relationships

The grid analysis is done to study a particular phenomenon and the relationship between social innovations and the various measurement parameters. During the investigation, the details of the social innovations were displayed in the column and the parameters were in the rows (please see Table 4). The grid table indicates various relationships and levels of effectiveness of the innovations. As we can note, a total of 509 codifications were done for all

Table 5. Analysis of the Innovation Phases During COVID-19.

S. No.	Innovations	Observed Phases of Different Innovations During COVID-19		
		Ideation	*Development*	*Scaling*
1	Remote-controlled trolley	■	■	
2	Contactless sanitizer dispenser	■	■	■
3	Ultraviolet C light-based sanitization box	■		
4	Corona Kavacha	■	■	■
5	WhatsApp chatbot for coronavirus	■	■	■
6	Coronavirus disinfectant tunnel	■	■	■
7	Microbiome test	■		
8	Automatic mask machines	■	■	■
9	Covisafe	■	■	
10	Feet-operated handwash machine and advance wash basin	■	■	■
11	Jeeva Setu ventilators	■	■	■
12	Low-cost PPEs the Navy's innovation	■	■	■
13	Ruhdaar the low-cost frugal innovator	■		
14	Safe swab phone booth testing	■	■	■

(Table 5 continued)

(Table 5 continued)

S. No.	Innovations	Observed Phases of Different Innovations During COVID-19		
		Ideation	*Development*	*Scaling*
15	Sanitiser tunnels	■	■	■
16	QKopy	■		
17	Marut Dronetech	■	■	■
18	BreakCorona and Coronasafe-network	■	■	
19	Infection-proof fabric	■	■	
20	Digital stethoscope	■		
21	Nocca Robotics, Aerobiosys Innovations, AgVa Healthcare	■	■	■
22	KlinicApp and Practo	■	■	■
23	AarogyaSetu	■	■	■
24	Asimov Robotics	■	■	

innovations. The highest segment is 'noble idea and development.' Further, new technology, innovation and opportunities with limited resources were noted as the other highest impact on the innovations. In terms of effectiveness, 'coronavirus disinfectant tunnel,' 'contactless sanitizer dispenser,' and 'Marut drone tech' have the highest impact on fighting the crisis.

Phase Analysis of the Social Innovations

Table 5 shows the phase analysis of the innovations during COVID-19 (the shade in the table indicates the extension of phases). The contents were studied based on the data collected to identify the various stages of the innovations. The social innovation process adapted from Van de Ven et al. (2008) is being used as a framework to study the phases of social innovation.

Discussion

From Table 2, it is observed that a total of nine factors (parameters) have been coded to measure the effectiveness of social innovations. Around 29.32% of the innovations are coded as 'noble idea and development.' Whereas new technology and innovation are recorded at 9.82%, opportunities with limited resources to be as 7.85% and sustainable development at 7.07%. Thus, it is pertinent to note that most innovations during the first wave of COVID-19 were inclined toward new thoughts, ideas and developments.

Table 3 in the data analysis shows the frequencies of the parameters. In the table, it is observed that noble ideas and development, new technology and innovations, opportunities with limited resources and sustainable development have been given more weightage regarding the effectiveness and impact of managing the crisis. Thus, it is imperative to note that the innovations were implemented with new and latest technologies and developed using optimum resources. Further, all the innovations were helping the country in sustainable development and improved the quality of community life in these crisis times.

The code map depicted in Figure 5 indicates more collinearity between sustainable development and the standard of human life. Also, it is noted that new technology, opportunities with limited resources and noble ideas were closer on the map, representing more similarities. It is interpreted that most of the factors had an intimate relationship in terms of measurement of the effectiveness of innovations. Thus, it is said that innovations were highly influential in managing the pandemic and crises. From the Grid Table 4, we can see the effectiveness of the innovations. Innovations include a Contactless sanitizer dispenser, Coronavirus disinfectant tunnel, Sanitizer tunnel, Marut Drontech, Klinicapp and practo, Aarogya Sethu and Asimov Robotics were found to be highly effective in fighting the crisis. These innovations scored the highest in terms of their performance.

Table 5 portrays the various phases of social innovations during the crisis of Coronavirus. As we can observe from the table, it is noted that 14 innovations had achieved the scaling stages. Moreover, it is relevant to point out that around five innovations had attained the development phases. In contrast, five innovations were still in the ideation phase. The study examined the stages of innovation. Thus, our results showed that most of the innovations had achieved the stage of development and scaling while fighting the virus. This seems to signify that the innovations were practical and had a more significant impact on mitigating the pandemic. However, few innovations were still at the early stage of the application. Organizations should be aware that these innovations can make a significant difference in fighting the Coronavirus. Thus, they should try to make these implemented on a larger scale. They should also develop mechanisms to get these innovations used by the beneficiaries.

Conclusion and Potential Implications

Social innovation brings about changes in our day-to-day life, such as in education, health and so on. Social innovations directly improve workforce potential and competence. In this article, to investigate various phases of the innovations process in selected 24 cases of social innovations taking place during COVID-19, nine social innovation tendencies have been identified. It is observed that out of the total of nine (parameters) coded to measure the effectiveness of the social innovations, around 29.32% of the innovations

were coded as 'noble idea and development, new technology and innovation are recorded to be 9.82%, opportunities with limited resources 7.85% and sustainable development 7.87%. Thus, it is imperative to note that most innovations were new and represented new thoughts and ideas. The innovations were implemented with new and latest technologies and developed using optimum resources. Further, all the innovations were helping the country in sustainable development and in improving the quality of community life in these crisis times.

The study attempted to develop a measurement to understand the perception of social innovation using Maxqda software designed and developed for analyzing qualitative and quantitative data. The social innovation tendencies were constructed after an extensive literature review. To do this, an in-depth literature review was done considering the available definitions and propositions. Initially, 24 factors were identified and finally, nine factors were retained by considering the views of a group of competent experts' opinions from the areas of management, managers from organizations, technology management and sociology.

Social innovations mostly find proper solutions to people's daily life problems. Their importance is very much felt at an individual, organizational and societal level. There is no unique solution for complex social issues, so an innovative solution is necessary to solve these problems.

Social innovations are for the development and application of novel activities, initiatives, services, processes and the development of goods intended to deal with social and economic problems faced by individuals and society. It's a new social order that changes joint or individual relations. At the micro-level, social innovations satisfy social needs by improving the current living standards, the ability of the individuals/groups and enhancing the production capacity of an organization. On the macro level, it brings a change in society, eradicating inequalities and offering sustainable development. Social innovations are done to satisfy a need and to provide an effective solution, and the solution benefits individuals, organizations and society.

Social systems improve through supportive social innovations and it is not only related to individuals or organizations or society; all society stakeholders such as politicians, governments, markets and even academics are mediators of social innovations. As time demands, we find many social innovations in businesses and every aspect of social life. Like in the present social disruption due to COVID-19, we see many social innovations to restore the day-to-day life of the common people. Here, we can note some of the earlier social innovations in the health sector such as the algorithm that can prevent the spread of HIV among homeless youths, the life-saving device that can seal a wound in under a minute, Wheelmap: Easy access to public places, Home Care: E-home Project, and so on. Social innovations must be given due attention because the obstructions to stable growth can only be overcome through them. It is, therefore, in this article, we have investigated the role of social innovations that have taken place during COVID-19 for the betterment of society.

Appendix 1. Social Innovations and Categorizations on Major Factors Indicated.

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
Remote-controlled trolley	'The unique trolley is a new idea.'	Noble Idea Development
	'The trolley contains two shelves for various items to carry.'	New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources
	'This item helps to reduce the risk of containment and infection of a deadly virus.'	Noble Idea Development, Standard of Human Life, Sustainable Development
	'This trolley is user-friendly. The patients can easily use it for pick-up of various needs from the tray as and when needed.'	New Technology and Innovation, Noble Idea Development, Standard of Human Life, Sustainable Development
	'This trolley is inhouse manufacturing with all sophisticated devices which ease the facility for communication and with a remote camera.'	Noble Idea Development, Opportunities with Limited Resources
	'This trolley is now being used in various hospitals and quarantine centres in India.'	Noble Idea Development, Opportunities with Limited Resources, Social Formation and Participation, Sustainable Development
Contactless sanitizer dispenser	'Mist-based contactless hand sanitizer dispenser.'	Noble Idea Development, Opportunities with Limited Resources, Sustainable Development
	'This machine-generated High-pressure droplet can penetrate both skin pores and under the nail tips.'	New Technology and Innovation, Noble Idea Development
	'The objective is to meet the requirement of the medical fraternity as well as the general public at offices, factories, colleges, public places, and homes this machine has come to use.'	Noble Idea Development, Opportunities with Limited Resources, Standard of Human Life, Sustainable Development
	'Unlike other devices that are timer-based and dispense a fixed amount of sanitizer, this sanitizer is atomized to spray as long as users keep their hands below the delivery nozzle. On 11 May 2020, it is handed over to two senior doctors at the PGIMER who are handling COVID-19 patients.'	New Technology and Innovation, Noble Idea Development, Standard of Human Life
	'The optimization has been undertaken by the Chandigarh-based Terminal Ballistics Research Laboratory (TBRL) in collaboration with the local industry.'	Noble Idea Development, Social Formation and Participation
	'It is based on water mist aerator technology, which was developed from water conservation.'	Noble Idea Development, Opportunities with Limited Resources
	'The Odisha's government initiates to install this machine across its offices, healthcare facilities, and secretaries.'	Noble Idea Development, Sustainable Development
	'This machine uses an ultrasonic sensor for contactless operation.'	Noble Idea Development
	'This machine was developed by CT University (CTU), Ludhiana, under the flagship of the research and innovation centre for excellence (RICE).'	New Technology and Innovation, Noble Idea Development
	'This device is operated with the Infra-Red hand sensor and accurate amount of sanitizer nozzle down a fine mist of sanitizer over the hands uniformly and consumes five times lesser sanitizer than the manual one. The device can be installed in various schools, universities and shopping malls where the public crowd is more.'	Noble Idea Development, Social Formation and Participation, Standard of Human Life, Sustainable Development

(Appendix 1 continued)

(Appendix 1 continued)

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
	'This device operates with an Infra-Red Sensor having a capacity of 2.5 liters and IR sensor operates with a miniature pump.'	New Technology and Innovation, Noble Idea Development
	'As prevention is the best cure for COVID-19, Railway Workshop has taken various initiatives for the safety of their workers until the development of the vaccine for COVID.'	Noble Idea Development, Opportunities with Limited Resources
	'To make a cost-effective foot-operated hand sanitizer, they have used available scrap materials like PVC pipes. The foot-operated hand sanitizer dispenser was developed by techies at Technopark. When anyone presses the foot pedal, with the help of spring action the bottle dispenses the liquid. The device is effective in public places and in companies where a large number of workers are employed. The production of one unit costs less than ₹500.'	New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources, Social Formation and Participation, Standard of Human Life, Sustainable Development
	'Contactless hand sanitizer.'	Noble Idea Development
	'The device has a capacity of 5-litre fluid with an adjustable discharge rate of 1.25 ml–2.5 ml as recommended.'	New Technology and Innovation, Noble Idea Development
	'It automatically dispenses when one places the hand below it.'	Noble Idea Development
	'About 75 dispensers have been manufactured which are supplied to companies located in Verna Industrial estates, local hospitals, the health department and 2 units donated to GMC for the OPD section.'	Noble Idea Development, Standard of Human Life, Sustainable Development
	'Automatic mist based sanitiser dispensing unit.'	Noble Idea Development
	'For sanitization of hands, while entering the buildings/office complexes contactless sanitizer dispensers are used that spray alcohol-based hand rub sanitizer solution.'	New Technology and Innovation, Noble Idea Development
	'It is based on water mist aerator technology, which was developed for water conservation.'	Noble Idea Development, Opportunities with Limited Resources
	'By the use of an atomizer, in one operation only 5 ml–6 ml sanitizer for 12 sec is discharged over both the palms so that the disinfection process can be completed.'	New Technology and Innovation, Noble Idea Development
Ultraviolet C light-based sanitization box	'Defence Research Ultraviolet Sanitizer (Druvs) was developed by DRDO.'	New Technology and Innovation, Noble Idea Development
	'This is a touch-free automatic operation.'	New Technology and Innovation, Noble Idea Development
	'This machine is used to sanitize objects without using chemicals.'	Noble Idea Development, Opportunities with Limited Resources
	'Automated luggage disinfector using UV-bath also developed by DRDO.'	Noble Idea Development
	'This machine uses a type of UV that is used for the purpose is Far-UVC, which is effective against Coronavirus.'	New Technology and Innovation, Noble Idea Development
	'The main objective of this machine is to disinfect the baggage or other objects.'	Noble Idea Development

(Appendix 1 continued)

(Appendix 1 continued)

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
	'The mechanism of this machine consists of a roller-based conveyor carriage moving inside a chamber which is configured with a UV bath of calibrated dosage. For sanitization of luggage, this machine can be used which are entering the campus of industrial establishments/defence units, etc.'	New Technology and Innovation, Noble Idea Development, Sustainable Development
	'The same system is planned to be used for the disinfection of items being carried onto naval ships and submarines.'	Noble Idea Development
Corona Kavacha	'Corona Kavach'	Noble Idea Development
	'The Corona Kavach is different from MeitY's COVID-19 feedback app. While the former has been designed to capture the outbreak, the latter collects feedback on any treatment undergone by individuals.'	New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources
	'The app uses a person's location to assess whether they are in the high-risk geographical zone or not.'	New Technology and Innovation, Noble Idea Development
	'It is developed by the National e-Governance Division of the Ministry of Electronics and Information Technology (MeitY) in association with the Ministry of Health and Family Welfare (MHFW).'	Noble Idea Development, Social Formation and Participation, Sustainable Development
	'Corona Kavach is designed to provide information about COVID-19 and capture information.'	Noble Idea Development
	'Corona Kavacha lets any person know if and when he/she comes into contact with someone who is already been infected by the virus by offering a one-hour location tracking window to keep a check on the surroundings.'	Noble Idea Development, Quality of Community Life
	'The data collected by this app will be useful to perform analysis and provide reliable information about the active COVID-19 cases in India. Moreover, Additional features are also added that will track a person's breathing capacity and a survey form to keep a self-check.'	Noble Idea Development, Quality of Community Life, Sustainable Development
	'The app also uses colour codes to figure out whether the user has come in contact with a COVID-19 carrier or not. While one colour will identify a user who has never come in contact with an infected person, another will indicate if a user is nearby.'	Change in Social Norms and Values, Development of Healthy Economy, Noble Idea Development
	'This app will track the data of the users every hour to alert them of whether they have crossed paths with any person who has tested positive for the infection.'	Change in Social Norms and Values, Development of Healthy Economy, New Technology and Innovation, Noble Idea Development, Quality of Community Life
Whatsapp chatbot for Coronavirus	'MyGov Corona Help the official WhatsApp chatbot desk.'	Noble Idea Development
	'Within the first week of its launch, it processed over 1.4 crore conversations from users across the country.'	Development of Healthy Economy, Noble Idea Development, Quality of Community Life, Standard of Human Life, Sustainable Development

(Appendix 1 continued)

(Appendix 1 continued)

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
	'This app is designed to serve information about the disease that is believed to be caused by the Novel Coronavirus (known as SARS-CoV-2).'	Noble Idea Development, Opportunities with Limited Resources, Social Formation and Participation
	'Users can begin with the MyGov Corona Helpdesk by simply saving the number—9013151515 in their contact list and then send a message to the chatbot. For userfriendly conversation, there is a direct link to the chatbot that uses machine learning and artificial intelligence (AI) algorithms to provide a set of information.'	New Technology and Innovation, Noble Idea Development
	'This app highlights various ways to spread social awareness to fight COVID-19.'	Noble Idea Development, Quality of Community Life, Standard of Human Life, Sustainable Development
	'Initially, the MyGov Corona Helpdesk was launched in English, though the government expanded its scope by bringing support for Hindi.'	Noble Idea Development, Standard of Human Life, Sustainable Development
	'The main objective of this app is to eradicate fake news and spread awareness about COVID-19.'	Noble Idea Development, Sustainable Development
	'The chatbot does provide access to state and language-specific chatbots offered by the Gujarat, Maharashtra, Karnataka, and Kerala governments.'	Noble Idea Development, Social Formation and Participation, Standard of Human Life, Sustainable Development
	'It crosses 1.7 crore users in 10 days of launch.'	Noble Idea Development, Social Formation and Participation, Standard of Human Life, Sustainable Development
	'The MyGov chatbot on WhatsApp provides details about the COVID-19 symptoms, professional advice from AIIMS Director, and basic knowledge about the coronavirus outbreak. It also includes the helpline number and email ID assigned by the government about the pandemic.'	New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources
Coronavirus disinfectant tunnel	'Techno advanced disinfectant tunnel.'	New Technology and Innovation, Noble Idea Development
	'The tunnel operated with the help of ultrasonic sensors and microcontrollers. It has three different levels of disinfection with two chambers.'	New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources
	'The main objective is to maintain effective sanitization.'	Noble Idea Development
	'IIT Kanpur's Technopark and Artificial Limbs Manufacturing Corporation of India (ALIMCO) have collectively developed.'	Noble Idea Development, Standard of Human Life
	'The mechanism is to spray ionized liquid disinfectant over a person in the 1st stage of the process. The liquid evenly distributes on the skin of the person and as compared to other normal disinfectants it can neutralize the virus from the surface more effectively.'	Noble Idea Development, Social Formation and Participation
	'In the 2nd chamber, the person encounters a hot air blast of 70-degree centigrade and this is to make sure that any bacteria that survived in the 1st stage would be killed. Then the person is exposed to UVC light with a wavelength ranging from 207 nm to 222 nm. This light can kill the virus and is safe for human eyes and skin.'	Noble Idea Development, Quality of Community Life, Standard of Human Life, Sustainable Development

(Appendix 1 continued)

(Appendix 1 continued)

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
	'This tunnel had been constructed to be used in areas where there is a high flow of people such as airports, bus stations, and even schools.'	New Technology and Innovation, Noble Idea Development, Social Formation and Participation
	'The innovators are planning to add a feature like the thermal camera to this tunnel which will help in recording the temperature of the person before they entered into the tunnel.'	Noble Idea Development
	'Disinfectant tunnel'	Noble Idea Development
	'The disinfectant was prepared to sanitize people within 20 seconds from any possible bacteria.'	Noble Idea Development, Opportunities with Limited Resources
	'The disinfectant consists of a combination of a water-soluble polymer and iodine. The solution is known to be effective against SARS, MERS, and Ebola viruses.'	New Technology and Innovation, Noble Idea Development
	'The tunnel has been designed to provide maximum protection in around 20 seconds.'	Noble Idea Development, Standard of Human Life, Sustainable Development
	'The automatic disinfection tunnel.'	New Technology and Innovation, Noble Idea Development
	'This tunnel is completely automatic and contactless. It has a sensor-based automatic hand sanitizer inside it and also records the temperature of every person walking in.'	New Technology and Innovation, Noble Idea Development
	'The sole purpose of this tunnel is to control the spread of the novel coronavirus.'	Noble Idea Development, Opportunities with Limited Resources
	'This system would help the individual to get disinfected up to 95% and the possibility of a virus staying alive on the surface.'	Noble Idea Development, Quality of Community Life, Standard of Human Life, Sustainable Development
	'Disinfection tunnel'	Noble Idea Development
	'The tunnel was built at a cost of around ₹90,000 and with a capacity of 1,000 litres, it will work uninterrupted for 16 hours.'	Noble Idea Development, Opportunities with Limited Resources, Social Formation and Participation
	'The objective is to maintain proper hygiene to protect yourself in a crowded place.'	Noble Idea Development, Quality of Community Life, Sustainable Development
	'The idea was generated by—D.Venkatesh, who owns a water treatment company in Tirupur, Tamil Nadu.'	Noble Idea Development, Social Formation and Participation
	'The Corona Disinfectant Tunnel is portable, with a 16-feet stainless steel structure fitted in a mild steel frame.'	New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources
	'Later—the tunnel was set up by the District Administration in collaboration with Young Indians.'	Noble Idea Development, Social Formation and Participation
Microbiome test	'This is a rapid home testing kit for COVID-19.'	Noble Idea Development
	'It displays accurate results within minutes.'	Noble Idea Development, Opportunities with Limited Resources
	'After receiving the kit, the user has to clean their finger with an alcohol swab and use the lancet provided to finger-prick. The cartridge provided reads the results from the blood sample thus obtained, within 5–10 minutes.'	New Technology and Innovation, Noble Idea Development
	'The COVID-19 screening test kit is an IgG and IgM-based tool that delivers results in 5–10 minutes.'	Noble Idea Development, Opportunities with Limited Resources

(Appendix 1 continued)

(Appendix 1 continued)

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
	'The Indian Council of Medical Research (ICMR) approved this kit and after proper quality checks and assurance, it will be deployed in the market.'	Noble Idea Development, Social Formation and Participation, Sustainable Development
	'This kit is easy to use and presents accurate results within minutes. The kit, priced between ₹2,000 and ₹3,000 is cost-effective.'	Noble Idea Development, Opportunities with Limited Resources, Standard of Human Life, Sustainable Development
Automatic mask machines	'Production and use of this machine are to overcome the shortage of N-95 masks and make India Self-Reliance.'	Noble Idea Development, Opportunities with Limited Resources, Sustainable Development
	'Pelican Rotoflex of Rajkot-based industry has developed one of its kind fully-automatic machines.'	New Technology and Innovation, Noble Idea Development
	'Various technologies such as metallurgy, new generation electronics from Siemens, pneumatics, web handling, forming/folding/welding were used and these all are within its in-house Research and development facility.'	New Technology and Innovation, Noble Idea Development, Social Formation and Participation
	'The Pelican industry is targeting to manufacture over 100,000 high-quality N-95 masks per day very soon.'	Development of Healthy Economy, Noble Idea Development, Opportunities with Limited Resources
	'They have a plan to bring the cost down from ₹200 to ₹70 with mass production.'	Development of Healthy Economy, Noble Idea Development, Opportunities with Limited Resources
	'Capacity-25,000 N95 masks per day, without human touch.'	New Technology and Innovation, Noble Idea Development
	'For making this purposeful there is great support from the Indian Government and active personal encouragement of the Hon'ble Chief Minister of Gujarat, Vijaybhai Rupani.'	Noble Idea Development, Opportunities with Limited Resources, Standard of Human Life, Sustainable Development
	'For filtration the N95 masks are made of multiple fabric layers, welded together, a nose wire/metal strip inserted, ties for ear loops welded automatically, and folded in a manner that gives a good facial fit.'	New Technology and Innovation, Noble Idea Development
	'The cost is expected to be 40% cheaper.'	Development of Healthy Economy, Noble Idea Development, Standard of Human Life
	'To make India self-reliant and to fight the shortage of N-95 masks in India and to eliminate the import of special automatic machines and their parts from China, this initiative shows a broader way.'	Noble Idea Development, Opportunities with Limited Resources, Sustainable Development
Covisafe	'COVISAFE is a transparent airtight box within which COVID-19 positive patients can be transported from one place to another.'	New Technology and Innovation, Noble Idea Development
	'It's objective is to save the doctors or the medical staff from being infected.'	Noble Idea Development, Standard of Human Life, Sustainable Development
	'This box has various facilities like it fits well on medical stretchers and is completely airtight and Emergency facilities like oxygen and ventilators can be easily installed on the box. Most importantly, when the coronavirus patient breathes, the air that comes out of the box is filtered.'	Development of Healthy Economy, New Technology and Innovation, Noble Idea Development

(Appendix 1 continued)

(Appendix 1 continued)

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
Feet-operated handwash machine and advanced washbasin	'This is a pedal-operated liquid soap and water dispenser machine.'	New Technology and Innovation, Noble Idea Development
	'It has a 500-litre water tank and 5-litre container for liquid handwash.'	New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources
	'This machine was developed for Karimnagar municipal corporation sanitation workers and other visiting people for a simple hands-free washing station.'	Noble Idea Development, Quality of Community Life, Standard of Human Life, Sustainable Development
	'Telangana man develop (name—Mupparapu Raju's) and he runs a shop selling street lighting devices.'	New Technology and Innovation, Noble Idea Development, Quality of Community Life
	'The mechanism of this machine depends on the two pedals which are fixed on an iron frame and these pedals are connected to the taps using clutch cables used in the bike.'	New Technology and Innovation, Noble Idea Development
	'The developer of this machine Mr Raju has built 10 such machines which are presently installed outside offices of district collectors, municipal corporation, municipality offices, and police checkpoints.'	Change in Social Norms and Values, New Technology and Innovation, Noble Idea Development, Sustainable Development
	'The first such machine was installed outside the Karimnagar municipal corporation office.'	Noble Idea Development, Quality of Community Life, Sustainable Development
	'Mr Raju also had built a disinfectant or pesticide sprayer that uses solar energy for usage by sanitation staff and farmers.'	Noble Idea Development, Quality of Community Life, Sustainable Development
Jeeva Setu ventilators	'This machine is expected to deliver 500 ml –600 ml of air per breath and 15–18 breaths per minute, as specified for COVID-19 patients.'	New Technology and Innovation, Noble Idea Development
	'Objective to produce such ventilators is to fulfil the shortage of ventilators in the country with the solution of an affordable medical ventilator.'	Noble Idea Development, Opportunities with Limited Resources, Quality of Community Life, Sustainable Development
	'It is a low-cost portable ventilator for COVID-19 patients.'	New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources
	'It is the first emergency ventilator developed by an engineering institute under the Kerala Technological University (KTU).'	Noble Idea Development
	'The product generates a visual and audio alarm system for low supply pressure, airway pressure, leakage detection, power failure, and low battery indication.'	New Technology and Innovation, Noble Idea Development
	'It includes all technical specifications like pressure monitoring, volume control, airflow monitoring, and backup battery mechanisms.'	New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources
	'Now it is handed over to General Hospital, Ernakulam, on 11 April 2020.'	Noble Idea Development, Quality of Community Life, Sustainable Development
Low-cost PPEs the Navy's innovation	'Low-cost PPEs have been patented by the Intellectual Property Facilitation Cell (IPFC) of Min of Defence, in association with National Research Development Corporation (NRDC), an enterprise under Min of Science and Technology.'	Noble Idea Development, Quality of Community Life
	'An introductory batch of PPEs has already been produced at Naval Dockyard in Mumbai.'	Noble Idea Development, Opportunities with Limited Resources

(Appendix 1 continued)

(Appendix 1 continued)

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
	'It's the main objective is to endow our front-line health care professionals with comfortable PPEs.'	Noble Idea Development, Quality of Community Life, Sustainable Development
	'The developed PPE by the Indian Navy is made out of special fabric that allows a high level of protection with high breathability against other normal PPEs available in the market. For this reason, it is more suitable for the hot and humid weather conditions that prevailed in India. The technology has also been tested and validated by the ICMR-approved Testing Lab.'	New Technology and Innovation, Noble Idea Development
	'A team of Innovators from the Navy is working in close coordination with IPFC which was set up under Mission Raksha Gyan Shakti.'	Noble Idea Development, Social Formation and Participation
	'For the mass production of this low-cost PPE, efforts are now ongoing by a core team of Navy, IPFC, and NRDC.'	Development of Healthy Economy, Noble Idea Development, Quality of Community Life, Social Formation and Participation
Ruhdaar the low-cost frugal innovator	'The developer of this machine will not charge any royalty for the product.'	Change in Social Norms and Values, Noble Idea Development, Sustainable Development
	'The developers have been taking assistance from the Design Innovation Centre (DIC) at IUST, using locally available materials the team has been able to design a low-cost ventilator.'	Noble Idea Development, Opportunities with Limited Resources
	'Their idea was to design and develop a low-cost alternative to a conventional ventilator.'	New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources
	'A team of engineering students from IIT Bombay, NIT Srinagar and Islamic University of Science and Technology (IUST), Awantipora, Pulwama, Jammu, and Kashmir.'	Change in Social Norms and Values, Noble Idea Development
	'Their team has tested the machine with the basic parameters such as tidal volume, Breaths per Minute, and Inspiratory: Expiratory Ratio which are successful and it also designs to monitor pressure continuously during its operation.'	Development of Healthy Economy, Noble Idea Development, Sustainable Development
	'Rudhaar has the calibre to provide necessary facilities like adequate breathing support to save the life of a critically ill COVID-19 patient. For the necessity of the situation, the team will now go for medical testing of the prototype. Once it will approve, then it will be taken for mass production by the small-scale industry for the betterment of this industry.'	Development of Healthy Economy, New Technology and Innovation, Noble Idea Development, Quality of Community Life
Safe swab phonebooth testing	'Safe swab: Phonebooth testing.'	Noble Idea Development
	'The authorities are hoping to be able to test around 10,000 samples a week with the introduction of the booths.'	Noble Idea Development, Opportunities with Limited Resources
	'Efforts are made to protect health care workers.'	Noble Idea Development, Quality of Community Life, Standard of Human Life, Sustainable Development
	'They have installed a plasma air sterilizer which will purify the air inside and kill the virus.'	New Technology and Innovation, Noble Idea Development, Sustainable Development

(Appendix 1 continued)

(Appendix 1 continued)

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
	'The booth will not only save time but protect health care workers as well who collect swabs.'	Noble Idea Development, Opportunities with Limited Resources
	'This booth is different from the South Korean booth. This booth facilitates the doctors to stand inside it and collects the samples. So there is no need to disinfect the booth after every swab collection as it takes very few minutes to collect the swab.'	Development of Healthy Economy, New Technology and Innovation, Noble Idea Development, Quality of Community Life
	'This has been designed such that it can withstand the monsoon too.'	Noble Idea Development
	'After installing the booth at Kasturba Hospital, they are planning to install it at KEM Hospital and Seven Hills Hospital.'	Noble Idea Development, Social Formation and Participation
	'Even if there is a shortage of PPEs, doctors can still stand inside the booth and collect samples.'	Noble Idea Development, Opportunities with Limited Resources
Sanitizer tunnels	'Jugaad Road Sprayers, Disinfectant Tunnels.'	Noble Idea Development
	'This tunnel has been assembled at the municipal corporation's workshop with the help of workers who assembled decontamination tunnels and converted small vehicles into boom sprayers to sanitize roads.'	Noble Idea Development, Opportunities with Limited Resources
	'It is developed by the municipal corporation's workshop, Srinagar, J and K.'	Noble Idea Development, Social Formation and Participation
	'They are installing them in hospitals and public places to contain the spread of COVID-19 in Srinagar after fabricating 100 decontamination and sanitization tunnels.'	Noble Idea Development, Opportunities with Limited Resources
	'It's cost-effective as it does not take much to fabricate a tunnel.'	Noble Idea Development, Opportunities with Limited Resources
	'It cost them ₹20,000 for each installation, the decontamination tunnels are priced well.'	Development of Healthy Economy, Noble Idea Development
	'The Srinagar civic body has installed decontamination tunnels at hospitals that have been declared as COVID-19 treatment centres.'	Noble Idea Development, Social Formation and Participation
	'The tunnel has three nozzles that spray one part per million sodium hypochlorite solution for the three to five seconds that people take to pass through it. It has a tank capacity of 500 litres, which allows it to work non-stop for over 15 hours.'	Noble Idea Development, Opportunities with Limited Resources
	'Indian Railways loco shed in Maharashtra's Bhusaval.'	Noble Idea Development, Social Formation and Participation
	'Vehicle sanitization tunnel.'	Noble Idea Development
	'The state's first vehicle sanitization tunnel was installed at the Gobindghat inter-state barrier in Paonta Sahib in Sirmaur district, Himachal Pradesh.'	Noble Idea Development, Sustainable Development
	'The main objective of this vehicle tunnel is to disinfect the vehicle like trucks as they are travelling across the states.'	Noble Idea Development, Social Formation and Participation
	'A tunnel is 20 feet high, 16 feet wide, and 20 feet long where even large vehicles can enter after going through the instructions displayed there.'	New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources
	'The vehicles carrying food, vegetables, etc, will be sanitized only through the sides while others will be sanitized from the top as well.'	New Technology and Innovation, Noble Idea Development

(Appendix 1 continued)

(Appendix 1 continued)

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
	'It is India's first organic disinfectant tunnel on the main road of Gowribidanur town.'	Noble Idea Development, Opportunities with Limited Resources
	'It is the first of its kind tunnel that uses an organic fumigant instead of Sodium Hypochlorite, is 20 feet high, and was completed with polythene sheets.'	New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources
Qkopy	'This app is launched by the Kerala Government with a partnership with QKopy online, which will help to share all the updated data related to Coronavirus or COVID-19 around the state.'	Noble Idea Development
	'It sends COVID-19 updates and travel information via phone notifications, and SMS to older phones as less than half of India's population have no smartphones. These messages are delivered both in English and in Malayalam, the local language.'	New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources, Sustainable Development
	'The app will focus on general announcements, information, and updated guidelines for travellers, details about the quarantine protocol, and also health and safety tips for visitors to the state.'	Change in Social Norms and Values, New Technology and Innovation, Noble Idea Development, Standard of Human Life, Sustainable Development
	'Within a day of the launch of this service, the State Government was able to disseminate authentic updates and instructions to over two lakh people instantly.'	Change in Social Norms and Values, New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources, Quality of Community Life
Marutdrone Tech	'Marut Dronetech Private Limited, a startup, founded by IIT Guwahati alumni has developed and deployed drones.'	New Technology and Innovation, Noble Idea Development
	'This drone is equipped with Disinfectant spray to prevent the virus from transmission or re-emergence from contaminated areas.'	New Technology and Innovation, Noble Idea Development, Quality of Community Life, Standard of Human Life
	'Its objective is to disinfect the public spaces to prevent Coronavirus.'	Change in Social Norms and Values, New Technology and Innovation, Noble Idea Development
	'Marut has covered eight districts, across Telangana State.'	Noble Idea Development, Quality of Community Life, Sustainable Development
	'Drones are fitted with cameras and speakers.'	New Technology and Innovation, Noble Idea Development
	'This drone Successfully disinfected 1900 km, using 9800 litres of chemical spanning.'	New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources, Standard of Human Life
	'Drones are calibrated with infrared cameras that will test temperature measurements.'	New Technology and Innovation, Noble Idea Development
	'Marut has also operated in other border districts with the help of Trichy Municipal Corporation and Andhra Pradesh Govt.'	Development of Healthy Economy, Noble Idea Development, Quality of Community Life
	'With a capacity of 15 drones and 18 pilots, Marut drones help attack the COVID-19 spread, 5 times faster than human methods!'	Noble Idea Development, Opportunities with Limited Resources, Quality of Community Life
	'Drone Patrol Teams can keep a track of people through installed cameras on drones.'	Noble Idea Development, Standard of Human Life

(Appendix 1 continued)

(Appendix 1 continued)

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
Breakcorona and coronasafe-network	'On behalf of the Kerala Government, Kerala Set-up Mission has called for innovative ideas and solutions to defeat the Global Pandemic.'	New Technology and Innovation, Noble Idea Development
	'The initial step of CoronaSafe Network is to develop and spread awareness and take precautions to bust fake news and myths.'	Development of Healthy Economy, Noble Idea Development, Quality of Community Life
	'By seeking ideas and solutions from proven sources, it has the potential for usage in the fight against CoronaVirus.'	Noble Idea Development, Opportunities with Limited Resources, Sustainable Development
	'The CoronaSafe Network portal also gives real-time updates on COVID-19 cases and also guides directions to the test centres. The page provides links to a list of leading media houses covering news on the topic.'	Development of Healthy Economy, New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources
	'When you zoom in to a state, it shows more detailed information on cases, including-Observation of the Total number of patients Hospitalized patients, Home Isolation Patients, Total number of confirmed cases, Patients cured or discharged and number of Deaths.'	Change in Social Norms and Values, Noble Idea Development, Standard of Human Life
Infection-proof fabric	'The "infection-proof fabric" is developed by The Indian Institute of Technology (IIT) and to be used at hospitals to prevent hospital-acquired infections (HAIs).'	New Technology and Innovation, Noble Idea Development
	'The main objective for the development of this type of fabric is to build up an affordable, novel textile-processing technology, which converts regular cotton fabric into the infection-proof fabric.'	New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources
	'There is financial support by the Department of Science and Technology, Ministry of Human Resource Development, IIT Delhi and Department of Biotechnology in the form of grants and fellowships.'	Development of Healthy Economy, Noble Idea Development
	'They are currently in the process of conducting large-scale manufacturing trials in the Delhi-NCR region. They have collaborated with AIIMS, Delhi to pilot their products.'	Development of Healthy Economy, Noble Idea Development, Quality of Community Life
	'They are also in early talks with some of the largest hospital chains in India for further pilots and strategic collaborations.'	Noble Idea Development, Quality of Community Life, Standard of Human Life, Sustainable Development
Digital stethoscope	'At IIT Bombay an innovative module was developed which converts conventional stethoscopes into digital ones.'	New Technology and Innovation, Noble Idea Development
	'Any conventional stethoscope can be converted into digital one by attaching AyuSynk to it and this will amplify chest sounds and send them wirelessly from patients to doctors without physical tubing.'	New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources
	'The basic version of the digital stethoscope can also be connected to mobile or laptop through a wire or via Bluetooth.'	New Technology and Innovation, Noble Idea Development
	'Some digital stethoscopes have been delivered to KEM Hospital in Mumbai by the Ayu Devices team.'	Development of Healthy Economy, Noble Idea Development, Quality of Community Life, Standard of Human Life, Sustainable Development
	'Apollo Hospital in Hyderabad has also requested the device.'	Noble Idea Development, Quality of Community Life

(Appendix 1 continued)

(Appendix 1 continued)

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
	'Over 1,000 units of the digital stethoscope are currently in use across the country, many of them in primary health centres and telemedicine companies.'	Noble Idea Development, Quality of Community Life, Standard of Human Life, Sustainable Development
Nocca robotics, aerobiosis innovations, Agva healthcare	'IIT Kanpur with start-up Nocca Robotics has developed a customized ICU—grade ventilator for handling coronavirus patients.'	Noble Idea Development
	'Nocca Robotics has also collaborated with Indian medical device makers Avi Healthcare and Polybond for the manufacturing of ventilators.'	Noble Idea Development, Social Formation and Participation
	'The main focus of this start-up is to minimize the risk of death due to a shortage of ventilators in ICU.'	Change in Social Norms and Values, Noble Idea Development
	'It comes under Make in India initiatives.'	Change in Social Norms and Values, Noble Idea Development
	'These ventilators will go through UL and TUV tests. As it is a piece of critical medical equipment, testing and strong standards are of paramount importance.'	Noble Idea Development, Social Formation and Participation, Standard of Human Life, Sustainable Development
	'Tender given to AgVa Healthcare in Noida to manufacture 10,000 ventilators in a month, by the end of May by the Indian Govt.'	New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources
	'They are giving importance to develope a portable, low-cost ventilator, which will enable patients to take the ventilator home with ease.'	Development of Healthy Economy, Noble Idea Development, Opportunities with Limited Resources
	'To date, around 600 AgVa ventilators have been installed in hospitals pan India and they also have a good presence in Tier-II and III cities.'	Development of Healthy Economy, Noble Idea Development, Standard of Human Life, Sustainable Development
KlinicApp and practo	'Founded on 15 December 2015 (E-diagnostic firm).'	Noble Idea Development
	'Each 'SARS-COV-2 Detection' package costs ₹4,500 as per the Indian Council of Medical Research guidelines, and results are made available in 48 hours.'	Development of Healthy Economy, Noble Idea Development
	'KlinicApp is focused on scaling up its capacity in all major cities, to a sufficient number of tests per day.'	Noble Idea Development, Quality of Community Life
	'KlinicApp has deployed 100 phlebotomists on the ground for collecting samples in Mumbai. They are trained as per ICMR guidelines and are equipped with disposable safety suits (PPEs) and other adequate gear.'	Noble Idea Development, Social Formation and Participation
	'KlinicApp is now doing the home test for coronavirus (COVID19) in Mumbai. The service is being provided in tie-ups with government-approved labs like Thyrocare and Metropolis.'	Development of Healthy Economy, Noble Idea Development
	'The tests are done only on doctor's prescriptions.'	Noble Idea Development, Standard of Human Life
	'KlinicApp has launched doorstep COVID-19 testing in Mumbai and plans to extend the services in Pune and Delhi in a week.'	Noble Idea Development, Opportunities with Limited Resources
	'Digital healthcare platform Practo has tied with private lab chain Thyrocare to carry out COVID-19 detection tests for ₹4,500.'	Noble Idea Development, Sustainable Development
	'Their personnel will collect the samples from the patient's homes directly and within 48 hrs, the test result will be made available on the Practo website.'	Noble Idea Development, Opportunities with Limited Resources

(Appendix 1 continued)

(Appendix 1 continued)

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
	'The service is already available in Mumbai and Pune and will be extended to other cities soon.'	Noble Idea Development, Sustainable Development
Aarogyasetu	'The Government of India launched the Aarogya Setu mobile App on 02 April 2020.'	Noble Idea Development
	'The mechanism used in this app is a BlueTooth-based contact tracing. It records details of all the people who have come in contact with you in your routine activities. If anyone of your contacts tests positive, the application will alert you.'	New Technology and Innovation, Noble Idea Development
	'The main purpose is to protect Indian citizens from mass spread coronavirus.'	Noble Idea Development, Standard of Human Life, Sustainable Development
	'The App is available in 12 languages and on Android, iOS, and KaiOS platforms.'	Noble Idea Development, Sustainable Development
	'Many food-delivery services, Urban Company (Service provided app) have mandated the use of the Aarogya Setu app for their personnel.'	Noble Idea Development, Quality of Community Life
	'It provides a list of ICMR-approved laboratories with a COVID-19 testing facility. It gives state-wise figures of confirmed, recovered, and deceased COVID-19 cases in the country.'	Noble Idea Development, Social Formation and Participation
	'The Central Industrial Security Force (CISF) is planning to include the app in their standard operating procedure (SOP).'	Noble Idea Development, Sustainable Development
Asimov robotics	'An autonomous robot donated to the COVID-19 ward of the Ernakulam government medical college hospital by Malayalam actor Mohanlal's Viswasanthi Foundation.'	Noble Idea Development, Social Formation and Participation
	'The robot can carry a payload of up to 25 kg and is capable of achieving a maximum speed of 1m per sec.'	New Technology and Innovation, Noble Idea Development
	'The purpose of this project is to reduce the interaction between COVID-19 patients and health workers by serving food and medicines as well as to address the shortage of PPE kits.'	Noble Idea Development, Standard of Human Life
	'The KARMI-Bot is not a standalone product. The operation of this Robotics is depending upon the distributed sensor network. It uses AI (Artificial Intelligence) and ML (Machine Learning) as well to come to a decision and on this basis, it responds and operates.'	Noble Idea Development
	'It is a Make In India initiative.'	Noble Idea Development
	'KARMI-Bot urges the patient to press the 'Go' button following which it moves to the next patient. "If a patient doesn't press the button within 30 seconds, then the KARMI-Bot will automatically move to the next patient in line.'	Noble Idea Development, Opportunities with Limited Resources

(Appendix 1 continued)

(Appendix 1 continued)

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
	'The aim was to create a cost-effective model of a robot.'	Development of Healthy Economy, Noble Idea Development
	'It can perform all the duties of nurses and sanitation workers inside the isolation wards, verbally converse with the patients, hand over food and medicines, and connect them with the doctors via video calls if they wish to speak.'	Noble Idea Development, Opportunities with Limited Resources
	'The robot is developed by ASIMOV robotics, a company working under maker village of Kerala start-up mission.'	Noble Idea Development

Source: Researcher's results.

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Article

Influence of Personality Type on Investment Preference and Perceived Success as an Investor

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Aniruddha S. Rao[1] and Savitha G. Lakkol[2]

Abstract

Over the last two decades, the behavioural finance literature has extensively relied on personality type to explain the non-rational behaviour of investors. This study considers Dark triad (Machiavellianism, narcissism and psychopathy) to explain its influences on investment preference and perceived success in investment. A primary survey was conducted on 227 individuals who invest in securities. Dark triad was measured using 27 items Short Triad Scale (SD3). The data were analyzed using multinomial logistic regression. The investment preference was evaluated by asking the respondents about their preferred investment avenues, individuals were asked how they evaluate their investment success. Personality variables were grouped into high, average and low based on the mean responses to the items under each variable. The results of the study indicate that individuals with low and average levels of psychopathy and low-level narcissism preferred investing only in mutual funds, bonds and equity. It was also found that Machiavellianism, narcissism, psychopathy and dark triad, all have a significant impact on investment preference. The dark triad also significantly impacted success, especially for those individuals who perceived their investment strategy as 'Very Successful'. This study helps financial advisors to suggest appropriate portfolios or investment avenues based on their personalities.

Keywords

Dark triad, Machiavellianism, narcissism, psychopathy, investors, investment preference

[1]Pooja Bhagavat Memorial Mahajana Post Graduate Centre, Mysore, Karnataka, India
[2]Kirloskar Institute of Management, Harihar, Karnataka, India

Corresponding author:
Aniruddha S. Rao, Pooja Bhagavat Memorial Mahajana Post Graduate Centre, Mysore, Karnataka 570016, India.
E-mail: anisrao2806@gmail.com

Introduction

Despite abundant information availability, the persistent contrary behaviour of investors to the efficient market hypothesis (EMH) is due to varied behavioural patterns. Prospect theory by Kahneman and Tversky (1979) paved the way for an alternative explanation of market movement (other than EMH) by incorporating psychological factors. Before the prospect theory, Slovic (1972) found that personality is the core of decision-making, influencing risk-taking attitude. Behavioural finance research has explored the non-rational behaviour of the investor and is critical of the expected utility theory (Kahneman & Tversky 1992).

Personality is a combination of multiple inherent characteristics, traits, behaviour and values. Personality helps us to know the drivers of an individual's motivation (Baker & Ricciardi, 2014). The knowledge of personality is useful to overcome the biases and emotions, which influence decision-making. It is also a useful tool in the hands of managers and advisors to enable effective investment decisions and thereby create portfolios. Within behavioural finance literature, the research can be classified into behavioural finance 1.0, till 1990. Prospect theory and the cause of deviations from cognitive thinking were the focus of this phase. Behavioural finance 2.0, (since 2000) expands the domain of finance beyond capital asset pricing, market efficiency and portfolios. In this stage, individual investors are not merely labelled as irrational.

Over the last two decades, numerous personality models were used for behavioural finance research, such as the Myers–Briggs Personality Model (MBTI) (1920), Eysenck's Three-Factor Theory (1963), Five-Factor Model (FFM) of Personality (1985), Meta theoretic Model of Motivation and Personality (3M) (2000) and HEXACO six-factor model of personality (2000). These models were considered to explain the behaviour, the sentiment of investors and the ability to invest beyond rationality. Risk-taking, herding behaviour, biases, investor confidence, investment preference and various aspects surrounding the decisions of investors regarding investment were explained by considering personality traits. Paulhus and Williams (2002) simplified personality variables located by Five-Factor and Six-Factor Personality Models and called it the 'Dark Triad'. It was a combination of personality variables, namely 'Narcissism', 'Psychopathy' and 'Machiavellianism' which are distinct but culminate into callous manipulation reflecting the dark side of personality.

These personality traits (variables) are referred to as 'dark' because of their malicious and mean qualities exhibiting cruelty and manipulation. Very high dark triad composite scores indicate that the person has artificially magnified self-views (narcissism), is capable of manipulation to meet their goals (Machiavellianism), and finally, lacks empathy or remorse (psychopathy). If an investor exhibits traces of a dark side, hypothetically he or she should favour a rational decision. Existing literature on decision-making suggests the same which is discussed in the following sections.

If studies can establish the extent of the dark side and its influence on financial and investment decisions, it will be interesting to explore the extent of emotional bias, herding behaviour and non-rational decision-making. In the given context,

the following review throws light on the dark triad and risk-taking, and rationality in decision-making.

Irrationality Debate

First, let's understand rationality in the context of behavioural finance. It means combining the existing information with multiple new information accessed or available and analyzing it to take an effective investment decision.

The excess market volatility in the 1980s questioned the complete reliance on EMH to explain and predict the market movement. The 1990s witnessed a major shift from the chart and time-series-based investment/market behaviour studies to studies using psychology frameworks to explain market movement anomalies (Singh et al., 2021). These studies have stressed the irrational decisions resulting in herd behaviour (Chang et al., 2000) of the investors, like Monday irrationality (Kamara, 1997) and weekend effect (Abraham & Ikenberry, 1994; Jaffe & Westerfield, 1985). It is also proved that investors often make irrational decisions under the influence of overconfidence (Kamara, 1997). Irrational decisions are fuelled by talks (word of mouth) and media (Shiller, 2002). It may be observed that the investors are manipulated and influenced by a plethora of factors other than investment-specific information.

On the contrary, this dark triad literature emphasizes that personalities with traces of psychopathy, narcism and Machiavellianism are themselves manipulators (Sekścińska & Rudzinska-Wojciechowska, 2020). In addition, past research indicates that the personality variables of dark triads influence rationality in decision-making. For instance, Osumi and Ohira (2010) opine that psychopathy can be rational even to accept unfair offers in some social situations. This is mainly due to insensitivity to unfairness.

A similar observation was made by Geis (1970) about Machiavellianism. In a Con Game, it is found that individuals with high Machiavellianism were better at convincing others. At different levels of the game, they sought cooperation and made more rational decisions.

Byrne and Worthy (2013) associate narcissism with an excellent ability to deal with ambiguous and misleading information while taking decisions. They are quick in filtering misleading information to take effective decisions having long-term utility.

Since the investors with subclinical dark triad are less explored in investment studies, the goal of this study is to illuminate the topic.

Dark Triad and Risk-Taking Behaviour

The dark triad studies have focused on multiple issues to inspect the influence of an individual's personality on the risk-taking behaviour of individuals which is not necessarily restricted to financial and investment risk. A glimpse of extreme

risk-taking can be found in several studies, namely illicit relationships (Adams et al., 2014), gambling (Biolcati et al., 2015), road raging (Britt & Garrity, 2006) and range of criminal acts, such as bullying, drug abuse, high degree of deception and so on (Azizli et al., 2016). The findings in these studies may not necessarily apply to risk-taking in financial and investment decisions. However, the finding of these studies can indicate the influence of personality type even in the field of behavioural finance.

In previous research, all three personality variables of the dark triad have not exhibited similar risk/investment preferences. In financial and investment decision-making literature, frequently 'Dark Triad' is referred to explain the propensity of risk-taking in investment and gambling. Of the three, narcissism and psychopathy explained a higher tendency to take investing, financial and gambling risks (Sekścińska & Rudzinska-Wojciechowska, 2020). This was consistent with the studies in other fields. For instance, Azizli et al. (2016) found that high risk-taking may lead to deception, criminality and anti-social tendency which was observed mainly in narcissistic and psychopathy personality types but not in Machiavellism.

In financial and investment decisions, risk is inherent. Therefore, several studies focused on risk behaviour in the presence of the dark side, but these findings may not be conclusive as the previous research indicates that risk-taking or risk aversion is not a consistent phenomenon. The tendency keeps changing (Hanoch et al., 2006). Though personality trait is consistent and subjected to fewer modifications (Conley 1984), the risk behaviour is not consistent. To draw conclusive evidence on the influence of personality on risk behaviour, we need substantial research evidence. In the context of the dark triad, similar evidence is needed. We can find scanty studies focusing on dark triad and investment decisions. In a recent study, Suchanek (2021) focused on dark triad and behavioural biases and suggested more studies are needed. Sekścińska and Rudzinska-Wojciechowska (2020) suggested high risk-taking investors with high narcissism and psychopathy scores stay in the long run. Our study focused on how successful they perceived.

Dataset and Methodology

The goal of this study is to understand the influence of personality type on investment preference given dark triad personality variables. Further, the article inspects the influence of the dark triad personality and its constituents on perceived success as investors. The following section details the method of data collection, the scale used on the respondents and the methodology of data analysis.

Data Collection

The pilot study was administered to 87 respondents through offline mode. The questionnaire was administered to those individuals who invest in mutual funds,

Indian stock markets, bonds and safe investment avenues like bank deposits and saving schemes, etc. Filter questions were also placed in the questionnaire to check this. Several stock broking companies were approached to find suitable respondents for this study.

All 87 were found fit for further analysis. Reliability and validity analysis was performed on this data. The Cronbach's alpha was greater than the satisfactory level of 0.70. Based on the pilot study, the sample size was determined using the precision method. This method is better suited for the calculation of sample sizes for survey-based studies (Verma & Verma, 2020).

$$\text{Full precession} = \left\{\text{mean} + \left(\frac{Zc^{*}\text{Std. dev}}{\sqrt{n}}\right)\right\} + \left\{\text{mean} - \left(\frac{Zc^{*}\text{Std. dev}}{\sqrt{n}}\right)\right\}$$

$$\text{Half precession} = \frac{\text{Full precession}}{2}$$

$$\text{Minimum sample size } (\text{SS}) = \frac{\text{variance} * Zc^{2}}{(\text{Half precession})^{2}}$$

where Z_c = Z value for 95% confidence interval,

n is the sample of the pilot study.

Based on the above calculation, the sample size was found to be 218. As a part of the main study, the questionnaire was administered to 239 retail investors, in September 2021.

The criteria were set that, all individuals were investors in any of the securities, that is mutual funds, bonds, equity and bank fixed deposits. The survey was conducted using both offline mode and online mode (google forms were used). From the total of 239 responses, 6 questionnaires were partially completed, 2 questionnaires, each had 1 item, which was answered twice and 4 questionnaires had a single answer marked for all the items, and because of these reasons total of 12 respondents were rejected. Hence, only 227 responses were qualified for further study.

Dinić et al. (2019) suggest that dark triad gained popularity due to simplified tools. They observe that since 2002 multiple studies have added other dark aspects to extend the triad to sadism, spitefulness, greed, dependency and perfectionism. Simple tools were developed by Jonason and Webster (2010), Dark Triad Dirty Dozen (DTDD) and Short Dark Triad (SD3) by Jones and Paulhus (2014). This study considered the SD3 measurement tool. SD3 is an empirically tested scale to measure dark triad personality traits (Siddiqi et al., 2020).

The survey instrument used in this study consists of 38 items which were divided into three sections. The first section consisted of six demographic questions. Five questions in the second section are about the financial and investment assessment questions, and the third section had 27 questions regarding the dark triad. SD3 contains nine items each to measure narcissism, Machiavellianism and psychopathy. The SD3 instrument is the most comprehensive

Table 1. Variable Name, Definition and Sources.

Variable	Definition	Source
Narcissism	It is the tendency where individuals exhibit grandiose identity, underlying insecurity, lack of empathy and pride	Jones and Paulhus (2014)
Machiavellianism	It is the tendency of the individual to be manipulative, insensitive to others and a strategic-calculating orientation along with a high level of self-interest	
Psychopathy	It is the tendency where individuals exhibit deficits in effect, lack of self-control, callous manipulation, recklessness and thrill-seeking	
Dark triad	It is a combination of narcissism, Machiavellianism and psychopathy	
Investment preference	It is defined as the investment avenue where an individual chooses to invest.	Authors
Perceived success	It is how each individual perceives the success of their investment.	Authors

and widely used tool to measure the dark triad (Siddiqi et al., 2020), hence it has been adopted in this study.

The variable used in this study is narcissism, Machiavellianism, psychopathy and dark triad, which are independent variables, and investment preference and perceived success are dependent variables. The source and definition of each variable are shown in Table 1.

A 5-point Likert scale was used to measure all personality items. A score of personality was calculated as the mean score of individual responses for each item of the dark triad using Equation (1). Higher scores indicate a higher level of possessing that particular trait (Lopes & Yu, 2017).

$$\text{Average Personality Score} = \frac{\sum_{i=1}^{n} \text{Likert value}}{9} \quad (1)$$

Similarly, the dark triad's personality score was calculated as the mean score of average personality scores of narcissism, Machiavellianism and psychopathy (Suchanek, 2021). Further, the investors were also classified into high, average and low narcissism, Machiavellianism, psychopathy and dark triad.

The respondents were asked to express their preferred investment avenues (mutual funds, equity, bond and safe investment avenues like bank deposits and saving schemes). Based on their investment preference, they are segregated into three main groups, namely high, average and low-risk investors. Equity preferred investors are high-risk investors, mutual fund investors are average-risk investors and bond investors are low-risk investors. Similarly, investors were asked to rate their level of perceived success, based on their investment decisions. Based on

Table 2. Descriptive Statistics.

	N	Range	Min	Max	Mean	Std. Deviation
Investment preference	227	5	1	6	2.37	1.515
Perceived success	227	4	1	5	2.96	0.659
Gender	227	1	1	2	1.46	0.500
Age	227	2	1	3	1.65	0.762
Highest educational achievement	227	3	1	4	1.98	0.680
Marital status	227	1	1	2	1.68	0.466
Annual income	227	4	1	5	1.83	1.094
Machiavellianism	227	2.00	1.00	3.00	2.2588	0.64941
Psychopathy	227	2.00	1.00	3.00	1.8377	0.83163
Narcissism	227	2.00	1.00	3.00	2.1140	0.71187
Dark triad	227	2.00	1.00	3.00	2.0661	0.56447
Valid *N* (listwise)	227					

Table 3. Different Levels of Personality.

Personality Type			
Machiavellianism	Low Machiavellianism	Average Machiavellianism	High Machiavellianism
Psychopathy	Low psychopathy	Average psychopathy	High psychopathy
Narcissism	Low narcissism	Average narcissism	High narcissism
Dark triad	Low dark triad	Average dark triad	High dark triad

their perceived success they were grouped into unsuccessful, average successful and very successful.

Table 2 shows the descriptive statistics of dark triads, investment preference and perceived success, that were computed. Subsequently, multinomial regression was applied and implemented. Multinomial regression analysis is appropriate in the case when numerous dependent variables are in categorical data and a single predictor variable (Bayaga, 2010). Hence, it is an apt method of analysis. Table 2 also shows the total number of responses included in this study ($N = 227$). Machiavellianism, psychopathy, narcissism and dark triad are the categorical data. Table 3 shows different levels of classification of personality for each category.

Based on the scores computed, the personality types are identified as shown in Table 3.

Table 4 shows the correlation between the dark triad, which is significant and moderately correlated. The reliability of the items which is measured using Cronbach's α is well above the acceptable value ($\alpha > 0.70$). The next section

Table 4. Correlations, Reliability and Validity Among the Dark Triads.

	Correlations and Reliability			
	Cronbach's α	Machiavellianism	Narcissism	Psychopathy
Machiavellianism	0.865	1	0.287**	0.358**
Narcissism	0.909	0.287**	1	0.277**
Psychopathy	0.880	0.358**	0.277**	1

Note: **Correlation is significant at the 0.01 level (2-tailed).

Table 5. KMO and Bartlett's Test.

	KMO and Bartlett's Test	
	KMO	Bartlett's Test (sig)
Machiavellianism	0.754	0.000
Narcissism	0.840	0.000
Psychopathy	0.759	0.000

Note: **Correlation is significant at the 0.01 level (2-tailed).

discusses the output of multinomial logistics regression analysis between the dark triad and investment preference, and the dark triad and perceived success on investment.

Table 5 shows the Kaiser–Meyer–Olkin Measure (KMO) and Bartlett's Test of sphericity statistics. KMO is a test for sample adequacy, which determines whether the sample is adequate to perform factor analysis. KMO is greater than 0.7 for all three traits. Bartlett's Test of sphericity checks for normality of the multiple variables and examines if the correlation forms an identity matrix. Since Bartlett's Test is significant, factor analysis could be performed.

Table 6 shows the factor analysis result. The Varimax rotation was used to determine the rotated component matrix. The matrix clearly shows the three distinct groupings based on the trait. Each item measured its respective trait. The factor loading was all greater than the satisfactory level of 0.5. All the items were found to have a good level of factor loadings.

The multinomial logistics regression analysis between dark triad and investment preference has been applied by considering the dark triad as a categorical variable, to understand how different levels of dark triad influence investment preference, and then by considering the dark triad and perceived success on investment, to understand the influence of the dark triad on perception on the success of the investment.

Findings

The following sections describe the findings of multinomial logistic regression. The findings have been presented in two parts. The first is how different levels

Table 6. Factor Analysis Result.

Rotated Component Matrix			
	Component		
	1	2	3
Machiavellianism 1		0.777	
Machiavellianism 2		0.78	
Machiavellianism 3		0.764	
Machiavellianism 4		0.776	
Machiavellianism 5		0.747	
Machiavellianism 6		0.657	
Machiavellianism 7		0.614	
Machiavellianism 8		0.572	
Machiavellianism 9		0.567	
Narcissism 1			0.694
Narcissism 2			0.822
Narcissism 3			0.742
Narcissism 4			0.662
Narcissism 5			0.637
Narcissism 6			0.583
Narcissism 7			0.665
Narcissism 8			0.898
Narcissism 9			0.571
Psychopathy 1	0.798		
Psychopathy 2	0.605		
Psychopathy 3	0.612		
Psychopathy 4	0.603		
Psychopathy 5	0.762		
Psychopathy 6	0.571		
Psychopathy 7	0.566		
Psychopathy 8	0.530		
Psychopathy 9	0.666		

Note: Extraction method: Principal component analysis. Rotation method: Varimax with Kaiser normalization. [a]Rotation converged in six iterations.

of personality influence risk-taking behaviours, through investment preference, and the latter is how the levels of personality influence their perceived level of success.

The Dark Triad and Investment Preference

Multinomial logistic regression was applied by considering the dark triad, age, education and annual income as independent variables and investment preference as the dependent variable. Table 7 shows the case summary of the variables and data. This also shows the number of respondents in each category along with their total percentages.

Table 8 shows the value of model fitting, goodness-of-fit and pseudo *R*-square model fitting information, indicating whether the variables added statistically significantly improve the model compared to the intercept alone. Since the *p*-value is below 0.05, the variables were added to improve the model. Goodness-of-fit (Pearson) indicates whether the data fits the model well. Since the *p*-value = 0.098 ($p > 0.05$), the data fits the model very well. Nagelkerke pseudo *R*-square is 0.541308, which means that all the independent variables considered in this analysis can explain the 54.1% variance in the dependent variable. The next section discusses the factors which influence various levels of investment preference.

Predictor Variables and General Propensity to Take Average Risk

By considering age, education and income, along with the different levels of the dark triad, understanding its influence on the average risk taker is found. Output in Table 9 is interpreted as follows.

Individuals who are undergraduate and postgraduate prefer not to invest in risky market securities. Rather, they prefer to invest in other investments, such as bank deposits, saving schemes and so on (undergraduates, 17.28 times and post graduates 18.02 times more than average-risk investment). This means that postgraduate investors are more risk-averse than graduate investors. Other education qualifications, age and annual income tend to have no significant impact on average-risk investments.

Individuals who are characterized by low psychopathy and average psychopathy prefer to invest in average-risk investments, 2.045 times and 4.252 times, respectively, than other investments. It can be further noted that as the psychopathy level of investors increases, investors become more risk-takers. Low narcissism individuals prefer to invest 2.96 times more in average-risk investments than other investments. Another level of narcissism, Machiavellianism and dark triad was found to have no significant impact on preference to invest in average-risk investments.

Predictor Variables and General Propensity to Take High Risk

Table 10 discusses the propensity of individuals to take high risks. The individuals who earn between 0 and 7.5 lacs (three groups) prefer not to invest in risky market securities. Rather, they prefer to invest in other investments, such as bank deposits, saving schemes and so on (0–2.5 lakhs—15.98 times, 2.51–5 lakhs—16.08 times and 5.01–7.5 lakhs—14.028 times more than high-risk investment). This means that as an individual's income increases, their capacity to take risks increases marginally. Education qualifications and age tend to have no significant impact on high-risk investments.

Table 7. Case Summary.

Particulars		*N*	Marginal Percentage (%)
Investment preference	Average-risk investment	87	38.3
	High-risk investment	56	24.7
	Low-risk investment	40	17.6
	Others	44	19.4
Perceived success rate	Unsuccessful	29	12.8
	Average success	167	73.6
	Very successful	31	13.7
Age	20–30	119	52.4
	30–40	68	30.0
	40–50	40	17.6
Highest educational achievement	Undergraduate	45	19.8
	Postgraduate	152	67.0
	PhD	20	8.8
	Others	10	4.4
Annual income	0–2.5 lakhs	121	53.3
	2.51–5 lakhs	50	22.0
	5.01–7.5 lakhs	36	15.9
	7.51–10 lakhs	12	5.3
	Above 10 lakhs	8	3.5
Psychopathy	Low psychopathy	100	44.1
	Average psychopathy	65	28.6
	High psychopathy	62	27.3
Dark triad	Low dark triad	29	12.8
	Average dark triad	154	67.8
	High dark triad	44	19.4
Machiavellianism	Low Machiavellianism	26	11.5
	Average Machiavellianism	117	51.5
	High Machiavellianism	84	37.0
Narcissism	Low narcissism	46	20.3
	Average narcissism	110	48.5
	High narcissism	71	31.3
Valid		227	100.0
Missing		0	
Total		227	

Table 8. Model Fitting, Goodness-of-Fit and Pseudo *R*-Square.

Model fitting information (final)	Sig. = 0.000 ($p < 0.05$)
Goodness-of-fit (Pearson)	Sig. = 0.098 ($p > 0.05$)
Pseudo *R*-square (Nagelkerke)	0.541308

Table 9. Predictor Variables and General Propensity to Take Average Risk.

Investment Preference		*B*	Std. Error	Wald	Sig.
Average-risk investment	Intercept	31.391	8,599.575	0.000	0.997
	20–30	−17.783	4,190.101	0.000	0.997
	30–40	−18.251	4,190.101	0.000	0.997
	40–50	0[c]	.	.	.
	Undergraduate	−17.282	2.098	67.877	0.000
	Postgraduate	−18.020	2.010	80.406	0.000
	PhD	−58.339	5,817.056	0.000	0.992
	Others	0[c]	.	.	.
	0–2.5 lakhs	4.079	7,509.707	0.000	1.000
	2.51–5 lakhs	4.186	7,509.707	0.000	1.000
	5.01–7.5 lakhs	4.286	7,509.707	0.000	1.000
	7.51–10 lakhs	24.095	9,320.507	0.000	0.998
	Above 10 lakhs	0[c]	.	.	.
	Low psychopathy	2.045	0.752	7.399	0.007
	Average psychopathy	4.252	1.164	13.354	0.000
	High psychopathy	0[c]	.	.	.
	Low dark triad	−2.303	2.491	0.855	0.355
	Average dark triad	−1.176	0.954	1.520	0.218
	High dark triad	0[c]	.	.	.
	Low Machiavellianism	0.079	2.160	0.001	0.971
	Average Machiavellianism	0.218	0.682	0.102	0.749
	High Machiavellianism	0[c]	.	.	.
	Low narcissism	2.962	1.375	4.638	0.031
	Average narcissism	0.209	0.539	0.151	0.698
	High narcissism	0[c]	.	.	.

Note: The reference category is others.

Table 10. Predictor Variables and General Propensity to Take High Risk.

Investment Preference		*B*	Std. Error	Wald	Sig.
High-risk investment	Intercept	50.760	4,190.101	0.000	0.990
	20–30	−17.862	4,190.101	0.000	0.997
	30–40	−17.770	4,190.101	0.000	0.997
	40–50	0	.	.	.
	Undergraduate	−17.471	1.822	91.949	0.000
	Postgraduate	−18.320	1.765	107.703	0.000
	PhD	−40.099	4,190.102	0.000	0.992
	Others	0	.	.	.
	0–2.5 lakhs	−15.987	1.901	70.745	0.000
	2.51–5 lakhs	−16.086	1.894	72.156	0.000
	5.01–7.5 lakhs	−14.285	1.652	74.774	0.000
	7.51–10 lakhs	5.166	5520.521	0.000	0.999
	Above 10 lakhs	0	.	.	.
	Low psychopathy	1.407	.796	3.126	0.077
	Average psychopathy	2.774	1.211	5.246	0.022
	High psychopathy	0	.	.	.
	Low dark triad	−2.222	2.630	0.714	0.398
	Average dark triad	0.006	1.087	0.000	0.996
	High dark triad	0	.	.	.
	Low Machiavellianism	0.505	2.206	0.052	0.819
	Average Machiavellianism	−0.408	0.749	0.297	0.586
	High Machiavellianism	0	.	.	.
	Low narcissism	3.642	1.433	6.465	0.011
	Average narcissism	0.273	0.623	0.192	0.661
	High narcissism	0	.	.	.

Note: The reference category is others.

Individuals who are characterized by average psychopathy prefer to invest in high-risk investments, 2.77 times more than other investments. Low narcissism individuals prefer to invest 2.64 times more in high-risk investments than other investments. Another level of narcissism, Machiavellianism and the dark triad were found to have no significant impact on preference to invest in average-risk investments.

Table 11. Predictor Variables and General Propensity to Take Low Risk.

Investment Preference		*B*	Std. Error	Wald	Sig.
Low-risk investment	Intercept	50.316	4,190.101	0.000	0.990
	20–30	−19.081	4,190.101	0.000	0.996
	30–40	−19.948	4,190.101	0.000	0.996
	40–50	0	.	.	.
	Undergraduate	−15.109	0.777	378.304	0.000
	Postgraduate	−15.726	0.000	.	.
	PhD	−37.676	4,190.101	0.000	0.993
	Others	0	.	.	.
	0–2.5 lakhs	−17.450	1.255	193.460	0.000
	2.51–5 lakhs	−17.141	1.208	201.235	0.000
	5.01–7.5 lakhs	−15.640	0.000	.	.
	7.51–10 lakhs	1.487	5,520.521	0.000	1.000
	Above 10 lakhs	0	.	.	.
	Low psychopathy	2.722	1.007	7.312	0.007
	Average psychopathy	3.862	1.357	8.100	0.004
	High psychopathy	0	.	.	.
	Low dark triad	−0.671	2.696	0.062	0.803
	Average dark triad	−0.598	1.225	0.238	0.626
	High dark triad	0	.	.	.
	Low Machiavellianism	−1.328	2.242	0.351	0.554
	Average Machiavellianism	−0.824	0.768	1.151	0.283
	High Machiavellianism	0	.	.	.
	Low narcissism	3.011	1.472	4.184	0.041
	Average narcissism	0.658	0.694	0.900	0.343
	High narcissism	0	.	.	.

Note: The reference category is others.

Predictor Variables and General Propensity to Take Low Risk

Table 11 discusses the propensity of individuals to take low risks. The individuals who earn between 0 and 5 lakhs (two groups) prefer not to invest in low-risk market securities. Rather, they prefer to invest in other investments, such as bank deposits, saving schemes and so on (0–2.5 lakhs, 17.45 times, 2.51–5 lakhs 17.14 times more than high-risk investments). This means that as an individual's income increases their capacity to take risks increases marginally, but this increase in preference for investing in low-risk investments is restricted only to non-income

Table 12. Model Fitting, Goodness-of-Fit and Pseudo *R*-Square.

Model fitting information (final)	Sig. = 0.000 ($p < 0.05$)
Goodness-of-fit (Pearson)	Sig. = 0.18 ($p > 0.05$)
Pseudo *R*-square (Nagelkerke)	0.522

tax income group. Undergraduate respondents also prefer not to invest in low-risk market securities. Rather, they prefer to invest in other investments, such as bank deposits, saving schemes and so on (undergraduates, 15.109 times more than low-risk investments).

Individuals who are characterized by low and average psychopathy prefer to invest in low-risk investments, 2.77 times and 3.862 times, respectively, more than other investments. Low narcissism individuals prefer to invest 3.011 times more in high-risk investments than other investments. Another level of narcissism, Machiavellianism and the dark triad was found to have no significant impact on preference to invest in average-risk investments.

The Dark Triad and Perceived Success Rate

Multinomial logistic regression was applied by considering the dark triad, age, education and annual income as the independent variable and perceived success rate as the dependent variable. Based on how individual investors perceive their success in investments, they are classified into unsuccessful, average successful and very successful.

Table 12 shows the value of model fitting, goodness-of-fit and pseudo *R*-square model fitting information, indicating whether the variables added statistically significantly improve the model compared to the intercept alone. Since the *p*-value is below 0.05, the variables were added to improve the model. Goodness-of-fit (Pearson) indicates whether the data fits the model well. Since the *p*-value = 0.098 ($p > 0.05$), the data fits the model very well. Nagelkerke pseudo *R*-Square is 0.522, which means that all the independent variables considered in this analysis can explain the 52.20% variance in the dependent variable. The next section discusses the factors which influence various levels of perceived success rate.

Predictor Variables and Propensity to Perceive Investment as Very Successful

Table 13 discusses the propensity of individuals to perceive their investment as very successful. Individuals with high narcissism perceive themselves to be unsuccessful, 2.897 times more than perceiving themselves as average successful. No other personality type was found to have a significant impact.

Table 13. Predictor Variables and Propensity to Perceive Investment as Very Successful.

Perceived Success Rate		*B*	Std. Error	Wald	Sig.
Very successful	Intercept	15.477	2.124	53.085	0.000
	20–30	−0.822	1.137	0.523	0.470
	30–40	0.331	4113.952	0.000	1.000
	40–50	0	.	.	.
	Undergraduate	−22.380	4681.622	0.000	0.996
	Postgraduate	−19.519	4681.621	0.000	0.997
	PhD	−36.574	0.000	.	.
	Others	0	.	.	.
	0–2.5 lakhs	−0.295	1.686	0.031	0.861
	2.51–5 lakhs	0	.	.	.
	5.01–7.5 lakhs	5.810	4681.621	0.000	0.999
	7.51–10 lakhs	3.104	4681.621	0.000	0.999
	Above 10 lakhs	21.667	0.000	.	.
	Low psychopathy	7.190	8139.462	0.000	0.999
	Average psychopathy	0	.	.	.
	High psychopathy	0.832	1.176	0.501	0.479
	Low dark triad	0.897	1.153	0.606	0.436
	Average dark triad	0	.	.	.
	High dark triad	−1.180	2.506	0.222	0.638
	Low Machiavellianism	−0.904	1.639	0.304	0.582
	Average Machiavellianism	0	.	.	.
	High Machiavellianism	−1.031	1.822	0.320	0.572
	Low narcissism	−2.897	0.974	8.838	0.003
	Average narcissism	0	.	.	.
	High narcissism	0.885	10.247	0.504	0.478

Note: The reference category is: Unsuccessful.

Predictor Variables and Propensity to Perceive Investment as Average Successful

Table 14 discusses the propensity of individuals to perceive their investment as average successful.

The individuals who are between 20 and 30 years of age perceive themselves to be average successful, 1.43 times more than they perceive as unsuccessful.

Individuals who are characterized by the average dark triad perceive themselves to be average successful 1.64 times more than others unsuccessful. On the contrary average and high, Machiavellianism perceives themselves to be unsuccessful, 4.827 and 2.091 times more than perceiving themselves as average successful.

Table 14. Predictor Variables and Propensity to Perceive Investment as Average Successful

Perceived Success Rate		*B*	Std. Error	Wald	Sig.
Average successful	Intercept	18.298	5,510.563	0.000	0.997
	20–30	1.493	0.641	5.422	0.020
	30–40	0	.	.	.
	40–50	−0.091	0.916	0.010	0.921
	Undergraduate	18.920	3,145.570	0.000	0.995
	Postgraduate	0	.	.	.
	PhD	−17.527	4,681.621	0.000	0.997
	Others	−16.854	4,681.621	0.000	0.997
	0–2.5 lakhs	−16.354	3,031.903	0.000	0.996
	2.51–5 lakhs	0	.	.	.
	5.01–7.5 lakhs	−0.578	1.099	0.276	0.599
	7.51–10 lakhs	0	.	.	.
	Above 10 lakhs	1.777	5,629.862	0.000	1.000
	Low psychopathy	0.895	5,629.862	0.000	1.000
	Average psychopathy	−0.164	4,732.564	0.000	1.000
	High psychopathy	19.518	6,903.491	0.000	0.998
	Low dark triad	0	.	.	.
	Average dark triad	1.649	0.788	4.382	0.036
	High dark triad	0.948	0.807	1.379	0.240
	Low Machiavellianism	0	.	.	.
	Average Machiavellianism	−4.827	1.800	7.193	0.007
	High Machiavellianism	−2.091	1.175	3.164	0.05
	Low narcissism	0	.	.	.
	Average narcissism	1.288	1.393	0.855	0.355
	High narcissism	−1.493	0.767	3.786	0.050

Note: The reference category is: Unsuccessful.

Even individuals with high narcissism perceive themselves to be unsuccessful, 1.493 times more than perceiving themselves as average successful.

Discussion and Conclusion

The literature in behavioural finance reinforced the point that the personality of investors has always been one of the key influencers on financial decision-making. One of the categories of personalities is the dark triads, which are the group of

psychopathy, Machiavellianism and narcissism, often called negative personality traits (Alsheikh Ali, 2020). In this study, the relation between the dark triads and investment preference and perceived risk perception was explored.

First, a significant relationship between psychopathy, narcissism and risk was found. Individuals with these traits tend to be risk-takers. This substantiates the findings of Sekścińska and Rudzinska-Wojciechowska (2020). A partially similar result was obtained by Kornilova (2017) concerning psychopathy influencing risk. Contrary to findings of Kornilova (2017), no significant relationship between Machiavellianism and risk was found. The dark triad was also not found to have any significant impact on risk.

When success perception was considered as the dependent variable, Machiavellianism, narcissism and dark triad did have a significant impact. The perception of the individual with these traits was more towards being unsuccessful. Individuals with a dark triad tend to be more greedy (Sekhar et al., 2020). The expectations from the investment are influenced by dispositional greed, which makes individuals perceive that their investments are unsuccessful, which is evaluated by dispositional greed.

The findings of this study can be applied in a real-life context in designing a portfolio for individuals who exhibit dark triads. The financial managers can create a portfolio based on the dark triad with individual investor alignment.

Future studies can look into risk-taking behaviours in a different financial decision-making context. The study can be further expanded to understand if the individuals with dark triad personalities also experience the cycle of market emotion and its impact on financial decisions. Alternatively, Daniel and Titman (1999) note that irrational investors have little impact on market movements. On the contrary, they observe that traders and arbitrageurs are rational and have more impact on the market. More studies on traders and arbitrageurs are needed. The perceived success variable can be explored further as overconfidence bias, to understand whether the dark triad trait individual is prone to such predispositions. This study can also be simulated given a diverse profession as one of the independent variables.

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Article

Revisiting the Impact of NPAs on Profitability, Liquidity and Solvency: Indian Banking System

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Preeti Sharma[1], Bhakti Bhushan Mishra[2] and Sachin Kumar Rohatgi[2]

Abstract

In the light of the fact that non-performing assets (NPAs) in the country are increasing at a very fast pace, this article intends to investigate the outcome of gross NPAs (GNAPs) ratio on profitability, liquidity and solvency in Indian banking system. To study this impact, we have used panel data of 30 Indian banks (12 government sector banks and 18 private sector banks) from 2014 to 2021 (8 years) collected from Prowess (CMIE) and money control. The current study uses four different panel regression models, that is, fixed and panel regression models, pooled regression models and seemingly unrelated regression models. The empirical outcomes of the current study confirm the outcomes of existing studies. The findings of this article confirm the substantial association between the GNPA ratio and profitability ratio, that is, net profit ratio, return on assets ratio and return on equity ratio. Further, the study also confirms the association between the GNPA ratio and liquidity ratios of banks (cash flow margin, current ratio, acid test ratio, cash ratio and operating cash flow ratio). We also found the impact of the GNPA ratio on the capital adequacy ratio.

Keywords

Gross NPA ratio, profitability ratios, SUR models, panel regression, capital adequacy ratio

[1]Department of Management, Sharda School of Business Studies, Sharda University, Greater Noida, Uttar Pradesh, India
[2]Amity Global Business School, Amity University, Noida, Uttar Pradesh, India

Corresponding author:
Preeti Sharma, Department of Management, Sharda School of Business Studies, Sharda University, Greater Noida, Uttar Pradesh 201306, India.
E-mail: sanskriti.112011@gmail.com

Introduction

In order to achieve India's vision of a five-trillion economy in the next five years, a safe, reliable and robust financial sector is crucial. Banking structures, including the country's central bank, play a very important role in expanding and widening the financial system, fostering savings institutionalisation and investment and pushing the country's economic growth (Bapat, 2012; Ghosh & Saggar, 1998; Velayudham, 1989). Currently banking system in India is responsible for regulating and managing over 70% of the funds that flow through financial sector in the country. The fluctuations in banking industry affect the economic growth of a country negatively (Moshirian & Wu, 2012). Non-performing assets (NPAs) are one of the key and most formidable glitches that have traumatised the whole banking sector in developing countries long afore economic liberalisation in 1991 (Ghosh & Saggar, 1998). An NPA is demarcated as default of payment for interest and/or instalment of principal for a credit facility for a specified period of time (Khan, 2007). Many researchers have investigated the relationship between loan growth and NPAs that concluded that when banks follow aggressive loan growth (though favourable for its business), these loans may turn into NPAs in future (Clair et al., 1992; Keeton et al., 1999). Several studies show the influence of NAPs on bank's effectiveness and overall productivity (Bawa et al., 2019; Sharma et al., 2020).

The functioning, profitability and performance of a banking system in the country are largely dependent on the amount of NPAs of the banks operational in the country. The effectiveness of the bank can be measured using a range of bank ratios, such as operating ratios, profitability ratios and liquidity ratios (Halkos & Salamouris, 2004; Kumbirai & Webb, 2010; Yeh, 1996). The financial enactment of a bank is usually judged by net profit ratio (NPR), return on assets (ROA), return on equity (ROE) and net interest margin, liquidity risk is calculated by the liquidity ratio, and capital adequacy ratio presents the idea of solvency position of the bank. A very high gross NPA (GNPA) ratio specifies the poor quality of the bank's asset while high net NPA (NNPA) is an indicator of overall health of the bank. In the loan portfolio, NPAs impact operating performance, which in turn disturbs the profitability, liquidity and solvency of cooperative bank (Michael, 2006; Purbaningsih & Fatimah, 2014). Different studies indicate that credit risk has a major adverse bearing on profitability and liquidity (Ruziqa, 2013). The studies discuss the positive association between the liquidity of banks and the adequacy of capital, the portion of non-performing loans and interest rates on loans and interbank transactions (Vodova, 2011).

In the light of above discussion, we apply the panel regression model on current 30 banks both from public and private sectors to measure the impact of the GNPA ratio (intended as GNPAs as a percentage of advances) on profitability, liquidity and solvency ratios. NPA has insignificant inverse relationship with net profit of the bank. The existence of NPAs has an important impression on the earning capacity and profitability of banks. An elevated amount of NPAs specifies a bulky number of credit evasions, which affects bank profitability and net worth (Dudhe, 2017). Several studies also indicate that the increase in NPA negatively affects the

ROA and ROE of banks. The increase in NPAs is responsible for increase in operating costs leading to decrease in cash flow from operating activities and because of this the cash flow margin ratio also goes down. Banks performance largely depends on available liquidity. Higher NPA not only impacts the liquidity of banks, but also force the banks to have higher investment in liquid assets. It also forces the banks to borrow money or raise short-term deposits. The operating cash flow ratio indicates the banks' capacity to discharge the current liabilities form the cash generated from operation. But the operating cash flow is inversely impacted by increased NPA level. In banks' books, loans and advances are primary items of assets, which have the loss potential due to loan defaults (NPA). The capital adequacy ratio (CAR) is the ratio of total capital of bank to risk weightage assets and directly related to quality of assets (loans and advances). NPA has an inverse relation with CAR. Keeping all the above-mentioned points in mind, the current topic has been taken to examine the impact of NPAs on Indian banking structure.

The research article goes in a subsequent way: The following segment provides a particularised overview of relevant researches and empirical literature in this field, followed by the study's purposes and justification. In the following sections, the methodology and methodological approach, as well as the data used, are explained, followed by data exploration and the calculation of empirical results. The final piece describes the discoveries, draws an inference and summarises the article, highlighting the study's major offerings to the literature.

Review of Related Literature

In this section, we present a wide survey of existing literature related to the offered topic. In their study, Seenaiah et al. (2015) conclude that operating profits, wage bills, NPAs and net interest margin affect the profitability of the Indian banks, whereas the priority sector advancing does not have any influence on the bank's productivity in India. It is further stated that the banks should reduce its operational expenses so that the net interest margin can increase, as presently it is affecting the banks' profitability in India. Jaisinghani and Tandon (2015) have tried to foresee the NPAs of the Indian banks by using logit and probit models. Barua et al. (2016) in their study stated that profitability is affected by the market concentration and the bank-specific macro variables. The study further concludes that the leverage, capitalisation credit risk and ownership structure are the important factors of the Indian bank's productivity. The study further states that the pecuniary crunch had no bearing on the profitability of the Indian banks. Mostak Ahamed (2017) has found that the non-interest income activities progress the profitability of the Indian banks and in particular to those which have a lower asset quality. The author concludes that the diversification activities increase the profitability in particular of those banks that have a low-quality asset. Vidyarthi et al. (2017) have concluded that the public sector banks need more attention with respect to NPAs management as it is affecting the profitability and efficiency

exponentially. Singh and Sharma (2018) in their study formed the opinion that capital adequacy ratio, deposits and profitability influence Indian bank liquidity absolutely, whereas bank size, NPAs and net interest margin disturb Indian banks' liquidity negatively. Goyal and Verma (2018) in their learning found the determinants of credit and NPAs. Their findings support the notion that past credit, higher interest rates and low growth have contributed to an increase in NPAs. However, the other determinants such as control and ownership structure have no noteworthy influence on the NPAs. Whereas in the study conducted by Bawa et al. (2019), authors have concluded that the liquidity of the Indian banks is not considered as a significant factor because the Reserve Bank of India as per its standard policy monitors the liquidity of the Indian banks on weekly basis and this protects the banks from the liquidity crisis. Swami et al. (2019) in their finding list the poor operating efficiency, lower capital base and reducing profits as the key factors in reducing the asset quality of the banks. Ramesh (2019) in his study found that ROE, loan maturity and credit-to-deposit ratio have an adverse connection with the NNPAs, whereas the operating expense and capital adequacy ratio have an inconsequential affiliation with the NNPAs. In addition, the author has stated that priority sector loans, non-interest income and collateral values have all played a significant role in increasing NPAs in public sector banks. Gaur and Mohapatra (2020) in their study explored the NPA–profitability relationship in the Indian banking sector. In their study, they have used panel data set of 37 scheduled commercial banks for the period of 14 years. They have concluded that due to the presence of heteroscedasticity, a high standard error is recorded which leads to a high adverse correlation between NPA and two profitability procedures, that is, ROA and ROE. Gupta and Kashiramka (2020) in their study analyse the importance of liquidity formation for instituting the financial stability of the banks. The authors conclude that the liquidity creation increases the financial stability of the banks as per its size. Further, they conclude that the private sector banks are more financially stable than the government sector banks. However, Thomas and Singh (2020) in their study found that the upsurge in the NPA ratio does not theoretically increase riskier advancing. They support the notion 'too-big-to fail' through the evidence stating that the big banks must have some incentives that is why they are taking higher risk and have high NPA ratios. Mehta and Kaushik (2020) have stated that the capital blocked or lost in NPA in various banks has a straight impact on the bank's profitability, liquidity and its market value. Further, they conclude in their study that the increase in NPA has an adverse relationship with earning per share (EPS) and market per share (MPS).

From the conclusive summary of related literature, a gap can be seen for study on the offered topic in context of the Indian banking system. Most of the researchers discuss the determinants of NPAs, bank specifics, internal and external factors and macro-economic variables causing NPAs. The effect of NPAs on the operating performance and profitability of commercial banks in the country is also being studied in several studies but it is limited to certain ratios. So, the

current study has been undertaken to test the impact of the GNPA ratio on profitability, liquidity and solvency in context of Indian banks.

Methodology: Data, Sample Frame and Empirical Model

In the current study, we have used the panel data of 30 banks (12 government sector and 18 private sector banks) from 2014 to 2020 (7 years). The data have been sourced from Prowess (CMIE) and www.moneycontrol.com. The description of variables taken for current study is as follows.

The Variables

The variables considered initially to develop the empirical model are defined below.

GNPAR: Gross Non-performing Assets Ratio (GNPA as percentage of advances)

NPR: Net Profit Ratio (Net Profit after Tax/Income from Financial Services + Interest Income)

ROA: Return on Assets (Net Profit/Average Total Assets)

ROE: Return on Equity (Net Profit/Shareholder's Equity), Shareholder's Equity = Equity Capital + Reserves and Surplus

CFMR: Cash Flow Margin Ratio (Cash Flow from Operating Activities/Total Revenue)

Here, Total Revenue = Income from Financial Services + Interest Income

CTR: Current Ratio (Current Assets/Current Liabilities)

ATR: Acid Test Ratio (Quick Assets/Quick Liabilities), Quick Assets = Current Assets (as inventories are 0) And Quick Liabilities = Current Liabilities–Short Term Borrowings, Loans, O/D

CR: Cash Ratio (Cash and Cash Equivalents/Current Liabilities)

OCFR: Operating Cash flow Ratio (Cash from Operating Activities/Current Liabilities)

CAR: Capital Adequacy ratio{(Tier 1 capital + Tier 2 capital)/Risk Weighted Assets}

Econometric Modelling of Panel Regression Models: Includes the Following Steps

First, we consider the model identification and then diagnostic testing of the models. There are certain assumptions for applying panel data regression. Assumptions about the properties of initial conditions play an important role in the identification of a suitable model. There subsists a set of essential and adequate

documentation settings for panel models. The preceding set of the panel equation showing usual fixed effect is as follows:

$$Y_{it} = X_{it}\,\beta + \alpha_i + \xi_t + \varepsilon_{it}$$

where Y_{it} shows the vector of the dependent variable, X_{it} is the vector of an observable regressor, β is the unknown coefficient, α_i is the individual effect, ξ_t is the time effect and ε_{it} shows the vector of error term.

Pre-testing for stationarity in short-panel data models is a matter of interest (not necessary for short panel data). In the current study, we have used Levin–Lin–Chu test for checking the presence of unit root in the panel data.

If individual effect u_i (cross-sectional or time-specific effect) does not exist ($u_i = 0$), ordinary least squares (OLS) produces competent and steady parameter estimates. So, the first requirement (for model identification) is to check whether all Coefficients are Continuous across Time and Individuals. Pesaran CD test has been used to check individuality of each cross-sectional unit. In the literature, the model based on time invariant but individuality in cross-sectional unit is known as the fixed effects (regression) model (FEM). Next, we check time effect with the help of Wald joint test on time dummies. The general preservative properties $\alpha_i + \xi_t$ being an unusual case of multiple interactive properties seems to be less observed. But once indicated, it converts insignificant and apparent (Bai, 2009). These additive properties can be detached by the within group renovation (least-squares dummy variables).

The next step in the identification process is to check exogeneity which indicates that the expected value of error terms should be zero (necessary to apply OLS). Then we check autocorrelation between the error term and regressor. Durbin–Watson test statistic has been used to check auto-correlation. Next, we check homoscedasticity in the error term. The homoscedasticity has been checked with Breusch–Pagan test. Ahn et al. (2001) reflect the condition of fixed T and noted that the least-squares method fails to present reliable estimator if serial correlation or heteroscedasticity is extant in ε_{it}. In this condition, dynamic panel regression models are more suitable.

To compare a random effect model to its fixed complement, the Hausman (1978) specification test was used. If the null hypothesis of uncorrelated individual effects with other regressors is not rejected, a random effect model is found to be more suitable than a fixed effect model.

Then next step is to do the diagnostic checking of models applied. The diagnostic testing involves whether intercept and regressors do not disrupt any Gauss–Markov assumption; a fixed effect model is still BLUE. For diagnostic checking of models, we test following assumptions. First assumption is to check whether the mean value of the error term is zero. Second, homoscedasticity has been tested by applying Breusch–Pagan test. The third assumption is checking endogeneity which means whether error terms are correlated with independent variables. Then auto-correlation has been checked using Durbin–Watson test. If the Durbin–Watson test reading is less than 1, it shows negative auto-correlation

Table 1. Summary Statistics.

Variable	Mean	Median	*SD*	Min	Max
GNPAR	6.70	4.69	5.90	0.314	27.3
NPR	0.901	2.86	7.36	–32.3	10.5
ROA	5.06	4.63	26.9	–105.	119.
ROE	0.179	0.335	0.808	–3.22	1.33
CFMR	0.574	6.56	17.5	–83.4	22.7
CTR	4.39	3.76	2.67	1.24	18.6
ATR	4.39	3.75	2.67	1.24	18.6
CR	3.25	2.53	2.50	0.490	17.8
OCFR	0.329	0.240	1.56	–5.84	6.51
CAR	12.9	13.0	2.41	1.12	19.0

Table 2. Test for Differencing Group Intercept.

	Regressor: GNPAR	
Dependent Variable	Test Statistic: *F*(24, 199)	*P* Value
NPR	6.67374	1.48844e-016
ROA	1.4099	0.0921361
ROE	7.78114	2.31418e-019
CFMR	4.80509	2.01996e-011
CTR	14.2222	7.90191e-033
ATR	14.2257	7.78688e-033
CR	16.2878	2.36316e-036
OCFR	1.07105	0.377593
CAR	10.4911	1.45357e-025

Source: Test output.

and if it is more than 3, it shows positive auto-correlation. The value of test between 1 and 3 shows no auto-correlation.

Analysis

Empirical Results

Table 1 demonstrates the summary statistics of independent and dependent variables taken for the current study where GNPAR is the regressor and NPR, ROA, ROE, CFMR, CTR, ATR, CR, OCFR and CAR are dependent variables.

Table 2 demonstrates the results of test conducted to check the common group intercept. The results show that the data are not poolable (rejects the hypothesis

Table 3. Pesaran CD Test for Cross-sectional Dependence.

	Regressor: GNPA (As a % of Advances)	
Dependent Variable	Test Statistic (*Z*)	*P* Value
NPR	3.360844	0.000777
ROE	2.546062	0.0109
CFMR	1.344946	0.179
CTR	1.799994	0.0719
ATR	1.733395	0.083
CR	–0.421130	0.674
CAR	10.705177	9.62e-027

Table 4. Wald Joint Test on Time Dummies.

	Regressor: GNPA (As a % of Advances)	
Dependent Variable	Test Statistic (*Z*)	*P* Value
NPR	6.80856	0.338915
ROE	7.57975	0.270536
CFMR	5.04073	0.5386
CTR	17.4308	0.00782374
ATR	17.3783	0.00798907
CR	7.74791	0.25716
CAR	45.0921	4.48706e-008

that the groups have common intercept) in case of NPR, ROE, CFMR, CTR, ATR, CR and CAR for both the regressors, that is, GNPAR so pooled model is not suitable for current data set. If the entire groups are found to have common intercept, OLS produces efficient and consistent parameter estimates. In case of variables ROA and OCFR, the null hypothesis of group having a common intercept is accepted (so OLS can be applied).

Tables 3 and 4 present the cross-sectional dependence or individual effect and time effect, respectively. The Pesaran CD test for cross-sectional independence has the null hypothesis that there is no cross-sectional or individual effect. We have not calculated cross-sectional and time effect in case of variables ROA and OCFR as OLS will be applied to regress these variables. The independent variable GNPAR shows individual effect only in case of NPR, ROE and CAR. There is no individual effect in variables CFMR, CTR, ATR and CR.

The time effect has been tested using Wald Joint test. The test has the null hypothesis that there is no time effect. On the basis of results of Table 4, only variables CTR, ATR and CAR have time effect other variables do not have time effect. In conclusion we can say that the fixed/random effect model will be applied.

Table 5. Regression Models (Independent Variable: GNPA as % of Advances).

Dependent Variables	Model		Coefficient	*SE*	*t*-ratio	*P* Value
NPR	SUR	Const	6.54284	0.565227	11.58	3.04e-024***
		*Z*2	−0.842451	0.0633846	−13.29	1.38e-029***
ROE	SUR	Const	0.806704	0.0614170	13.13	4.27e-029***
		*Z*2	−0.0937435	0.00688731	−13.61	1.37e-030***
CFMR	Fixed	Const	17.8416	2.31893	7.694	0.0001***
		*Z*2	−2.57838	0.346264	−7.446	0.0001***
	Random	Const	16.5560	2.20115	7.522	0.0001***
		Z2	−2.38642	0.285364	−8.363	0.0001***
CTR	Fixed	Const	3.30540	0.285493	11.58	0.0001***
		Z2	0.162429	0.0426300	3.810	0.0007***
	Random	Const	3.32749	0.348460	9.549	0.0001***
		Z2	0.159131	0.0395254	4.026	0.0001***
ATR	Fixed	Const	3.30482	0.285443	11.58	0.0001***
		Z2	0.162103	0.0426226	3.803	0.0007***
	Random	Const	3.32659	0.348438	9.547	0.0001***
		Z2	0.158853	0.0395218	4.019	0.0001***
CR	Fixed	Const	2.49170	0.267298	9.322	0.0001***
		Z2	0.113230	0.0399130	2.837	0.0082***
	Random	Const	2.48963	0.338672	7.351	0.0001***
		Z2	0.113539	0.0377700	3.006	0.0026***
CAR	Fixed	Const	13.4664	0.411916	32.69	0.0001***
		Z2	−0.0811369	0.0615075	−1.319	0.1974
	Random	Const	13.6388	0.471408	28.93	0.0001***
		Z2	−0.106873	0.0533870	−2.002	0.0453**

Note: **Means significant at 5% level of significance, ***means significant at 1% level of significance.

Table 5 reveals the results of the regression model. The variables NPR and ROE have only individual effect but no time effect so seemingly unrelated regression (SUR) models have been used. For other variables, we have used fixed and random effect models. The outcomes of SUR models show that GNPAR significantly impacts NPR and ROE ratio at 1% level of significance. Both NPR and ROE share inverse association which shows both NPR and ROE are negatively impacted by GNPAR. We can also conclude the impact of GNPAR on CTR, ATR and CR (at 1% level of significance) and CAR (5% level of significance). CFMR (return on equity) and CAR (capital adequacy ratio) are seen to have negatively impacted by GNPAR.

Table 6 displays the result of rho, joint and Hausman tests. Rho is the variance in dependent variable due to individual effect or individual specific term. From the results of Table 6, we see very less individual impact on

Table 6. Result of Rho, Joint and Hausman Tests.

	Z^2	Z^2	
		Hausman Test	
Dependent Variable	Rho	Chi-square	*P* Value
NPR	0.18	0.73	0.393
ROE	0.23	0.13	0.717
CFMR	0.02	3.43	0.064
CTR	0.14	0.36	0.548
ATR	0.14	0.35	0.554
CR	0.17	0.04	0.945
CAR	0.36	9.84	0.001

Table 7. Pooled OLS Model for Variables ROA and OCFR.

	Regressor: GNPAR			
	ROA		OCFR	
	Coefficient	*P* Value	Coefficient	*P* Value
Const	23.50	0.000***	1.345	0.000***
GNPAR	−0.5070	0.014**	−0.02910	0.016**
dt_2	−9.941	0.043**	−0.591	0.079*
dt_3	−16.63	0.001***	−0.856	0.002***
dt_4	1.185	0.839	−0.0595	0.866
dt_5	−32.85	0.000***	−1.626	0.000***
dt_6	−25.11	0.000***	−1.528	0.001***
dt_7	−21.96	0.000***	−1.119	0.000***

Note: *Means significant at 10% level of significance, **means significant at 5% level of significance, ***means significant at 1% level of significance.

dependent variables due to individuality of banks. Hausman test is used to compare the better fit between fixed effect and random effect models. Hausman test has the null hypothesis that GLS estimates are consistent. On acceptance of the hypothesis, we can take the random effect model as a better fit model. It can be seen from results that in case of all the variables (except CAR), the null hypothesis that GLS estimates are consistent has been accepted so the random effect model is more suitable. In case of CAR, the fixed effect model is more suitable.

Table 7 put forth the results of OLS models (run for variables ROA and OCFR) which include time dummies as well. We see that GNPAR has a significant impact on both ROA and OCFR (at 5% level of significance). The time dummies of both the variables are also significant (at 1% level of significance) for all the years except 2017.

Table 8. Diagnostic Checking.

	Independent Variable: GNPAR				
	Assumption 1	Assumption 2		Assumption 3	Assumption 4
Dependent Variable	Mean of Error Term	Chi-square	*P* Value	Correlation of Error Term with IDV	Durbin–Watson
NPR	1.039e-014	118.749	1.18829e-0	0.0734	1.134
ROA	1.446e-015	0.094463	0.758578	0.000	2.154
ROE	2.182e-014	64.0107	0.064163	0.1347	1.543
CFMR	2.182e-014	64.0107	1.23742e-0	0.1542	1.543
CTR	5.105e-015	262.587	4.68501e-0	−0.0433	1.333
ATR	1.247e-014	262.666	4.50202e-0	−0.1423	1.332
CR	8.120e-016	290.768	3.38157e-0	0.0050	1.366
OCFR	1.353e-016	0.574767	0.448371	0.000	2.064
CAR	1.096e-014	166.846	3.61449e-0	0.000	1.031

Diagnostic Checking

In this section, we examined whether the intercept and regressors violate any Gauss–Markov assumption; a fixed effect model remains BLUE. The results of diagnostic checking have been reported in Table 8. First assumption in this direction is to check whether mean value of error term is zero (to check this mean value of disturbance has been calculated). As per the results, it can be said that mean is almost zero in all the panel series (Column: Assumption 1). Then homoscedasticity has been checked using Breusch–Pagan test. As per the result that null hypothesis that there is homoscedasticity has been rejected (except variables ROA and OCFR). To control this problem of heteroscedasticity we have applied robust standard error. Next, we check the endogeneity that is to check whether error terms are correlated with independent variables. The correlation between the error term and independent variable is also close to zero in all variables so the endogeneity is not reported. So, the data are free from the problem of endogeneity. Then auto-correlation has been checked using Durbin–Watson test. If the Durbin–Watson test reading is less than 1, it shows negative auto-correlation and if it is more than 3 it shows positive autocorrelation. The value of test between1 to 3 shows no auto-correlation. As per the results of Durbin–Watson test all the variables are free from auto-correlation. So, we can say that the model developed for the study is fit as it clears all Gauss–Markov assumptions.

Discussion and Conclusions

For any bank, loans and advances are integral part of operation, but at the same time it is like a double-edged sword, if the quality of assets is non-performing in nature. It not only leads to non-recovery of loans but also stops the credit creation process subsequently. Beside these, NPA lowers the margins of banks and force the banks for higher provisions. The empirical outcomes offered in the current research ranges data from 2014 to 2020. The study replicates the findings of Louzis et al. (2012) in terms of bank size and NPA ratios; the larger the bank, the higher the NPA ratio. As per the findings of current study we can conclude that NPR is significantly impacted by NPA and inverse association indicates the fall in NPR with increasing NPAs. Further we found that cash flow margin ratio is impacted by GNPA ratio, negatively. So, we can conclude the negative association of cash flow margin with NPAs depending on the quantum of NPAs as a proportion to its advances. The ROA ratio is impacted by NPAs sharing negative association with it which implies the decrease in the ROA ratio with increasing NPAs. ROE is impacted by NPAs negatively. The current ratio and acid test ratio also have significant impact on GNPAs ratio. Cash ratio is also impacted by GNPAs ratio. Here also it can be concluded that cash ratio is impacted by GNPAs depending on their proportion in context of advances. The operating cash flow is also negatively impacted by NPAs. The capital adequacy is also seen to be impacted by GNPA ratio negatively. So, it can be said that the percentage portion of NPAs with advances specifies the connection between capital adequacy ratio and NPAs which is an inverse association amid the two.

The proposed study also guides to study the impact on NPAs on some more ratios related to operating efficiency and profitability of banks. Current study is limited to the Indian banking system so there is an ample scope for testing the same in global context taking a bigger and broad panel data.

Economic Implication

The study can provide valuable guidelines for policymakers to frame policies in the Indian banking system as a part of banking reform committees. These policies can be beneficial for the bankers, depositors, investors and the management to assess how the GNPA affects the profitability, liquidity and solvency of the banks. Further, they can also establish an affiliation between the capital adequacy and the NPAs.

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Article

Understanding Family Business Internationalisation: A Systematic Literature Review with Thematic Lenses

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Akansha Gupta[1] and Amit Kumar Dwivedi[2]

Abstract

This article is a systematic review and a critical examination of 61 journal articles (published from 1996 to 2019) on the family business internationalisation (FBI). The purpose of this article is to identify the key factors that have an impact on the FBI. The result of a systematic review of factors affecting the growth of FBIs is presented and utilises both the Australian Business Deans Council ranking and H-index to objectively demonstrate all the factors that can have an impact on family business to internationalise. The key findings reveal a total of five factors out of 108 factors, which were mentioned in minimum of four papers. Using the most influential articles identified in the analysis, the article concludes with six factors family ownership, role of networks, mindset of the family founder, cross-generational involvement, family involvement which needs to be controlled by family business if they want to achieve internationalisation.

Keywords

Literature review, family business (FB), internationalisation, factors, family business internationalisation (FBI)

Introduction

According to Sciascia et al. (2010), family business internationalisation (FBI) is becoming a hot issue in the academic community. It is becoming increasingly

[1]Entrepreneurship Development Institute of India, Gandinagar, Gujarat, India
[2]Department of Policy Advocacy, Knowledge & Research, Entrepreneurship Development Institute of India, Gandinagar, Gujarat, India

Corresponding author:
Akansha Gupta, Entrepreneurship Development Institute of India, Gandhinagar, Gujarat 382428, India.
E-mail: akansha05@ediindia.org

important for financial institutions to expand their operations outside of local markets as the global economy becomes more interconnected. The FBI may be distinct from that of a business with a different form of ownership (Fernández & Nieto, 2006; Graves & Thomas, 2004, 2006; Johanson & Vahlne, 2009). As a result, it's critical to isolate family businesses (FBs) from other forms of businesses when considering internationalisation.

About 20 years ago, the early study on the FBI was published in academic publications; now is the moment to examine the past and make any necessary improvements for the future. The following research questions will be addressed in this article: (a) What significant factors impact the FBI? (b) Which theories and approaches are used to globalise FBs? The solutions to these questions will be uncovered following an examination of prevalent scholarly publications.

Despite the increasing volume of information on the FBI, this undeveloped topic lacks compelling knowledge that connects the disparate findings of earlier research. To overcome this issue, 61 English-language, peer-reviewed journal articles published between 1991 and 2019 and originating from peer-reviewed journals were evaluated in depth. It is well established that this subject is thematically and methodologically heterogeneous, fractured and incoherent, and that it encompasses multiple periodicals. Due to this impracticality, a systematic approach to article selection and a narrative review are utilised to perform a literature review. Baumeister and Leary (1997) said that narrative review is particularly suited for connecting disparate disciplines of research in order to synthesise the literature efficiently.

After analysing the chosen literature, it is determined that the findings that impact family ownership and other elements of internationalisation are vastly dissimilar. Despite the fact that some scholars contend that family ownership and engagement have a good effect on internationalisation (Carr & Bateman, 2009; Zahra, 2003), others contend that family ownership hinders the internationalisation process (Graves & Thomas, 2006; Fernández & Nieto, 2005). Several essential factors support the FBI, whilst others hinder the process.

This article makes a stronger contribution. An extensive review of the field is provided at the outset of this research. The first comprehensive summary of studies on FBI was given by Kontinen and Ojala (2010). This study piece is an examination of the papers released up until 2019 and is a continuation of the systematic inquiry. Since there has been a significant growth in study in this area since that time, this analysis offers a more thorough analysis of the variables affecting the FBI.

The remainder of this article is organised as follows: Following the description of how the literature is picked, the overall conclusions of the entire sample are charted. Following is a summary of the results contained in the literature sample. The article concludes with concluding remarks and suggestions for future research based on the results of the thematic analysis used to identify the important components.

Methodology

This article's systematic literature review method is based on PRISMA. In this review, the SCOPUS database was employed. SCOPUS contains the majority of studies pertaining to family businesses. The keywords were determined based on our past knowledge and group brainstorming. The literature required for the purpose of our research is chosen using a systematic selection procedure comparable to that of David and Han (2004) and Newbert (2007), but with variations.

The selection norms are the following:

1. Exploration of only peer-reviewed journal articles published in English from 1980 to 2019 and written exclusively in English.
2. Perform a SCOPUS database search.
3. Ensure the substantive significance of the probable articles by noting the following keyword combinations in the article or abstract:

TITLE (((“family firm*”) OR (“family business*”) OR (“family enterprise*”) OR (“family influence*”) OR (“family owner*”)) AND ((“international*”) OR (“global*”) OR (“Mode of entry*”) OR (“foreign*”) OR (“export*”) OR (“international sales*”) OR (“international commitment*”) OR (“foreign direct investment*”))) AND (“factors*”). Confirm the significance of the articles by examining all the abstracts that explore issues affecting the globalisation of FBs.

4. The remaining papers must be thoroughly scanned and their connections to issues influencing the globalisation of family businesses examined.

Exclusion criteria included the absence of an Australian Business Deans Council (ABDC) ranking, papers lacking FBI features and publishing type (anonymous publications and book reviews). Then, 70 papers were deemed eligible after being filtered by the aforementioned criteria, and after reviewing the entire texts, 61 articles were selected for evaluation. The PRISMA flowchart in Figure 1 illustrates step-by-step removal and inclusion of SCOPUS papers. The authors analysed the content of all selected articles using a predetermined classification method. The data are represented by the following headings:

1. Analysis method (literature review, systematic literature review, quantitative, qualitative article), data collection method, analysis country, industry and sample size.
2. Theoretical approaches: internationalisation theories and models, theories that have been used to explain the effects of FBI.
3. Factors that influence FBI includes topics such as family ownership, the role of networks and family involvement.

Huge attention and research efforts have been made over the last 20 years. Until now, policymakers, practitioners and academics have been completely oblivious

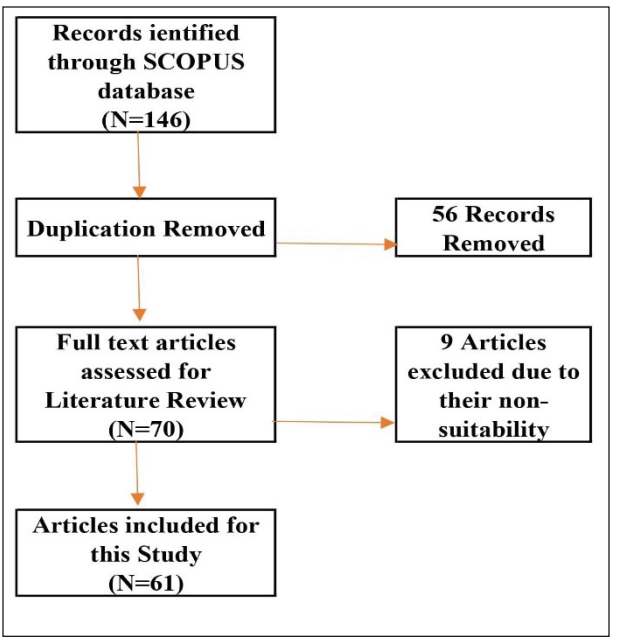

Figure 1. Prisma Flow Diagram.

to how the FBI process began and progressed. It's fascinating to learn about the important elements that influence the internationalisation process, as well as what resources need be purchased and what methods should be implemented to accelerate the process. The table-by-table findings of the literature review are quoted in the next paragraphs.

Table 1 details the 61 studies that we have used for our systematic literature review (SLR), including their data collecting technique, study type (quantitative or qualitative), nation, industry, sample size, number of citations, ABDC category and H-index. Table 1 will help you understand the type of data collection method they used to reach this conclusion, the context in which the research was conducted, any specific industry if the research was conducted industry-specifically, the samples they collected for their research and the findings of their research.

In addition, the top 10 papers by total number of citations are displayed. Gallo and Sveen (1991); Fernández and Nieto (2005); Gallo and Pont (1996); Kontinen and Ojala (2010); Graves and Thomas (2006); Davis and Harveston (2000); Scisscia et al. (2012); Pukall and Calabr (2014); Okoroafo (1999); and Claver et al. (1999) are the authors of the top ones (2009). This will aid in identifying the top 10 publications containing significant research on the specified topic. The influence of these 10 works is the greatest; hence, the number of citations must be specified. This will also aid in identifying the primary writers whose research has a bearing on this topic.

Table 1. Relevant Information of 61 Selected Papers/Analysis of Information in the Literature.

H-Index	Authors	Data Collection (Secondary/Survey)	Study Type (Conceptual/ Empirical (Quan./Qual.)	Country	Sample Size	Citations	ABDC Category
>150	Hennart et al. (2019)	Survey	Empirical (Quantitative)	Germany France, Italy and Spain	9214	34	A*
	Evert et al. (2018)	Secondary data	Empirical (Quantitative)	USA.	159	13	A
	Kraus et al. (2016)	Survey	Empirical (Quantitative)	Germany	426	71	A
	Sánchez-Bueno and Usero (2014)	Secondary data	Empirical (Quantitative)	Europe and Asia	882	51	A
120–149	Sciascia et al. (2012)	Survey	Empirical (Quantitative)	USA	1035	267	A
75–99	Ilhan-Nas et al. (2018)	Secondary data	Empirical (Quantitative)	Turkey	374	7	A
	Cesinger et al. (2016)	Interviews	Empirical (Quantitative)	Germany,Austria, Switzerland	334	38	A
	D'Angelo et al. (2016)	Secondary data	Empirical (Quantitative)	Italy	417	46	A
	Calabrò et al. (2016)	Semi-structured interviews and secondary data	Empirical (Qualitative)	Italy, USA, Europe	4	41	A
	Kontinen and Ojala (2011)	Semi-structured interviews and secondary data	Empirical (Qualitative)	Finland	8	157	A
	Chen et al. (2014)	Secondary data	Empirical (Quantitative)	Taiwan	217	51	A
	Lin (2012)	Secondary data	Empirical (Quantitative)	Taiwan	772	126	B
	Pukall and Calabrò (2014)	NA	Systematic Literature Review	NA	72	259	A
	Claver, Rienda and Quer (2009)	Mail Survey	Empirical (Quantitative)	Spain	92	195	A
	Liang et al. (2014)	Survey	Empirical (Quantitative)	China	902	94	A
	Davis and Harveston (2000)	Survey	Empirical (Quantitative)	USA	1078	270	A
	Okoroafo (1999)	Survey	Empirical (Quantitative)	USA	187	233	A
	Gallo and Pont (1996)	Survey	Mixed methodology	Spain	57	353	A
	Gallo and Sveen (1991)	Interviews	Empirical (Qualitative)	NA	NA	505	A
	Graves and Thomas (2006)	Secondary data	Empirical (Quantitative)	Australia	9731	351	A
	Fernández and Nieto (2005)	Secondary data	Empirical (Quantitative)	Spain	10,579	682	A
	Ramón-Llorens, García-Meca and Duréndez (2017)	Secondary data	Empirical (Quantitative)	Spain	187	29	A

(Table 1 continued)

(Table 1 continued)

H-Index	Authors	Data Collection (Secondary/Survey)	Study Type (Conceptual/ Empirical (Quan./Qual.)	Country	Sample Size	Citations	ABDC Category
50–74	Patel et al. (2012)	NA	Literature Review	NA	NA	58	C
	Plakoyiannaki et al. (2014)	Interviews and secondary data	Empirical (Qualitative)	Greece	8	17	A
	Minetti et al. (2015)	Survey	Empirical (Quantitative)	Italy	20,000	22	A
	Kampouri et al. (2017)	NA	Literature Review	NA	25	12	A
	Liu et al. (2011)	Secondary data	Empirical (Quantitative)	Taiwan	179	46	A
	Claveret al. (2008)	Survey	Empirical (Quantitative)	Spain	92	108	C
30–49	Carr and Bateman (2009)	Secondary data	Empirical (Quantitative)	Global	65	55	A
	Dou et al. (2019)	Secondary data	Empirical (Quantitative)	USA.	112	3	A
	Jorge et al. (2017)	Interviews and secondary data	Empirical (Qualitative)	Portugal	2	2	B
	Almodóvar et al. (2016)	Secondary data	Empirical (Quantitative)	Spain	610	8	C
	Kontinen and Ojala (2010)	NA	Systematic Literature Review	NA	25	306	C
<30	Pacheco (2017)	Secondary data	Empirical (Quantitative)	Portugal	82	8	B
	Scholes et al. (2016)	Interviews and secondary data	Empirical (Qualitative)	Singapore	6	36	B
	Jimenez et al. (2019)	Secondary data	Empirical (Quantitative)	Spain	159	1	B
	Ratten et al. (2017)	NA	Literature Review	NA	NA	17	C
	Memili et al. (2017)	Secondary data	Empirical (Quantitative)	USA	386	2	C
	Lehrer and Celo (2017)	Interviews and secondary data	Empirical (Qualitative)	Germany	1	1	C
	Braga et al. (2017)	Online survey	Empirical (Quantitative)	Portugal	156	8	C
	Sundaramurthy and Dean (2008)	Secondary data	Empirical (Quantitative)	USA.	489	18	C
	Wei and Tsao (2019)	Survey and secondary data	Empirical (Quantitative)	Taiwan	119	NA	C

(Table 1 continued)

(Table 1 continued)

H-Index	Authors	Data Collection (Secondary/Survey)	Study Type (Conceptual/ Empirical (Quan./Qual.)	Country	Sample Size	Citations	ABDC Category
	Mensching et al. (2016)	Interviews	Empirical (Qualitative)	Germany, Switzerland and Austria	126	16	C
	Cesinger et al. (2014)	Survey	Empirical (Quantitative)	Germany	112	21	C
	Marin et al. (2017)	Survey	Empirical (Quantitative)	Spain	58	5	A
	Larimo (2013)	Survey	Empirical (Quantitative)	Finland	343	17	B
	Claver et al. (2007)	Interviews and secondary data	Empirical (Qualitative)	Spain	6	103	B
	Menéndez-Requejo (2005)	Secondary data	Empirical (Quantitative)	Spain	1612	71	C
	Graves and Thomas (2004)	Survey	Empirical (Quantitative)	Australia	9731	152	C
	Mustafa et al. (2013)	Interviews and secondary data	Empirical (Qualitative)	Singapore	4	2	C
	Calabrò et al. (2009)	Survey	Empirical (Quantitative)	Norway	146	68	C
	Kansikas et al. (2014)	Survey	Empirical (Quantitative)	Finland	2000	5	C
	Fang et al. (2018)	Secondary data	Empirical (Quantitative)	USA	4925	24	A
	De Massis et al. (2018)	NA	Literature Review	NA	NA	35	A
	Ray et al. (2018)	Secondary data	Empirical (Quantitative)	India	343	15	A
	Kano and Verbeke (2018)	NA	Empirical (Qualitative)	NA	NA	24	A
	Pascucci and Bartoloni (2018)	Interviews and secondary data	Empirical (Qualitative)	Italy	2	NA	C
	Benito-Hernández et al. (2014)	Survey	Empirical (Quantitative)	Spain	1846	17	C
	Anand (2013)	Interviews and secondary data	Empirical (Qualitative)	Japan	1	6	C
	Stieg et al. (2018)	Online survey	Empirical (Quantitative)	Germany, Austria, Switzerland and Liechtenstein	1062	6	C
	Tsao et al. (2018)	Survey and secondary data	Empirical (Quantitative)	Taiwan	105	2	C

The selected articles have opted for qualitative, quantitative and literature review approaches. A total of 65% of the 61 chosen papers utilised quantitative analysis, while 13% utilised single or multiple case study analysis. Ten papers were literature reviews, with two utilising systematic literature reviews and one employing a hybrid technique. This demonstrates that this topic of study is not new and that it must be condensed to make a substantial addition to the existing literature. The majority of research has been conducted within the past 3 years (22 out of 61). This demonstrates the significance of this study field in the present day. In addition, these publications have received little citations due to the limited time they have for the same.

As data collecting methods, secondary data collection and survey questionnaires predominated. In fact, 17 papers relied only on survey data, while 16 relied on secondary data sources. Seven of the eight qualitative publications utilised interviews and secondary data sources. The data set used to analyse the FBI was compiled from 18 nations, 11 of which are in Europe. More data were gathered in Spain (12 databases), the United States (9 databases), Germany (7 databases), Italy (5 databases) and Taiwan (5 databases).

The survey sample sizes ranged from 82 to 9731 businesses. In studies employing qualitative research methodologies, the number of instances ranged from one to eight. Twelve examples of the 22 articles that examined manufacturing enterprises and businesses from a variety of industries comprised the 22 articles evaluated. This recommended that non-manufacturing industry-specific studies are necessary, given the possibility of disparities between manufacturing and service businesses.

The ABDC ranking and H-index will assist the researchers in determining which journal is the most widely read in this specific topic. As the criterion for selection was ABDC ranking, it is also displayed for each of the 61 selected papers. This will assist justify the selection of research publications for our study. The majority of the selected articles are A-category (31 articles), followed by B-category (7 articles) and C-category (22 articles).

Table 2 depicts the internationalisation-related ideas employed in the examined studies. Socioemotional wealth theory has been utilised in 14 publications. In 11 studies, the Uppsala model of internationalisation was employed. The resource-based perspective on internationalisation was implemented in six research based on management competencies. Despite being the most important aspect in FBI, the network theory of internationalisation was employed in only two research works. Numerous papers have shown internationalisation briefly in their study, albeit without employing internationalisation theories in their conceptual frameworks. Given the complexity of the internationalisation process, there is a need for research that adopts a more comprehensive perspective (Bell et al., 2003; Johanson & Vahlne, 2003). Only one article utilised Dunning's eclectic paradigm.

Table 3 displays the criteria cited in each of the 61 studies that were chosen after careful consideration. These 61 articles focus mostly on elements that might have a favourable or negative impact on the globalisation of FBs. This helps to understand the influence of many factors on the FBI. All of these variables, which

Table 2. Theoretical Frameworks used in 61 Articles.

Framework	No. of Times Used	Framework	No. of Times Used
Socio-emotional wealth	14	Institutional theory	1
Uppsala model of internationalisation	10	Strategic decision process theory	1
Agency theory	9	Stagnation theory	1
Resource based view	6	Upper-echelon theory	1
Stewardship theory	6	Dunning's eclectic paradigm	1
Social capital theory	3	Stage model theory	1
Network theory	2	Organisational capabilities perspective	1
Theory of resources and capabilities	2	Willingness and ability framework	1
Pecking order theory	2	Global niche business model	1
Transaction cost theory	2	Gravity model	1
Internationalisation theory	1	Behavioural agency theory	1

Table 3. Factors Affecting Family Business Internationalisation in 61 Selected Articles.

Authors	Factors Affecting Family Business Internationalisation
Hennart et al. (2019)	Selling quality products
Wei and Tsao (2019)	Family influence, employee commitment, customer loyalty, corporate reputation, top management heterogeneity, family heterogeneity (family ownership and governance)
Jimenez et al. (2019)	Political risk exposure, family control
Dou et al. (2019)	Cross-generational involvement, presence of a family board
Ilhan-Nas et al. (2018)	Board composition, family ownership, institutional distance, foreign equity ownership
Evert et al. (2018)	Family ownership, family involvement
Fang et al. (2018)	Family ownership, knowledge-based resources, founding and later generation family owners
De Massis et al. (2018)	Family firm heterogeneity, family involvement
Ray et al. (2018)	Family ownership, family management and foreign institutional ownership
Kano and Verbeke (2018)	Location choice and operating mode

(Table 3 continued)

(Table 3 continued)

Authors	Factors Affecting Family Business Internationalisation
Stieg et al. (2018)	Collaboration intensity, international market knowledge, education and international business experience
Pascucci and Bartoloni (2018)	Mindset of the family founder, competitive strategy, localisation, international product strategy, commitment of family owner towards internationalisation
Tsao et al. (2018)	Top management heterogeneity, family heterogeneity (family ownership and governance)
Ramón-Llorens et al. (2017)	CEO academic qualification
Marin et al. (2017)	Leverage, profitability, family ownership
Memili et al. (2017)	Family governance (i.e., family ownership and involvement in management and board of directors)
Lehrer and Celo (2017)	Boundary spanning across global product markets, boundary buffering across global financial markets
Kampouri et al. (2017)	Role of networks
Jorge et al. (2017)	Family ownership, family management
Braga et al. (2017)	Institutional factors, relative size of the firm, family factors, information obstacles, innovation
Ratten et al. (2017)	relational norms, social networks
Pacheco (2017)	Family ownership, control structure, firm size, family involvement, leverage
Kraus et al. (2016)	External ownership, the presence of a non-family CEO, the presence of non-family members on the advisory board, international networks
D'Angelo et al. (2016)	External managers, family ownership
Calabrò et al. (2016)	Incoming generation involvement, mediating role of altruism and competence-based trust
Scholes et al. (2016)	Trust, harmony, networks, resources/capabilities
Mensching et al. (2016)	Family influence, family involvement, market entry mode, Family CEOs, non-family CEOs
Almodóvar et al. (2016)	Human asset quality
Minetti et al. (2015)	Family ownership, collaboration with foreign firms and intermediaries, corporate governance
Sanchez-Bueno and Usero (2014)	Degree of family ownership, type and the degree of ownership of the second largest shareholder
Pukall and Calabrò (2014)	Role of knowledge and networks, risk attitudes
Kansikas et al. (2014)	Product and service quality, delivery time
Plakoyiannaki et al. (2014)	Attitude towards risk, family owner's mindsets, governance, strategic use of IT, digital entry modes
Benito-Hernández et al. (2014)	Debt level of the firm, family ownership
Cesinger et al. (2014, 2016)	Perceived psychic distances, perceived cultural distances and relative perceived performances, collaboration intensity, international market knowledge and network trust

(Table 3 continued)

(Table 3 continued)

Authors	Factors Affecting Family Business Internationalisation
Chen et al. (2014)	Family ownership, institutional ownership
Liang et al. (2014)	Family ownership, family involvement in management
Mustafa et al. (2013)	International networks
Anand (2013)	Involvement of the second and subsequent generations, strong alliances
Larimo (2013)	Firm Management, export strategy
Patel et al. (2012)	Push factors: Strategic drivers, competitive forces, family demands and pull factors: Desirable location, network's and alliances, pre-emptive positions
Lin (2012)	Family ownership
Sciascia et al. (2012)	Family ownership
Liu et al. (2011)	Family ownership, family control, organisational slack
Kontinen and Ojala (2010,2011)	Limited financial capital, long-term plans, possibility to take quick decisions, fear of losing control in the context of internationalisation, firm size, flexibility of the management team, new network ties, alertness in international opportunity recognition
Carr and Bateman (2009)	Family ownership, family control
Claver et al. (2007, 2008, 2009)	Firm age, firm size, generation of the family firm, strategic alliances, market entry strategies, strong international commitment long-term vision, presence of external managers
Calabrò et al. (2009)	Non-family board members, Board's involvement in advisory tasks
Sundaramurthy and Dean (2008)	Frequency of board meetings, number of family members on the board, participation in university family business programs, percentage of stock ownership
Fernández and Nieto (2005)	Family ownership, second generation family business, family business with collaborative agreements (alliances), joint ownership
Menéndez-Requejo (2005)	Second generation, firm size
Graves and Thomas (2004, 2006)	Networks, Selection of markets based upon psychic distance, knowledge, ownership (asset power), location, transaction costs, organisational capabilities, innovation, managerial capabilities, management capacity, expertise and processes
Davis and Harveston (2000)	Entrepreneurial characteristics (age and education), internet usage and investment in Information technology
Okoroafo (1999)	Generation of the firm
Gallo and Pont (1996)	Owner's long-term commitment, family member's interest, speed in decision-making and concentration of power by an individual
Gallo and Sveen (1991)	Company culture, international knowledge and attitudes, organisation structure, company strategy

Table 4. Thematic Analysis and Themes Emerged.

Themes	Factors Included	Mentioned in
Family ownership	Family ownership	19
Family business networks	Role of networks (4), relational norms (1), social networks (1), international networks (2), network trust (1), new network ties (1)	10
Family business founder	Mindset of family founder (2), commitment of family owner towards internationalisation (1), long-term plans (1), possibility to take quick decisions (1), long-term vision (1), fear of losing control in the context of internationalisation (1), owner's long-term commitment, speed in decision-making (1)	8
Cross-generational involvement	Cross-generation involvement (1), involvement of the second and subsequent generations (1), incoming generation involvement (1), second generation (1), generation of family firms (2)	6
Family involvement	Family involvement	6

are responsible for the FBI, must be investigated in depth. All of these variables might eventually serve as the foundation for any FB.

Table 4 is the centre piece of our research since it contains all of the variables in a single location. It demonstrates how numerous variables hinder or facilitate the FBI. This also aids comprehension of how different research have focused on contrasting aspects to demonstrate their impact on FBI.

The articles which did not use internationalisation theories, the largely used agency theory (9 articles), stewardship theory (6 articles) and social capital theory (3 articles). Additionally, theory of resources and capabilities, transaction cost theory, pecking order theory and network theory were employed (2 articles each). Institutional theory, upper-echelon theory, strategic decision process theory, stagnation theory, stage model theory, organisational capabilities perspective, willingness and ability framework, global niche business model and gravity model were also utilised (1 article each). Overall, it suggests that amalgamations of quite a few theories, with the exception of internationalisation theories, dominated studies on FBI. This might be considered a research gap that prompted the present investigation. Though, these prior researches make the study of FBI disjointed, and the assessment of findings challenging. All in all, the formation and the reasoning of the theoretical frameworks used were contentious: There was lack of relevant account of the theories that were seen as vital, and there was often no explanation of whether the framework enforced was built on 'theories' or whether the foundation was laid on perspectives. Moreover, the theory tended to be ineffectively used in the substantial study of the data.

Annexure 1 and Table 2 portray the distribution of articles. There are nine articles on FBI from the *Journal Family Business Review*.

Annexure 1. Distribution of Articles by Time Period and Journal.

	Number of Articles Per Time Period							
Journal	1991–2002	2003–2005	2006–2008	2009–2011	2012–2014	2015–2017	2018–2020	Total
Family Business Review	4	1	1	1	2			9
International Journal of Globalisation and Small Business		2		1	1			4
Journal of General Management			1					1
Multinational Business Review			1					1
Journal of Small Business and Enterprise Development			1					1
Management International Review				1				1
Journal of Family Business Strategy				1				1
Management and Organization Review				1				1
Journal of Small Business Management				1	1	1		3
Small Business Economics					1			1
European Management Journal					1			1
Business Horizons					1			1
International Studies of Management and Organization					1			1
International Journal of Business and Globalisation					1		1	2
European Journal of International Management					1	1		2

(Table Annexure 1. continued)

(Table Annexure 1. continued)

	Number of Articles Per Time Period							
Journal	1991–2002	2003–2005	2006–2008	2009–2011	2012–2014	2015–2017	2018–2020	Total
South African Journal of Business Management					1			1
Marketing Intelligence and Planning					1			1
World Review of Entrepreneurship, Management and Sustainable Development					1			1
Journal of Business Research					1	1	1	3
Economica						1		1
Journal of Leadership and Organizational Studies						1		1
Thunderbird International Business Review						1	1	2
Journal of World Business						2	1	3
International Journal of Wine Business Research						1		1
International Journal of Entrepreneurship and Small Business						1		1
Review of International Business and Strategy						1		1
Journal of Business Strategy						1		1
Journal of Business and Industrial Marketing						1		1

(Table Annexure 1. continued)

(Table Annexure 1. continued)

	Number of Articles Per Time Period							
Journal	1991–2002	2003–2005	2006–2008	2009–2011	2012–2014	2015–2017	2018–2020	Total
Journal of Business and Industrial Marketing						1		1
Review of International Business and Strategy						1		1
International Journal of Management and Enterprise Development						1		1
Applied Economics						1		1
International Business Review						1		1
Journal of Small Business Strategy							2	2
Global Strategy Journal							4	4
Journal of International Financial Markets, Institutions and Money							1	1
Chinese Management Studies							1	1
Journal of International Business Studies							1	1
	4	3	4	6	14	17	13	61

Annexure 2 displays several factors and the number of articles in which they have been referenced in order to identify the most influential elements on the FBI. The next stage is to identify the elements that have the greatest influence on the FBI. To accomplish so, we must identify the elements that have been stated by researchers at various times. This table displays the various elements and the frequency with which they are cited in various publications.

The factors that appear in the majority of studies demonstrate their prominence in comparison to other variables. Consequently, these elements may be generalised based on their recurrence. In contrast, the characteristics that were just described

Annexure 2. Number of Papers Having Same Factors.

Factors	Number of Times It Is Mentioned	Factors	Number of Times It Is Mentioned
Selling quality products	1	Competence based trust, trust	1+1
Family influence	2	Resources/capabilities	1
Employee commitment	1	Market entry mode	1
Customer loyalty	1	Family CEOs	1
Corporate reputation	1	Human asset quality, product and service quality	1+1
Political risk exposure	1	Corporate governance	1
Family control	3	Delivery time	1
Cross-generational involvement, second generation, involvement of the second and subsequent generations, generation of family firms, incoming generation involvement	1+1+1+2+1	Strategic use of IT, digital entry modes	2+1
Mediating role of altruism	1	International knowledge and attitudes	1
Board composition, presence of non-family members on the advisory board, number of family members on the board, presence of a family board	1+2+1+1	Debt level of the firm	1
Family ownership	19	Perceived psychic distances, Perceived cultural distances	1+1
External managers	2	Relative perceived performances	1
Knowledge based resources	1	Organisation structure	1
Founding and later generation family owners	1	Strong alliances	3
Family firm heterogeneity	2	Joint ownership	1
Family involvement	6	Push factors, pull factors	1+1

(Table Annexure 2. continued)

(Table Annexure 2. continued)

Factors	Number of Times It Is Mentioned	Factors	Number of Times It Is Mentioned
Family management	3	Strong international commitment	1
Foreign institutional ownership, external ownership, foreign equity ownership	2+1+1+1+1	Flexibility of the management team	1
Location choice	2	Alertness in international opportunity recognition	1
Operating mode	1	Institutional distance	1
Collaboration intensity, collaboration with foreign firms and intermediaries	3+1	Organisational slack	1
International market knowledge	2	Limited financial capital	1
Education and international business experience, CEO academic qualification	1+1	Long-term plans	1
Mindset of the family founder, commitment of family owner towards internationalisation, long term plans, possibility to take quick decisions, long term vision, fear of losing control in the context of internationalisation, owner's long-term commitment, speed in decision -making	2+1+1+1+1+1+1	Attitude towards risk	1
Localisation	1	Board's involvement in advisory tasks	1
Top management heterogeneity	1	Frequency of board meetings	1
Presence of a non-family CEO	2	Firm age	2
Leverage	2	Participation in university family business programs	1

(Table Annexure 2. continued)

(Table Annexure 2. continued)

Factors	Number of Times It Is Mentioned	Factors	Number of Times It Is Mentioned
Profitability	1	Percentage of stock ownership	1
Family governance	1	Company culture	1
Boundary spanning across global product markets	1	Management capacity	1
Boundary buffering across global financial markets	1	Expertise and processes	1
Institutional factors	1	Transaction costs	1
Relative size of the firm, firm size	1+5	Innovation	2
Information obstacles	1	Organisational capabilities, managerial capabilities	1+1
Concentration of power by an individual	1	Company strategy, market entry strategies, competitive strategy, international product strategy, export strategy	1+1+1+1+1
Social networks, new network ties, relational norms, role of networks, international networks, network trust	1+1+1+4+2+1	Family member's interest	1

in a single publication are more context-dependent and cannot be generalised to the whole research field.

The theme that has formed after assessing all key components is shown in Table 4. The final phase is to identify significant elements by identifying repeated factors stated in at least six separate publications. After that, these aspects are put together in order to establish a common theme.

The topics that emerged from the thematic analysis were family ownership, the role of networks, the family founder's mindset, cross-generational involvement and family involvement. These five characteristics were shown to have the greatest influence on the FBI. Therefore, all researchers and FBs must examine these variables as the foundational components. They must be given serious consideration since they might inhibit or help the FBI.

Discussion

After conducting a literature analysis, we have identified around 108 elements that can have an effect on the FBI. We are attempting to highlight crucial

characteristics that the majority of researchers have deemed relevant. We determined the following six elements, which we refer to as 'key factors'.

Family Ownership

Fernández and Nieto (2005) explain a negative association between family ownership and internationalisation, as assessed by export activity. Sanchez-Bueno and Usero (2014) and Benito-Hernández et al. (2014) support the views of Fernández and Nieto that the degree of family ownership has a negative effect on the degree of international diversification, and Liu et al. (2011) discovered that the family ownership affects the international involvement of high-tech firms. Claver et al. (2007) demonstrate an inverted U-shaped relationship, that is, a non-linear relationship between family ownership and international entrepreneurship; this suggests that international entrepreneurship is maximised when family ownership levels are moderate, whereas Liang et al. (2014) suggest that family ownership depicts a U-shaped relationship with regard to internationalisation.

According to Tsao et al. (2018), family ownership is highly connected with international tendency. Lin (2012) finds a direct link between family ownership and MNC internationalisation velocity, as well as an indirect link between family ownership and internationalisation scope and rhythm. According to Minetti et al. (2015), family ownership improves the likelihood of enterprises exporting, implying that family ownership has an impact on a firm's internationalisation process. Jorge et al. (2017) backed up Minetti, Murro and Zhu's argument that family ownership is linked to family company internationalisation. Family ownership and control individualistically explain the breadth of family SMEs, according to D'Angelo et al. (2016). Internationalisation may be maximised if both the management team and the ownership structure are open to outside input. It is only possible to increase internationalisation. According to Evert et al. (2018), increasing family ownership reduces the likelihood of initial international entrance. Chen et al. (2014) disagree with previous findings, claiming that FB would internationalise if there is a high level of family ownership. Ray et al. (2018) backed up Chen, Hsu and Chang's findings that businesses dominated by family owners do not choose internationalisation owing to high ownership. Marin et al. (2017) discovered that FBs with a higher level of family engagement in their ownership performed better in their internationalisation process.

Role of Networks

Graves and Thomas (2004) claim that FB prefer not to interact with other enterprises. Access to resources and competencies essential for internationalisation, as well as access to foreign relationships and market expertise, are both favourable factors on family company internationalisation. According to Coviello and McAuley (1999), networks are critical in the process of FBI, and the inclination to internationalise is reliant on the set of network links. According to Mustafa et

al. (2013), worldwide networks are the driving force behind Singaporean family enterprises' internationalisation. Scholes et al. (2016) also support the idea that networks help small FBs to internationalise. According to the findings, social networks and relational norms are important for increasing FB international performance (Ratten et al., 2017). International chances are acknowledged by developing new formal networks rather than family or informal networks, according to Kontinen and Ojala (2011). According to Cesinger et al. (2016), high network trust aids in the FBI. International networks were discovered to have a beneficial association with the FBI (Kraus et al., 2016). Memili et al. (2017) discovered that internationalisation and family ownership had an inverted U-shaped connection. Fang et al. (2018) conducted research to better understand how different sorts of family owners affect internationalisation. Based on the updated Uppsala model (Pukall & Calabr, 2014), an integrative theoretical model was created, incorporating the frameworks of network view and SEW. The findings back with previous research by Kampouri et al. (2017) that found a link between network role and internationalisation process.

Mindset of the Family Founder

According to Pascucci and Bartoloni (2018), a founder's attitude towards FBI is determined by his or her devotion. The author's findings reflect previous research showing the attitude of the family founder is critical in the internationalisation process. If the entrepreneur takes a worldwide strategy, the degree of internationalisation is favoured since it affects the scale and time dimension of the company. According to Gallo and Pont (1996), FBI is driven by the owner's long-term commitment and rapidity in making decisions. Plakoyiannaki et al. (2014) discovered that the attitudes of family owners had an impact on international paths. Claver et al. (2009) found that long-term vision is linked to entrance modalities that need more international commitment. Fear of losing control and long-term planning are variables impacting FBI, according to Kontinen and Ojala's (2010) research.

Cross-generational Involvement

According to Okoroafo (1999), there is a lower likelihood of a FB becoming worldwide if it is not done in the first and second generations. Foreign market entry should be more aggressive for first- and second-generation FB owners. According to Menéndez-Requejo (2005), if a FB is in its second generation, it has a better chance of becoming internationalised. Fernández and Nieto (2005) agree with Menéndez-Requejo's findings that the presence of the second and subsequent generations in the family SME encourages international engagement. According to Claver et al. (2007), the emergence of FB has a substantial impact on the formation of worldwide strategic alliances. According to Anand (2013), the key cause for FBs worldwide development is the engagement of the second and

following generations in management decision-making. According to Calabrò et al. (2016), the engagement of future generations influences the decision to utilise and explore foreign prospects. Internationalisation is aided by cross-generational engagement in the firm, according to Dou et al. (2019).

Family Involvement

Family engagement in management has an inverted U-shaped association with the chance of internationalisation, according to Liang et al. (2014). Memili et al. (2017), on the other hand, found that the first two had a U-shaped association. Family engagement lowers the chances of first-time foreign admission (Evert et al., 2018). According to Mensching et al. (2016), the greater the family engagement in active management, the more successful the internationalisation plan will be. According to Pacheco (2017), family engagement has both a negative and positive impact on internationalisation. According to De Massis et al. (2018), family engagement plays a role in the junction of international business and family firm heterogeneity.

Synthesis

Based on a thorough literature study, the theme analysis in this research tried to assess the factors that have a significant influence on FBI: (1) review of previous research, (2) H-index and ranking system (ABDC) and (3) thematic analysis to identify emergent themes from the many variables were all used in the study and assessment of factors.

To begin, all articles pertaining to FBI were gathered from the relevant source SCOPUS, which includes key research in SMEs. Following that, these publications went through a series of processes to ensure that only the most relevant studies were selected for our systematic literature review. Second, the articles were assigned according to their H-index and ABDC score. We came up with 61 papers out of a total of 146 papers after a lengthy screening procedure. These 61 publications were given important details such as the paper's methodology, the nation in which the study was conducted, the industry referenced in the research, sample size, data gathering technique, citations, H-index and ABDC rank. Finally, we mentioned the top 10 publications with the most effect on this topic.

Finally, thematic analysis was used to group elements into five categories: family ownership, network role, family founder mindset, cross-generational involvement and family involvement. We used three tables to conduct our investigation. The first table listed the factors from all of the papers that had been chosen. The second table listed all of the variables along with the number of publications in which they were discussed. The third and final table aids in the selection of five elements that have the greatest overall influence. Furthermore,

we devised five distinct themes. Only by properly monitoring these six important aspects in FB will they be able to accomplish FBI.

Implications and Future Research

Many studies have been conducted in order to better understand the elements that influence FBI. Nonetheless, there was a lack of factor compilation, and the corpus of information failed in providing the most important elements. This research bridged the gap, with the findings of this publication contributing by pinpointing significant factors in that body of work.

Many review studies on the FBI have attempted to summarise and synthesise the contradicting opinions, according to Kontinen and Ojala (2010) and Pukall and Calabro (2014). Because they lack meta-analytical skills, these research pieces are unprofessional in offering definite closure. This problem can only be answered by employing meta-analytic approaches to collate data on the FBI from a variety of studies and nations, resulting in a more comprehensive and concise understanding than any one study (data set) can provide. Furthermore, research must address two major concerns: the absence of measurement equivalence for both the FB and internationalisation constructs, as well as the lack of contextualisation of theories utilised to analyse FBI in previous studies.

The influence of family management heterogeneity on FBI should be investigated. Future research should look at the combined and independent effects of family engagement in business management and ownership. Future research should distinguish between different types of internationalisations for different FBs, such as whether they purposefully build networks for the aim of internationalisation or if they internationalise because of existing networks. A detailed investigation of the learning process that occurs during networking activities for internationalisation on the factors and effects of international opportunity recognition of FBs is also required. In the future, the researchers may consider other interpersonal elements that influence internationalisation, such as family values and interactions among family members. The risk preferences of the owner/manager may also be investigated to see whether they mediate. The study might also look at whether risk preferences of owners/managers influence the relationship between family ownership and internationalisation efforts. A full examination of family and ownership arrangements, as well as their impact on various types of internationalisations, would be intriguing.

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Article

To Study and Explore the Adoption of Green Logistic Practices and Performance in Manufacturing Industries in India

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Ajit M. Maurya[1], Bhushan Padval[1], Madhurendra Kumar[2] and Ashish Pant[3]

Abstract

Environmental concerns are top priorities for all nations in the globe today. Organisations must thus address these problems given the ongoing pressure on them to take action that is environmentally friendly. One industry that has a negative impact on the environment is logistics. Logistics activities have greatly risen as a result of globalisation. The logistics market will reach USD 6,300 billion on a global scale by 2024, with a compound annual growth rate of 4.9% from 2019 to 2024. In order to improve the environment and reduce carbon emissions, manufacturing companies are implementing new strategies and green regulations. Green logistics has recently gained popularity in wealthy nations. Despite being in developing nations, it is still in its early stages and requires more attention. The lack of promotion and adoption of green techniques in logistics by developing nations had been questioned. For the Indian manufacturing sector, the current study focuses on green logistics drivers, challenges, practices and performance metrics (especially in the oil and gas sector). Because it is a well-known industry that generates a significant amount of carbon emissions, the oil and gas sector was chosen for the research study. This industry's downward vertical includes the main logistics functions, such as marketing and wholesaling

[1] Thakur Global Business School, Mumbai, Maharashtra, India
[2] Fashion Technology, Amity University, Raipur, Chhattisgarh, India
[3] Rajeev Gandhi College of Management Studies, Navi Mumbai, Maharashtra, India

Corresponding author:
Ajit M. Maurya, Thakur Global Business School, Thakur Educational Campus, Thakur Village, Kandivali, Mumbai, Maharashtra 400101, India.
E-mail: ajit.maurya@thakureducation.org

and has never been centred on green logistics. The implementation of the green logistics practices is governed by a number of drivers and barriers that both enable its implementation and may serve as obstacles. These factors must be thoroughly explored because they are the most important ones. This study's main goal is to provide a conceptual framework for green logistics that will apply to the logistics activities carried out by the Indian manufacturing industry (oil and gas) and the impact they have on economic and environmental performance. In the context of the oil and gas industry, the key green logistics drivers that could facilitate the adoption of green logistics practises have been thoroughly researched. By outlining the finest green logistics methods and factors that the sector should take into account, this study is further developed. The officials and managers who work for the downward logistics of the oil and gas industry were selected for the study and the survey questionnaire was employed as the research tool. Finally, using structural equation modelling, the effects of these green logistics practises on economic and environmental performance have also been researched and examined (SEM). When developing various rules and incentives for the Indian manufacturing sector to encourage the adoption of green logistics practices, this report would be crucial for the government. The results of this study about various green logistics activities may be related to creating a long-term plan for the industrial sector. The research will be helpful to future researchers, practising managers, governmental organisations, academic institutions and the Indian manufacturing industry as a whole.

Keywords

Green procurement, green logistics, logistics and distribution, occupational safety, health hazard, green marketing

Introduction

According to a report by the IBEF Knowledge Centre, India's logistics industry is likewise growing quickly. One of India's well-known domestic rating agencies stated that the country's logistics market is presently valued at about USD 160 billion and is expected to increase at a rate of up to 10% in the coming years. The rise is an improvement over the compound annual growth rate (CAGR) of 7.8% that the industry had experienced over the previous five years (IBEF, n.d.).

Typically, the logistics system is blamed for having a considerable impact on global energy consumption and greenhouse gas (GHG) emissions (Kim & Han, 2011; Murphy & Poist, 2003). In the United States, the transportation sector is primarily responsible for 28% of all GHG emissions (USEPA, 2021). Stakeholders are putting more pressure on businesses to accept responsibility for the negative and damaging effects their three logistical operations have on the environment. The current study focuses on green logistics practices, which the Indian manufacturing industry is either doing now or plans to apply in its logistics operations (especially in the oil and gas industry). The implementation of the

green logistics practices is governed by a number of drivers and barriers that both enable its implementation and may serve as obstacles. These 'drivers' and 'barriers' are the important elements, thus they must be thoroughly investigated. The performance will also be impacted by the use of green logistics practices. The research discusses performance in terms of both the economy and the environment.

The primary goal of this research study is to create a conceptual framework for the green logistics practises used in the operations of a specific Indian manufacturing sector (oil and gas) and their impact on the performance of the economy and the environment. By leveraging this study and investigating the green logistics techniques being used by a small portion of the Indian manufacturing sector, a theoretical framework has been developed. First, there has been a lot of research done on the key factors and obstacles that could help or impede the adoption of green logistics practises. This study is expanded upon by a list of the top green logistics strategies that the Indian manufacturing sector should take into account (especially the oil and gas industry). Their economic and environmental performances have eventually been examined in relation to green logistics techniques. Such thorough research studies could aid the Indian manufacturing sector in strategic decision-making regarding the adoption of green logistics practises for achieving environmental goals, as well as providing insight into the effects of these practises on the environmental and economic performances, thereby achieving long-term sustainability.

The move towards greening logistics, which should not only focus on following government regulations but also satisfy customer demands and uphold environmental obligations, is motivated by the rising environmental awareness. Green logistics affects society, the economy and the environment in addition to the environment. Green logistics, according to Lee and Klassen (2008), are logistics activities carried out by a business or organisation that considers environmental concerns and integrates them into the supply chain to improve environmental performance. The term 'green logistics' is used to describe a number of procedures that minimise the environmental issues associated with logistics operations by maintaining a balance between economic and environmental outcomes. Green logistics is the development of current logistics that emphasises the performance of these logistics-related activities in an eco-friendly manner to understand economic growth while preserving the available and existing resources, thereby safeguarding the environment from the negative effects of the activities (Zang et al., 2020).

According to a study by EyeforTransport (O'Reilly, 2007), about 25% of tested businesses in the United States, United Kingdom, Gulf countries and Asia Pacific have worked with outside logistics providers to promote their image as being more environmentally friendly or advance their green and sustainable projects. Utilising green logistics helps to promote stable growth in the economy and environment by reducing the negative effects of logistical activities on the environment, such as gas emissions, trash and noise (Wang et al., 2018). In other words, green logistics strives to reduce environmental harm and damage caused by logistics during various logistics activities and aids in environmental clean-up, allowing for the efficient and effective use of logistics resources. As a result,

environmentally friendly and sustainable development is made possible. Green logistics operations consider how different distribution techniques would affect the environment, how much energy will be used during those activities, how much garbage will be produced, and how to manage that waste's treatment (Sbihi & Eglese, 2009). According to Martinsen and Bjorklund (2012), there is an increase in demand for green logistics activities. The interest in green logistics is rising as a result of this trend. By incorporating the green concept into their logistical systems, businesses in the manufacturing industry and other sectors are forced to increase both their efficiency and environmental performance. Academics, teachers and managers are debating the environmental challenges in logistics-related operations as a result. By supporting the industrial sector's pro-environmental initiatives, numerous reports and projections have been issued to demonstrate the significance and urgency of this area of knowledge. However, the emergence of environmental concerns in logistics operations, particularly in poor nations, is still in its infancy.

Manufacturing is the backbone of any nation and is crucial to contemporary civilisation since it encompasses a wide range of activities, from textile manufacture to steel production. Manufacturing is built on the idea of transforming raw materials into the practical goods that society needs and uses. Several divisions of the manufacturing industry exist depending on various variables. The manufacturing sector is segmented as follows according to the raw materials employed:

1. *Agro-based Industries:* Cotton, Wool, Jute, Sugar, Tea, Coffee, Silk, Textile, Rubber, etc.
2. *Mineral-based Industries:* Iron and Steel, Aluminium, Cement, Oil and Gas, etc.

The oil and gas sector plays a significant role in the global logistics system, which also includes international shipping, export and import services, and inventory management. As a result, this sector provides room for a workable strategy to achieve the viability of environmentally friendly logistical activities. This is one of the justifications for taking into account this sector for implementation studies of green logistics methods in the context of Indian manufacturing. One of the most significant major non-renewable resources in the planet, petroleum is acquired from offshore or underground areas (Hussain et al., 2013). Oil is crucial because it generates income for the nation.

Given that countries with oil deposits are among the richest in the world, the worldwide supply and distribution of these reserves, as well as their consumption and production, are incredibly uneven (Yergin, 2011). By 2050, it has been predicted that there will be about 9.8 billion people on the planet (UNPD, 2017). Additionally, the population of India is growing quickly and has already surpassed 140 Crore.

India's enormous population growth has significantly strained the country's existing and readily accessible non-renewable resources, which in turn affects climate change. Additionally, the downward-vertical logistical activities of the oil and gas business in India make it one of the most polluting industries in the world

(Abubakar, 2014). Thus, it is essential to incorporate green practices into the logistics for oil and gas, as this will aid in resolving environmental issues. In order to address some of the environmental challenges in the business, sustainable logistics methods should be implemented in the logistical operations of India's oil and gas sector. There is a dearth of research on green logistics in this sector, and little is known about the factors that influence whether green logistics methods are adopted or used, as well as how they affect both environmental and economic performances. Only a few studies have addressed the importance of sustainability, environmental protection and GHG emission reduction measures. Although it is uncommon for research to be focused on examining the elements that affect enterprise performance (Frynas, 2009; García-Rodríguez et al., 2013; Wan Ahmad et al., 2016).

The idea of 'green logistics' is still in its infancy in India and requires a lot of attention. Although it is aware of the green logistics idea, the manufacturing sector is still not fully applying it. There are not many research works on the subject specifically related to the Indian manufacturing industry. Both of the green logistics strategies have been the subject of all studies. In the context of the Indian oil and gas industry, there are no studies that examine all the activities of green logistics techniques and their effects on performances. However, due to the narrow scope of this study, the researcher was unable to locate a single empirical study that addresses many green logistical challenges in one location, let alone in the context of the descending logistics activities of the Indian oil and gas business. Additionally, the majority of studies have only taken into account one or a maximum of two green logistics operations. Studies have talked about how transportation affects productivity. However, these studies do not pay attention to other performances, including economic and environmental ones. By doing the research that provides a foundation for the complete performance of green logistics practices, many holes will be filled. Research on the practices and performance difficulties of green logistics methods within the Indian manufacturing industry is lacking, according to green logistics academics. By creating a green logistics performance-based framework with the aid of various descriptive and inferential statistical studies on a subset of the Indian manufacturing industry, the current research study intended to close these gaps (oil and gas). This will make it easier for businesses in related industries to adopt green practices that will improve how they manage their overall performances.

The lockdown, slower pace of mobility and lower usage of fossil fuels have undoubtedly helped nature recover, but they are definitely not a fix. The quantity of CO_2 and other GHG emissions has significantly decreased globally, and wildlife is now regaining former habitats. Different carbon policies have been developed and implemented over the last couple of decades by regulatory agencies and governments, but each of the plans has significant drawbacks.

A discussion of current carbon policies is as follows.

The United States of America saw an initial uptick in environmental-related activities and initiatives in the 1950s and 1960s (Ghosh et al., 2020). Later, the governments of numerous nations established varied carbon policies (Ghosh et al., 2017). All of these measures fall into one of three main categories: carbon taxes

and prices, carbon cap-and-trade programmes and strict carbon cap policies (Ghosh et al., 2016). These policies' mechanisms are as follows.

1. *Carbon Tax Policy:* Regulatory agencies impose taxes on each unit of emissions (Kushwaha et al., 2020). The fundamental tenet of the carbon tax policy, according to Labatt and White (2007), is to place a price on each unit of carbon emissions in order to earn money for funding brand-new prospects for advancement in green technology. This expense can be thought of as a more straightforward carbon tax (Ghosh et al., 2020). The amount of the emissions tax varies greatly between nations. This policy is quite straightforward and straightforward to apply compared to other policies (Ghosh et al., 2018).

2. *Carbon Cap and Trade Policy:* Organisations are permitted to emit under this policy, known as the cap, up to a certain limit. An organisation may purchase carbon credits from other organisations if it needs to emit more. It generates carbon credits that can be sold to other businesses if its emissions are below the target level (Ghosh et al., 2016).

3. *Strict Carbon Cap Policy:* Regulating bodies permit organisations to emit CO_2 up to a threshold limit, which is known as the cap, in cases where rigorous carbon cap policies are in place. According to this policy, the fine for exceeding the limit is extremely severe (Chen et al., 2013). Therefore, businesses must control their carbon emissions to stay below the threshold. When it comes to carbon policies, this one is regarded as the strictest.

Literature Review

Green Logistics

The goal of logistics operations is to satisfy customers while incurring the fewest expenses and highest revenues possible. The phrase was first used in numerous reports of manufacturing companies. However, the term 'logistics' is now combined with 'green', leading to the creation of a new term 'green logistics'.

It is also clear that the supply chain's incorporation of environmental concerns can affect choices made about location, fuel type, raw material sourcing and route planning. According to Lee and Klassen (2008), 'green logistics' refers to an organisation's activity that integrates environmental considerations into supply chain management (SCM). Green logistics practises include evaluating the environmental impact of various distribution strategies and cutting back on energy use (Sbihi & Eglese, 2009).

According to estimates, freight from logistics activities is the source of 8% of the global energy-associated carbon emissions (Karaman et al., 2020). The use and acceptance of green and low carbon logistics modes are in extensive development around the world due to the global increase in global warming and environmental degradation.

A survey of the literature has been conducted in order to explore the topics already investigated by researchers in the field of green supply chain management (GSCM) and to determine the factors for the study of GSCM.

Historical Perspective of GSCM

Since the beginning of the industrial revolution, managing industrial pollution has been a significant social problem. The Indian oil and gas industry is experiencing severe environmental challenges, as can be observed from the literature review relating export and the environment. However, the researcher is adamant that environmental concerns should not prevent a promising industry from expanding. As a result, the implementation of GSCM is required to support the expansion of the oil and gas industry and exports. To further evaluate the GSCM performance of the respondent organisations in question, it is crucial at this point to research the GSCM-related literature in order to have a thorough understanding of the premise and parameters of the GSCM.

According to Sarkis et al. (2011), the multidisciplinary field of GSCM has gained importance from academia and industry in recent years. Both environmental management and SCM literature are the sources of GSCM. Addressing the impact and connections between SCM and the environment is part of adding the 'green' component to supply-chain management. Since the industrial revolution, there have been significant historical concerns about industrial pollution and its impact on the environment. Adam Smith's labour-specialisation policies spawned the growth of suppliers and vendors, manufacturing, logistics, distribution and marketing, which resulted in the creation of the specialised field of study known as SCM.

These were some of the early advancements in the field of GSCM, according to Seuring and Müller (2008), which were subjective and conceptual in nature and introduced numerous concepts and practises linked to GSCM. As the subject has expanded, case studies investigation led to the development of a theory, which was then tested through empirical studies presented as models. Therefore, GSCM refers to the process of incorporating environmental considerations into SCM, which includes product design, material sourcing and selection, manufacturing procedures, delivery of the finished product to consumers and end-of-life management of the product after its useful life (Srivastava, 2007).

Green Process Design

A straightforward method for achieving green design, according to Graedel (2002), is to remove a potentially hazardous material from a process or product or to process one that is less problematic. However, this method is occasionally unwelcome and may hasten the depletion of potentially limited resources.

Hendrickson et al. (2001) claim that because environmental issues were completely disregarded throughout the creation of new products and processes,

green design aids in the development of environmentally friendly products and processes. Untreated hazardous garbage is disposed of wherever it is most convenient. By introducing the idea of green into the design process, these issues can be solved. He argued that the three objectives for a sustainable future should be the primary focus of the notion of green design:

- Manage renewable resources to ensure sustainability.
- Minimise the use of non-renewable resources.
- Elimination of toxic and harmful emissions to the environment.

Green Procurement

According to Salam (2008), a green purchase is one that incorporates actions such as material reduction, reuse and recycling into the purchasing process. He added that it is a solution for businesses that are both environmentally conscious and prudent financially. This idea reduces environmental effect through product selection.

Jumadi and Zailani (2010) backed up Salam's claim by stating that 'green procurement' is the practice of acquiring goods or services that have a lower overall environmental impact. They recommended a few typical components of green procurement programs:

- Recycled products content
- Energy efficient products and energy efficient standby power devices
- Alternative fuel and fuel-efficient vehicles
- Bio-based products
- Non-ozone depleting substances
- Environmental protection priority chemicals

Green Manufacturing

The crucial facets of green operations include green manufacturing and remanufacturing (Srivastava, 2007). According to Johansson and Winroth (2009), green manufacturing seeks to continuously improve industrial practises and end products in order to lessen or prevent contamination of the air, water and land. Additionally, they said that by making these enhancements, hazards to humans and other species might be reduced.

Employee involvement is crucial for creating or implementing environmental performance within the company, according to Johansson and Winroth (2009). Because industries' environmental effects have lasted for a long time, green manufacturing depends on long-term thinking. A fast shift will require greater capital investment, but if a longer time frame is taken into account, it is responsible.

Green Marketing

According to Ishaswini and Datta (2011), the creation of the green marketing mix 'which preserves natural resources and at the same time delivers value-added

products and services' is a result of consumer consumption of eco-friendly products and attitudes toward these items.

Chen and Chai (2010) defined 'green marketing' as the actions made by businesses to address environmental or 'green' issues by providing sound products or services to satisfy consumers and society. Kumar (2011) asserts that green marketing has grown because, despite the fact that human demands are limitless, natural and manmade resources are scarce.

According to Chitra (2007), eco-friendly items are made with less harm to the environment in mind when they are planned and manufactured. When there was a great deal of discussion about Rachel Carson's Silent Spring, which published and addressed serious concerns on the sustainable and healthy environment, in the 1960s, environmental issues gained international attention (Marly et al., 2011).

Green Logistics and Distribution

According to Jiange (2008), the growth of solid waste has a significant impact on sustainable development. To address this issue, the green packaging method is used, which covers the entirety of the package life cycle.

Indicators for system evaluation are used to monitor and manage the packaging system (Zhang & Liu, 2009). Green distribution can be broken down into green packaging and green logistics, according to Shalishali et al. (2009). Size, shape and material considerations that affect distribution also have an impact on a product's transport characteristics. Better packaging and altered loading patterns can be employed to enhance space and decrease the amount of handling needed to offset these effects.

The oil and gas industry is one of the eight key industries and has a significant influence in the economy's decision-making. The country's economic expansion is closely tied to the demand for energy; as a result, it is anticipated that the oil and gas sector would expand even more, which is good news for investors. Numerous additional industrial fields are supported by this business. However, it poses a serious threat to the ecosystem and has a negative impact on many aspects of our world, including the air, water and soil.

The distributor and the oil and gas manufacturing sector are connected by a crucial logistical chain. Road transportation is used for the majority of logistics operations. This method is popular because it is adaptable and allows for the delivery of supplies to remote sections of the nation (Mariano, 2017). Oil consumption in India increased from 2008 to 2016 at a CAGR of 3.3%, reaching 4.0% in 2016. By 2025, India would surpass the United States and China as the third- and second-largest oil consumers in the world, respectively. In India, there are around 56,190 retail gas stations as of March 2016—13,000 each from Bharat Petroleum and Hindustan Petroleum Ltd, and about 25,000 from Indian Oil Corporation Ltd (Arockiaraj, 2017). Logistics activities play a significant role in the oil and gas supply chain. Discussing and analysing several important sectoral concerns may be necessary to make these logistics operations more environment friendly.

We can understand through various research papers, as described in the tabular form below.

Sr No	Green Logistics	Description	References
1	Green transportation	It is a method for organising distribution with the use of environmentally friendly vehicles that enhances the performance of the economy, society and the environment. Examples include using less fuel, backhauling, clean vehicles and organic green vehicles.	Umar Sherif et al. (2021); Wang et al. (2020); Tian et al. (2019); Chang et al. (2018)
2	Green packaging	It is a method of employing packaging materials that enhances the performance of the environment, the economy and society. Examples include using recyclable materials, reusing materials, green packaging materials, and minimising waste, material use and unpacking time.	Wang et al. (2020); Moustafa et al. (2019); Chhabra et al. (2017); Zhang and Zhao et al. (2012)
3	Green warehousing and distribution	It involves limiting movement, using energy-efficient lighting, utilising warehouse layout and inventory strategy, using energy-efficient buildings, etc., to maximise energy for inventory/storage.	Carli et al. (2020); Bartolini et al. (2019); Li et al. (2015); Rudiger et al. (2016)
4	Green value-added services	It is a method of creating strategic planning, controlling and including value while utilising the most recent equipment and technology for green logistics that enhances performance in terms of the environment, the economy and society.	Liu et al. (2018); Sureeyatanapas et al. (2018); Mustapha et al. (2017)

GSCM: Research Gaps

The following gaps have been found from the review.

1. It is noted that the bulk of GSCM investigations, regardless of subcategories, have been carried out in China, South East Asian, European and American countries. There have only been a few research reported in the Indian context in generally and the oil and gas industry in India specifically.
2. The review's studies all place a greater emphasis on the car, pulp and paper industries, retail sectors, logistical services (3PL), electrical and electronic industries such as infrastructure. Literature on the oil and gas industry processing industries is scarce.

Objective of the Study

1. Analysing performance metrics following the adoption of green logistics methods in a few sectors of the Indian manufacturing industry (oil and gas).
2. To create a conceptual framework for the oil and gas manufacturing industry in India that will aid in the future deployment of green logistical practises.

Hypotheses

Green process design practices (GPDP)

H_1: GPDP has no significant impact on EFP
H_2: GPDP has no significant impact on OP
H_3: GPDP has no significant impact on EP

Green procurement practices (GPP)

H_4: GPP has no significant impact on EFP
H_5: GPP has no significant impact on OP
H_6: GPP has no significant impact on EP

Green logistic and distribution practices (GLDP)

H_7: GLDP has no significant impact on EFP
H_8 GLDP has no significant impact on OP
H_9: GLDP has no significant impact on EP

Occupation safety and health hazard (OSHH)

H_{10}: OSHH has no significant impact on EFP
H_{11}: OSHH has no significant impact on OP
H_{12}: OSHH has no significant impact on EP

Barriers and drivers of green supply chain management (BADGSCM)

H_{13}: BADGSCM has no significant impact on EFP
H_{14}: BADGSCM has no significant impact on OP
H_{15}: BADGSCM has no significant impact on EP

Economic financial performance (EFP)
Operational performance (OP)
Environmental Performance (EP)

Research Methodology

Defining variables:

A. Demographic variable (moderating variable)

1. Category of organisation.
2. Type of ownership of your organisation.
3. Annual turnover.

B. Green process design practices (independent variables)

1. Process is designed for optimum energy consumption of material/ energy.
2. Process design includes reuse, recycle and recovery of material.
3. Process design avoids or reduces use of hazardous substances.
4. Process design reduces wastage (solid, liquid and gas).
5. Process design meets environmental and safety standards.

C. Green procurement practices (independent variable)

1. Cooperate with suppliers for environmental procurement.
2. Firm has a cell for environmental audit of supplier's internal environmental management.
3. Procure from ISO certified suppliers.
4. Educate and assistance provided to suppliers on environmental matters in order to increase supply chain efficiency.
5. Cooperate with suppliers in environmental packaging.

D. Green logistic and distribution practices (independent variable)

1. Regularly optimises the logistics system in cooperation with the transport service providers.
2. Environment-friendly facility location.
3. Routing systems to minimise travel distances.
4. Waste transport and disposal.
5. Identification, collection and distribution of products/parts that will be recycled, reused.

E. Occupational safety and health hazards (independent variable)

1. Written safety rules and regulations.
2. Management commitment to workers safety.
3. Employee safety committees.
4. Safety and health training.
5. Improvements in worker safety.

F. Barriers and drivers of GSCM (independent variable)

1. Short-term planning over long term.
2. Lack of market for recyclable products.
3. Lack of knowledge about environmental impacts.
4. Lack of information sharing between customer and supplier.
5. Top management commitment.

G. Economic and financial performance (dependent variable)

1. Decrease fees for waste treatment and disposal.
2. Decreased fines for environmental damages and accidents.
3. Increased market share.
4. Increase of total revenue.
5. Increased investment to implement selected strategies.

H. Operational performance (dependent variable)

1. Increase amount of goods delivered on time.
2. Decreased inventory level.
3. Decreased scarp rate.
4. Promote products quality.
5. Increased product line.

I. Environmental performance (dependent variable)

1. Reduction of air emission.
2. Reduction of waste water.
3. Reduction of solid wastes.
4. Decrease of consumption of hazardous/harmful/toxic materials.
5. Decrease of frequency for environmental accidents.

Green process design practices were measured using five items. The sample items are as follows: (a) Process is designed for optimum energy consumption of material/energy. (b) Process design includes reuse, recycle and recovery of material. (c) Process design avoids or reduces use of hazardous substances. (d) Process design reduces wastage (solid, liquid and gas). (e) Process design meets environmental and safety standards. All items are measured on the 5-pointer scale as not considering, planning to consider, considering it currently, initiating the implementation and implementing successfully. Green procurement practices, green logistics and distribution practices and occupational safety and health hazard were measured using five items. All items are measured on the 5-pointer scale as not considering, planning to consider, considering it currently, initiating the implementation and implementing successfully. Barriers and drivers of GSCM were measured using five items. All items are measured on the 5-pointer scale as strongly disagree, disagree, neutral, agree and strongly agree. Economic and financial performance, operational performance and environmental performance was measured using five items. All items are measured on the 5-pointer scale as not at all, a little bit, to some degree, relatively significant and significant.

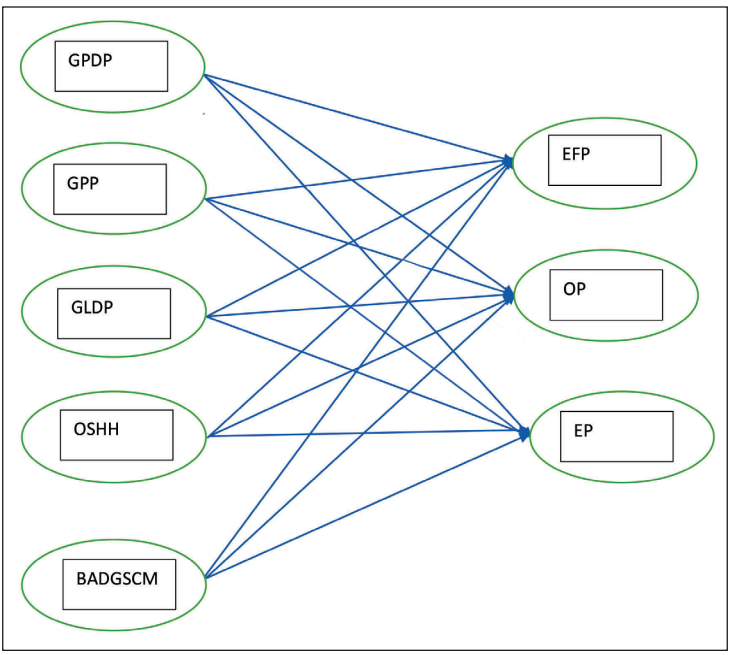
Sample: 176 responses were collected through Google Form. Error checking and verification were done for various stages of data analyses, that is, editing, coding, data entry and data analysis. Value, label, field, string, scaling for various questionnaire options were done on Smart PLS 4.

The demographic variable had 35% small-scale industries, 33.3% medium-scale industries and 31.7% large-scale industries. Type of ownership of the organisation was 36.7% private and proprietorship and 26.7% in partnership.

The methodology is the general research strategy that outlines how research is to be undertaken and, among other things, identifies the methods to be used in it. Data from 176 respondent were considered all over the country. GPDP, GPP, GLDP, OSHH and BADGSCM directly or indirectly explain EFP, OP and EP through structural equation modelling with Smart PLS 4.

Theoretical Result Framework

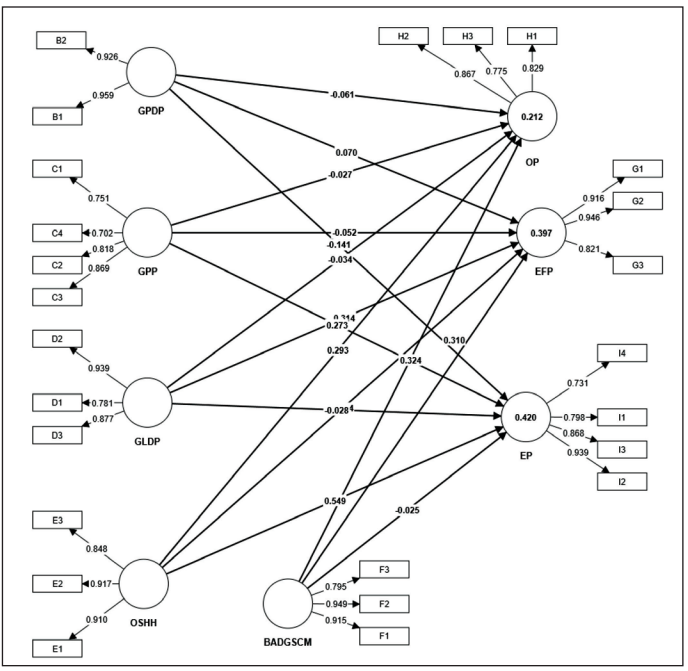
The conceptual framework that has been suggested demonstrates the impact of green logistics practises on economic financial, operational, and environmental performance. The effects of green logistics practises on environmental performance, operational performance, and economic financial performance are demonstrated by hypothesis H1 through H15. The major function of the research design is to establish a framework for the planned study's use of exploratory, descriptive, and inferential analyses to test the aforementioned hypotheses and ultimately achieve the study's objectives.



Result and Analysis

A statistical hypothesis is a claim that may be verified using data from observations that have been modelled after actual values drawn from a set of random variables. Modelled as the realised values of a set of random variables with a common probability distribution in a set of potential joint distributions, the data collection (or multiple data collections collected together) is a set of data. The set of potential probability distributions is precisely the hypothesis being tested. A statistical hypothesis test is a technique for drawing conclusions from data. A multivariate statistical analysis method used to assess structural links is called structural equation modelling.

To assess the link between observable variables and latent constructs, it combines multiple regression analysis and factor analysis.



Measure

Underlying Factors Retained Through SEM

Using structural equation modelling, hypotheses 1 through 15 were tested. The testing procedure has examined the suggested research structural models. Smart PLS 4.0 was used to calculate the simulations using structural equation modelling. Table 1 displays the fundamental factors that SEM retained. Table 2 shows the path coefficient, which is the predicted impact of an independent variable on a dependent variable after accounting for all other factors in the model. Each observed variable's ability to accurately reflect the construct it is meant to measure is displayed in the outer loading matrix. In Table 3, it is also known as the factor loading matrix or the measurement model matrix. The coefficient of determination, or R-square, is a metric for how well a model fits the data and accounts for the variation of its endogenous variables (Table 4).

A frequently used metric to evaluate the discriminant validity of the latent variables in SEM is the heterotrait–monotrait ratio. The heterotrait measurement threshold (HTMT) is the ratio of the average correlation between items measuring different constructs to the average correlation between identical constructs. Better discriminant validity is shown by a lower HTMT score, which suggests that the constructs are distinct from one another (Table 5).

Root Mean Square Standardised Residual (SRMR): This calculates the typical discrepancy between the model's projected values and its observed values. A better match is indicated by lower SRMR values (Table 6).

Table 1. Underlying Factors Retained Through SEM.

Underlying Factors	Items Retained Through SEM
B. Green Process Design Practices	
B1. Process is designed for optimum energy consumption of material/energy	Yes
B2. Process design includes reuse, recycle and recovery of material	Yes
B3. Process design avoids or reduces use of hazardous substances	No
B4. Process design reduces wastage (solid, liquid and gas)	No
B5. Process design meets environmental and safety standards	No
C. Green Procurement Practices	
C1. Cooperate with suppliers for environmental procurement	Yes
C2. Firm has a cell for environmental audit of supplier's internal environmental management	Yes
C3. Procure from ISO certified suppliers	Yes
C4. Educate and assistance provided to suppliers on environmental matters in order to increase supply chain efficiency	Yes
C5. Cooperate with suppliers in environmental packaging	No
D. Green Logistic and Distribution Practices	
D1. Regularly optimises the logistics system in cooperation with the transport service providers	Yes
D2. Environmentally friendly facility location	Yes
D3. Routing systems to minimise travel distances	Yes
D4. Waste transport and disposal	No
D5. Identification, collection and distribution of products/parts that will be recycled, reused	No
E. Occupational Safety and Health Hazards	
E1. Written safety rules and regulations	Yes
E2. Management commitment to workers safety	Yes
E3. Employee safety committees	Yes
E4. Safety and health training	No
E5. Improvements in worker safety	No
F. Barriers and Drivers of GSCM	
F1. Short-term planning over long term	Yes
F2. Lack of market for recyclable products	Yes
F3. Lack of knowledge about environmental impacts	Yes

(Table 1 continued)

(Table 1 continued)

Underlying Factors	Items Retained Through SEM
F4. Lack of information sharing between customer and supplier	No
F5. Top management commitment	No
G. Economic and Financial Performance	
G1. Decrease fees for waste treatment and disposal	Yes
G2. Decreased fines for environmental damages and accidents	Yes
G3. Increased market share	Yes
G4. Increase of total revenue	No
G5. Increased investment to implement selected strategies	No
H. Operational Performance	
H1. Increase amount of goods delivered on time	Yes
H2. Decreased inventory level	Yes
H3. Decreased scarp rate	Yes
H4. Promote products quality	No
H5. Increased product line	No
I. Environmental Performance	
I1. Reduction of air emission	Yes
I2. Reduction of waste water	Yes
I3. Reduction of solid wastes	Yes
I4. Decrease of consumption of hazardous/harmful/ toxic materials	Yes
I5. Decrease of frequency for environmental accidents	No

Source: Authors (Smart PLS 4).

Table 2. Path Coefficient.

	BADGSCM	EFP	EP	GLDP	GPDP	GPP	OP	OSHH
BADGSCM		0.310	–0.025				0.324	
EFP								
EP								
GLDP		0.314	–0.028				–0.034	
GPDP		0.070	–0.141				–0.061	
GPP		–0.052	0.273				–0.027	
OP								
OSHH		0.144	0.549				0.293	

Source: Authors (through Smart PLS 4).

Table 3. Outer Loading Matrix.

	Total Effects
BADGSCM -> EFP	0.310
BADGSCM -> EP	–0.025
BADGSCM -> OP	0.324
GLDP -> EFP	0.314
GLDP -> EP	–0.028
GLDP -> OP	–0.034
GPDP -> EFP	0.070
GPDP -> EP	–0.141
GPDP -> OP	-0.061
GPP -> EFP	–0.052
GPP -> EP	0.273
GPP -> OP	–0.027
OSHH -> EFP	0.144
OSHH -> EP	0.549
OSHH -> OP	0.293

Source: Authors (through Smart PLS 4).

Table 4. R^2 Overview.

	R^2	R^2 Adjusted
EFP	0.415	0.397
EP	0.437	0.420
OP	0.234	0.212

Source: Authors (through Smart PLS 4).

Table 5. Discriminant Validity—Heterotrait–Monotrait Ratio.

	BADGSCM	EFP	EP	GLDP	GPDP	GPP	OP	OSHH
BADGSCM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EFP	0.618	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EP	0.358	0.521	0.000	0.000	0.000	0.000	0.000	0.000
GLDP	0.584	0.617	0.502	0.000	0.000	0.000	0.000	0.000
GPDP	0.356	0.375	0.164	0.521	0.000	0.000	0.000	0.000
GPP	0.537	0.492	0.568	0.830	0.592	0.000	0.000	0.000
OP	0.508	0.515	0.786	0.319	0.171	0.287	0.000	0.000
OSHH	0.603	0.579	0.728	0.769	0.355	0.683	0.490	0.000

Source: Authors (through Smart PLS 4).

Table 6. Model Fit.

	Saturated Model	Estimated Model
SRMR	0.088	0.106
d_ULS	2.533	3.619
d_G	1.782	1.895
Chi-square	1489.485	1558.734
NFI	0.624	0.607

Source: Authors (through Smart PLS 4).

Table 7. Path Coefficient Mean, *SD*, *T*-values and *P* Values.

	Original Sample (*O*)	Sample Mean (*M*)	Standard Deviation (*SD*)	*T*-statistics (|O/*SD*|)	*P* Values
BADGSCM –> EFP	0.310	0.319	0.099	3.121	0.002
BADGSCM –> EP	–0.025	–0.025	0.085	0.293	0.769
BADGSCM –> OP	0.324	0.311	0.108	2.992	0.003
GLDP –> EFP	0.314	0.314	0.074	4.257	0.000
GLDP –> EP	–0.028	–.027	0.096	0.298	0.766
GLDP –> OP	–0.034	–0.029	0.092	0.375	0.708
GPDP –> EFP	0.070	0.070	0.081	0.861	0.389
GPDP –> EP	–0.141	–0.141	0.075	1.867	0.062
GPDP –> OP	–0.061	–0.056	0.092	0.660	0.509
GPP –> EFP	–0.052	–0.051	0.086	0.612	0.541
GPP –> EP	0.273	0.284	0.089	3.072	0.002
GPP –> OP	–0.027	–0.018	0.086	0.314	0.753
OSHH –> EFP	0.144	0.134	0.118	1.220	0.222
OSHH –> EP	0.549	0.538	0.083	6.584	0.000
OSHH –> OP	0.293	0.291	0.099	2.944	0.003

Source: Authors (through Smart PLS 4).

Measurement Model

Quality of the construct in the study is assessed based on the evaluation of measurement model. The assessment of quality criteria starts with evaluation of factor loading which is followed by establishing the construct reliability and construct validity (Table 7).

Table 8. Construct Reliability and Validity.

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted
BADGSCM	0.865	0.887	0.918	0.790
EFP	0.875	0.881	0.924	0.803
EP	0.855	0.858	0.903	0.702
GLDP	0.841	0.893	0.901	0.754
GPDP	0.877	0.932	0.941	0.889
GPP	0.796	0.798	0.867	0.620
OP	0.765	0.764	0.864	0.680
OSHH	0.871	0.871	0.921	0.796

Source: Authors (through Smart PLS 4).

Table 9. Fornell Larcker Criterion.

	BADGSCM	EFP	EP	GLDP	GPDP	GPP	OP	OSHH
BADGSCM	0.889							
EFP	0.535	0.896						
EP	0.321	0.453	0.838					
GLDP	0.484	0.556	0.440	0.868				
GPDP	0.314	0.331	0.150	0.457	0.943			
GPP	0.440	0.409	0.488	0.662	0.492	0.788		
OP	0.427	0.430	0.640	0.271	0.106	0.230	0.825	
OSHH	0.516	0.504	0.628	0.662	0.323	0.573	0.402	0.892

Source: Authors (through Smart PLS 4).

Factor Loading

Factor loading refers to 'the extent to which each of the item in correlation matrix correlates with given principal component'. Factor loading can range from –1 to +1 with higher absolute value indicating a higher correlation of the item with the underlying factor. Item had factor loading in the study less than the recommended value of 0.50. Hence, items were removed for further study.

Reliability Analysis

Reliability is defined as the extent to which a measuring instrument is stable and consistent. The essence of reliability is repeatability. If an instrument is administered over and over again it will give the same result. Indicators of reliability have reliability statistic over required threshold of over 0.70 (Table 8).

Convergent Validity

Convergent validity is the degree to which multiple attempts to measure the same concept are in agreement. The idea is that two or more measures of the same thing should co-vary highly if they are the valid measure of concept. When average variance extracted (AVE) value is greater than or equal to the recommended value of 0.50, item converge to measure the underlying construct and hence convergent validity is established (Fornell & Larcker, 1981) (Table 9).

Conclusion

The industries will be assisted in removing the main obstacles to the adoption of GLP by the findings produced. Business owners, decision-makers and even the government will benefit from this. The practitioners should concentrate on and address the impediments that have the greatest impact.

In order to establish sustainability between the economy and the environment, green logistics highlights numerous methods used to lessen the environmental issues associated with logistics operations, particularly those linked to GHGs, transportation, packaging and warehousing. Due to the manufacturing sector's growing role in the Indian economy, research is needed to encourage the country's manufacturing sector to adopt green logistics practises for the benefit of the larger ecological system.

Managerial Implication

In the study, tools for green logistics practises were created. Top management, the government and managers are all expected to use these tools to regularly measure and assess their performance across the various broad categories.

The studies and results of the green logistics practises on environmental and economic performance can also be seen and understood inside the Logistics Department of the Manufacturing Industry. Additionally, this might be beneficial for internal benchmarking.

Limitations and Future Directions

The following restrictions apply to the current study's examination of green logistics issues and performance problems in a selected Indian manufacturing industry.

1. The industry is attempting to establish or implementing new policies and techniques known as 'green practises' in a variety of logistics-related activities. The respondents were a little hesitant to provide their information because green logistics is still quite new as an organised activity.
2. On the basis of earlier research in this area, the sample size for the study was chosen. The size may change in future trials if it is statistically

calculated. Any variance in the study's overall findings could be caused by this variation in the sample size.
3. The respondents were contacted for this study at the researcher's convenience and with their consent. The outcomes might alter if another non-probabilistic or probabilistic approach is used in the future.
4. The research study was completed for the oil and gas industry, a specific manufacturing industry. The numerous responses selected were from all kinds of work in this sector. As a result, the framework is modelled for this specific business and is applicable to other industries that depend heavily on logistics.

Based on the aforementioned restrictions, this work calls future researchers' attention to the following issues.

1. Non-probability sampling was selected for this investigation, and the sample size was established with the aid of earlier research. Future researchers may choose to use a different sample size after using any other method of determining the sample size, or they may choose to use any other non-probability or probability sampling strategy. Future researchers could experiment with different data collection techniques to empirically assess the applicability of the study's findings.
2. Future researchers might carry out the same investigation in other sectors as electrical and electronics, automotive, clothing, paper publishing, auto component, etc. Future scholars are only being advised to focus on industries with high levels of logistics activity. This is the only significant recommendation.
3. The two-performance metrics have been examined in terms of the economy and the environment. Societal performance is a different performance metric that is currently gaining prominence. A recent development in green logistics is as follows: because green logistics is still in its infancy as an organised activity, the respondents were quite reticent to share their responses. The report does not specifically address how green logistics would affect society.
4. The researchers may in the future include other moderators from the list of green logistics drivers. In the upcoming study, the market's effect can easily be added as a moderator in addition to the one that is already in place. Future studies on domestic and foreign green logistics practices in the oil and gas sector may also be conducted.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Article

A Bibliometric Analysis on Business and Management Research During COVID-19 Pandemic: Trends and Prospects

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Anshu Rani[1] and Pavithra Salanke[2]

Abstract

As the global pandemic of COVID-19 has drawn significant attention with an increasing number of research studies appearing in the literature, it is imperative to analyse the recent trends of research and future thrust areas. In numerous fields of knowledge, including business and management, the COVID-19 problem has produced enormous research undertakings. A bibliometric study of the articles published during the COVID-19 period in the area of business and management is rare with the focus on the South-Asian context. The total number of articles identified for the purpose of research throughout the Scopus database was 3,648 using the COVID-19 keyword and limiting this search to published journal articles in the domain of business and management. Further, VOSviewer software was used to analyse data and finds were presented. VOSviewer software has given the results on the cluster of authors, country of publications, citation analysis, co-citation, keywords and significant journals of publication. Given that the COVID-19 epidemic is still far from being under control, more research is needed to determine the direction of future research and other current topics. This study will provide the prospects in COVID-19-related business research and will end by pointing out the implications of these results.

Keywords

COVID-19, research trends, VOSviewer, business, business research during COVID-19, bibliometric analysis

[1]REVA University, Bangalore, Karnataka, India
[2]School of Commerce and Management Studies, Dayananda Sagar University, Bangalore, Karnataka, India

Corresponding author:
Anshu Rani, REVA University, Bangalore, Karnataka 560064, India.
E-mail: meetanshu2504@gmail.com

Introduction

COVID-19 has emerged as the most fatal disease, wreaking havoc on world economies in every way. There are 3,39,15569 confirmed cases and 4,50,127 deaths across India as of 8 October 2021 (Government of India, n.d.). Worldwide, there are 236,511,950 active cases and 4,828,340 deaths (Wikipedia, n.d.). As a result, governments and civil society organisations are working to limit its impact on human lives while also providing monetary easing to keep businesses afloat and reduce rising unemployment, particularly in emerging countries (Goodell, 2020). Governments around the world responded by enacting a variety of policies to mitigate the pandemic's impact, including travel bans, border closures, lockdowns (restricting people's movement) and recovery programmes (to assist workers and companies who have lost employment and production, respectively). Regardless of the rules put in place by policymakers, the Novel coronavirus was destined to kill people and limit economic growth, resulting in a significant negative productivity shock. The disease's consequences, as well as the measures adopted to battle it, have prompted questions regarding epidemic preparedness (Aristovnik et al., 2020; Leach et al., 2021; Mahi et al., 2021). The crisis adversely affected low-wage, unstable jobs, but it also had a significant impact on the middle-class income group.

Coronavirus and related diseases such as Ebola, SARS and MERS have been the subject of extensive research during its impact years (Deng et al., 2020; Gong et al., 2020). There is still a lot of work to be done in future as well. However, the number of such studies has increased significantly since the epidemic of COVID-19 in all the disciplines of research (Yang et al., 2020). The impact of COVID-19 was so evident in each area of life and highly impacted the input-process-outcomes of the business and its management. The coronavirus and pandemic literature in business and management has rarely been thoroughly reviewed in a bibliometric review till 2021. As a result, this research has been taken up as a delicate attempt to review the existing business and management literature on COVID-19 through bibliographic analysis. Besides, the influence of COVID-19 is so powerful that there is the necessity for more research within the area of business and management to make better decisions. The whole COVID-19 literature in the context of business, economics and management has rapidly increased thus, become vital to summarise. In light of the recent COVID-19 pandemic's business consequences, the study's goal is to examine the published scientific works that specifically address business and management related topics (Aristovnik et al., 2020). In order to help future researchers and policymakers, this study will provide a comprehensive bibliographic analysis of the literature from the past (2019) to the present (2021) (Bauwens et al., 2021).

This article studied a corpus of COVID-19 and business and management papers to address concerns to enable business practitioners and researchers to understand the impact of the pandemic on future growth. The following research questions have been undertaken to examine in this article: (a) What are the publishing growths and patterns in the time span of the COVID-19 pandemic particularly in the area of business and management? (b) What are the most used

keywords and prominent research clusters associated with them? (c) Who are the top researchers and their citation strength in the area of business and management? (d) Which are the top journals and countries studying the pandemic in the area of business and management till today?

This study contributes to the literature by reviewing recent studies relating to COVID-19 and business research and by supporting other researchers in conducting a study on other pandemic-related topics. In relation to the connection between business research and the COVID-19 pandemic, this study should contribute to the literature. Classifying the literature between epidemics and research in business might lead to the identification of various open research issues to be investigated in the near future.

Literature Review

On 26 March, India's Union Finance Minister announced a raft of measures under the Pradhan Mantri Garib Kalyan Yojana to ease the resulting financial troubles. The statement addressed a variety of welfare measures, including rationing and direct cash transfers under different current SP systems. More humanitarian measures were announced six weeks into the lockdown, including migrant worker rations, the implementation of the 'One Nation-One Ration Card' and increased NREGA funds. Innovative methods, such as piggybacking on and vertical and horizontal growth of certain existing SP programmes (such as PDS), were used to accomplish the response, despite the fact that it was delayed (Sanyal & Shrivastava, 2021). As of 11 October 2021, 238,714,967 cases are registered worldwide with 4,868,709 deaths. We could see that India has 33,971,607 total cases and there is an increase of 314 new cases with 450,814 deaths. There is a gradual rise in new cases and the number of death in most of the countries worldwide (Woldometer, n.d.).

The impact of COVID-19 has rapidly grown in the sectors of healthcare, vaccine, transportation, manufacturing, information technology, tourism, education, SMEs, e-commerce, transportation, employment, income, investment, phycology, work–life balance, entertainment, etc., and will show differential influence in the coming decade as well. The workplace study by McKinsey and Org examines the perspectives of more than 65,000 survey participants from 423 different organisations. A desolate picture of the COVID-19 pandemic and its impact on the workplace, nevertheless, business challenges have enhanced across the organisations since 2019, and persistent gaps remain in research to understand the scenario better (mckinsey.com, 2021). Therefore, examining the trends and prospects for new research related to COVID-19 in the area of business and management will be highly fruitful for coming researchers.

Bibliometric analysis has grown in popularity in recent years in business research (Khan et al., 2021), and its popularity is due to (a) the advancement, availability and affordability of bibliometric software like Gephi, Leximancer and VOSviewer, as well as scientific databases like Scopus and Web of Science, and (b) the bibliometric analysis's growing use in business research shows that it's more than just a passing trend; it reflects the method's usefulness in two key

areas: managing large volumes of scientific evidence and producing significant results. To discover emerging trends in article and journal performance, collaboration patterns and research constituents, scholars use bibliometric analysis for various reasons, including the exploration of the intellectual structure of an existing domain in the extant literature (Verma & Gustafsson, 2020). It can therefore be used to decode and map the accumulated scientific knowledge as well as evolutionary nuances of well-established fields by attempting to make sense of large volumes of unstructured information rigorously through bibliometric analysis. It's for this reason that well-conducted bibliometric studies can help lay the groundwork for expanding an area in novel and significant ways, because they give researchers an all-in-one view, enable them to identify knowledge gaps and generate new ideas for investigation, and allow them to better position their intended contributions to the field. Bibliometric analysis in business research is a guide, which presents a significant avenue for business scholars who wish to conduct future research in this domain (Cruz-Cárdenas et al., 2021). This study will attempt the analysis with help of VOSviewer software and will answer the research questions.

Research Method

Bibliometric analysis refers to the study and analysis of citations of scholarly publications using different frameworks, tools, and methods. This has led to the development of various metrics to generate an understanding into the intellectual structure of a broad academic field and evaluate scientific journals, research and researchers accordingly. According to Ellegaard and Wallin (2015), bibliometric analysis is a systematic, concise and generalisable process that minimises the inherent subjectivity of description and systematic reviews, which is why we used it to review the relevant literature in this study (Donthu et al., 2021). By showcasing the frontiers of the existing relevant intellectual borders and knowledge structure, displaying references through mapping enables researchers to understand research trends generally and intuitively (Verma & Gustafsson, 2020). We used four different procedures proposed by Donthu et al. (2021) to conduct a bibliometric review of the related literature. Figure 1 depicts the four-stage process workflow for the existing study. Numerous bibliometric indicators and scientific knowledge mapping techniques are used to answer the research questions. This is the brief of process and data collection.

The results of collecting exhaustive bibliometric data on COVID-19-related research have been meticulously planned. All relevant documents and publications in the Scopus database were identified between the periods of 1 November 2019 to 30 September 2021. This database has been used in previous studies; however, it became more relevant in the area of business and management because most of the quality journals are found in this database. Keeping one database in search will also reduce the probability of overlap in search. Further, only journal articles and conference articles were considered for this study excluding letters, reviews, notes, editorials, white papers, reports, book and book chapters. The broad range

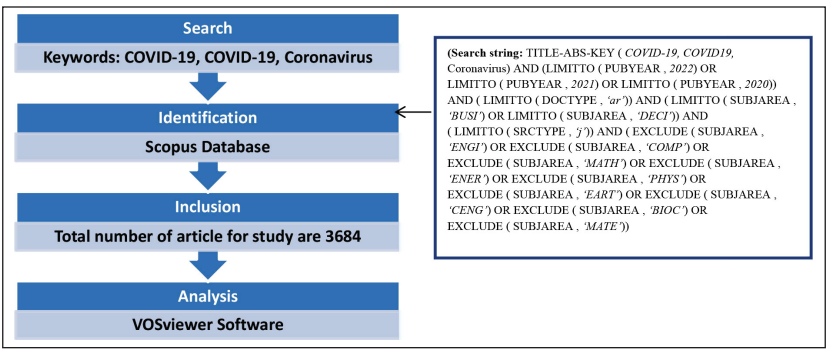


Figure 1. Flowchart of Database Determination.

of COVID-19-related keywords was included in the applied search query, which extended prior narrowly defined queries by including 'novel coronavirus', 'coronavirus', 'COVID-19', 'COVID19', 'Coronavirus' and 'COVID-2019', in titles, abstracts and keywords were applied for search. In addition, the subject areas were specifically narrowed down to business and management and decision-science. As a result of the screening process, a dataset of 3,684 documents was short-listed for further analysis for this article.

The next step was a comprehensive bibliometric analysis, which allowed for a novel approach to literature review while also vastly improving traditional literature review methods. An organised review of the literature is a traditional method for analysing and evaluating scientific literature that offers a comprehensive look at the subject matter (Bauwens et al., 2021). The downside to this approach is that it has several drawbacks related to subjective factors, time commitment and effectiveness. By using modern bibliometric approaches, these limitations can be reduced and extensive scientific literature collections can be efficiently handled. By using VOSviewer bibliometric studies on COVID-19 research have so far strengthened the findings and implications of those results.

Finally, the review process included only documents written in English. Comma-separated values format was used to export the information to a separate file. Various bibliometric techniques were used as a result of this information to provide evidence of the result. The study has presented citation analysis, co-citation analysis, keyword analysis and country analysis to present the data in the next section.

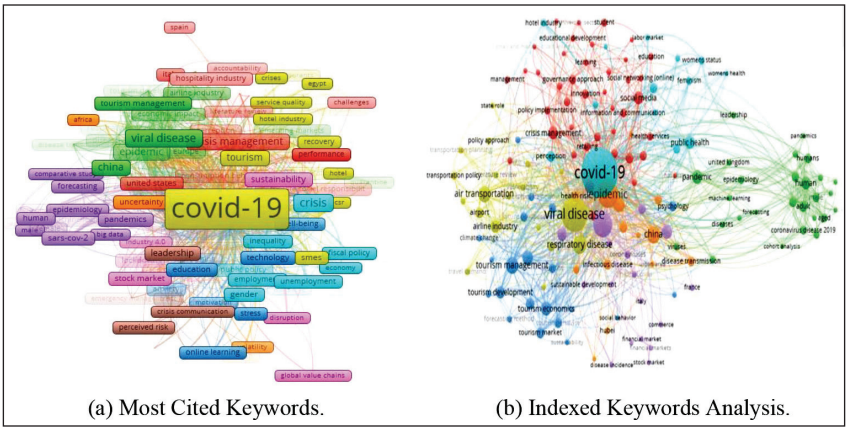
Analysis, Visualisation and Discussion

Keywords Analysis

Keywords and co-words evaluation are used to trace the current knowledge structure of the field of study taken for research. In this study, a systematic method

is used to discover scientifically subfield linkages, track the phenomenon and build a semantic field map. A different approach is used to perform co-word analysis, which makes it possible to use the text's content directly to grasp co-occurrence interactions when building the framework. This allows us to extract scientific maps based on the text's high frequency of usage. With the help of a keyword mapping clustering algorithm, a conceptual structure and a thematic map for the existing research are created. By evaluating the proximity of keywords used during research, the study develops a conceptual framework for the field and uses clustering to identify groups of papers that express common concepts (Aria & Cuccurullo, 2017). The study also identifies the configuration of existing research clusters (Demiroz & Haase, 2019).

With the help of VOSviewer, keyword analysis is undertaken to discover which terms have appeared the most frequently in the research. This study adds weight to our criteria for looking for COVID-19 study literature in the business field. Based on the cartography, it's assumed that results from keyword research will accurately reflect the article's content and, in turn, identify the main cluster discussed in the relevant literature (Khan et al., 2022; Verma & Gustafsson, 2020). The results are presented in Figure 2, which shows 'COVID-19' is the top keyword used in business and management research during the intended time span of COVID-19, followed by crisis, viral disease, crisis management, sustainability, tourism, leadership, China and technology, which are the most frequently used keywords . The indexed keyword analysis also reflected that the top three keywords are Covid-19, viral disease and respiratory disease followed by other 10 inductive words, epidemic, crisis management, Public health, China, pandemic, tourism management, air transportation, social media, human, online, as significant keywords used during the period of 2020 and 2021 in business and management area of research.



(a) Most Cited Keywords. (b) Indexed Keywords Analysis.

Figure 2. Keyword Analysis Using VOSviewer.

There are six evident clusters shown in the results with several keywords. The six clusters are denoted by different colour indications in indexed keyword analysis. The dominant keywords of clusters are (a) COVID-19 (*epidemic, public health, perception, online, hotel industry, women's status*), (b) viral disease (*respiratory, airline industry, airport, transport policy, state role*), (c) China (*disease transmission, health, infectious disease, corona, psychology*), (d) crisis management and social media (*retailing, innovation, health service, government policy, education, online learning, ICT*), (e) human and pandemic (*Coronavirus, UK, virus, leadership, epidemiology, adult, male, cohort analysis*), (f) tourism management (*tourism development, economy, sustainable development, market and climate change*). This analysis shows the linkage between the keywords and help in understanding the trends of research in the field of business and management during the pandemic so far.

Most Cited Authors and Publications

This section highlights the most influential researchers working in the field of business and management during the period of coronavirus. More than 56.7% of the authors have only one published work and therefore the output is diverse. The distribution shows that scientific publication contributions are not concentrated among a small number of authors, but rather are spread across a larger group. Figure 3 represents the most cited authors and their citation values to get a better idea of their productivity and the ramifications of their work. The clusters of co-citation of authors are shown in Figure 3(a), wherein six different groups are identified.

Zhang Y. is the most prolific researcher when it accounts for the number of publications. An active researcher who has written and published a whopping seven scientific papers, followed by Zhang X. and Zhang J. However, there is no monopoly on the research work during this time. There are five groups of writers presented in Figure 3(b) who were mostly cited for their work in the area of business and management during COVID-19. The references in the research paper published during this time period were also analysed and are represented in Figure 3(c). Gössling (2020) has been cited in the majority of the paper in the business and management area.

Journals Analysis

Aside from that Table 2 lists out the most published journal and the total document published in these journals. This information is essentially significant for those authors who are looking to publish scientific papers about COVID-19 in the area of business and management. An active researcher who has written and published a whopping seven scientific papers, followed by Zhang X. and Zhang J. However, there is no monopoly on the research work during this time. There are five groups

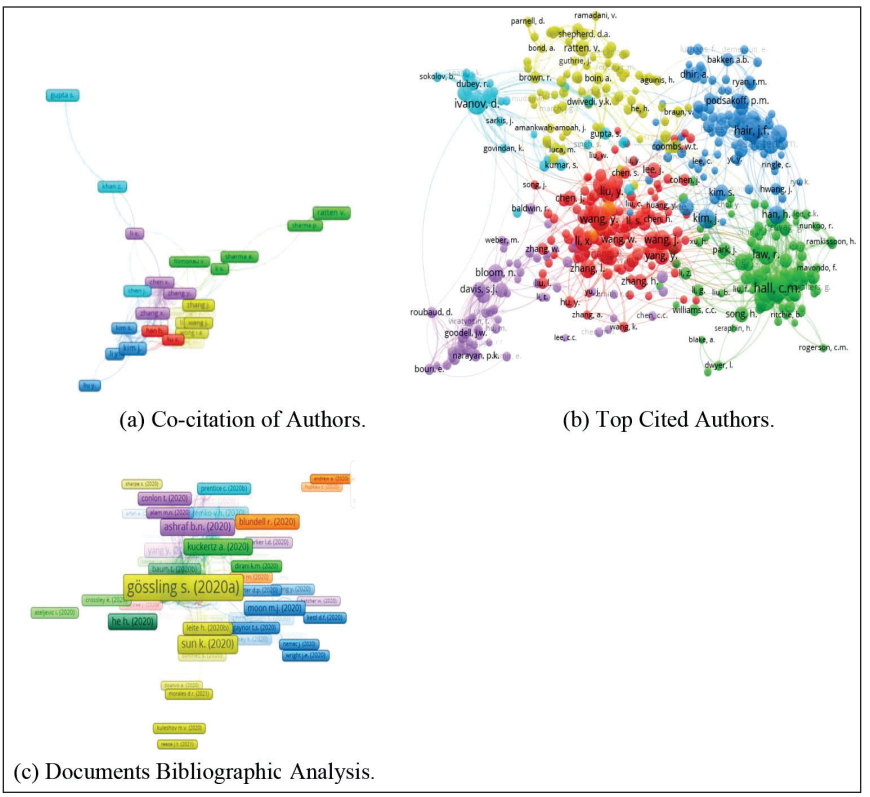


Figure 3. Most Cited Author Using VOSviewer.

of writers presented in Figure 3(b) who were mostly cited for their work in the area of business and management during COVID-19.

Figure 4 is a visual representation of the journal's total strength link of documents and clusters. This also shows the number of publications year-wise. The new authors can target the journals that are publishing in 2022 for their recent research. As can be seen in Figure 4, almost all of the top journals in this field of study have an increasing publication trend.

Country Analysis of Published Research

This section examines the geographic distribution of publications by author affiliation and country. On the basis of total publications, the countries listed in Figure 5 are the most productive. Multi-country publications (MCPs) and an MCP ratio are also considered during this analysis.

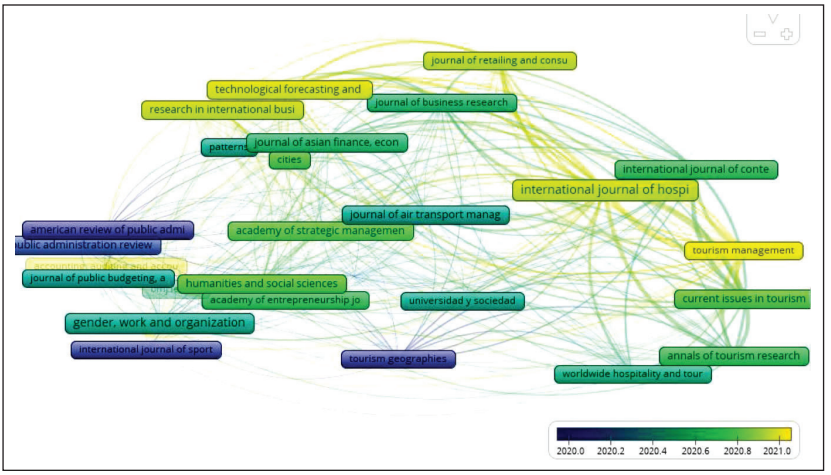


Figure 4. Publishing Journal Visualisation.

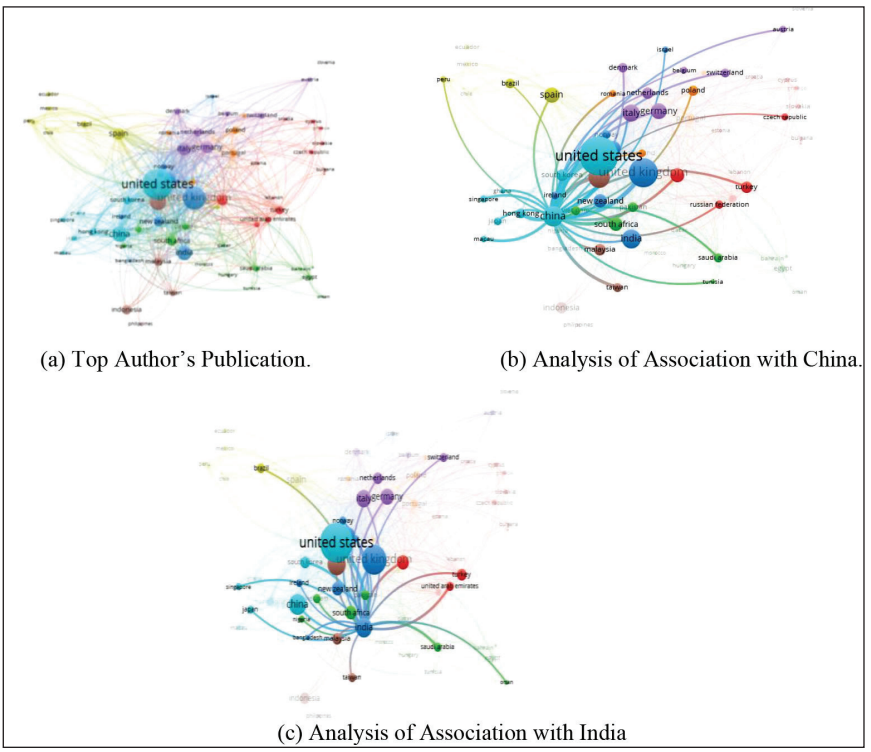


Figure 5. Country Analysis of Published Research Using VOSviewer.

Table 1. Top Authors' Publications.

Author	Citations	Total Link Strength
C. M. Hall	464	423.48
Y. Wang	363	350.47
S. Gossling	356	330.63
J. F. Hair	322	313.33
B. W. Ritchie	313	297.98
D. Scott	295	286.58
D. Ivanov	336	275.25
R. Law	252	244.80
X. Li	245	241.81
Y. Liu	252	240.59
J. Wang	245	237.47
M. Sarstedt	247	236.23
J. Kim	249	235.23
Y. Zhang	233	229.92
Y. Li	225	218.57
L. Zhang	214	209.92
C. M. Ringle	217	207.31
N. Bloom	215	203.29
H. Han	212	196.39
C. Wang	191	188.12

According to the analysis report, the United States leads in this area of research, followed by the United Kingdom, Italy and China. However, compared to other top publication countries on the list, the United States' collaborative publication output is superior among the top three. Nearly, a third of all developed countries' authors' publications collaborate with researchers from other countries, according to this ratio.

The United States and the United Kingdom were the most active collaborators. Both countries have a high level of collaborative scientific output due to them both having the most publishing countries. In addition to the United States, the authors from the United Kingdom worked with research groups from Italy, Germany, Australia, China and India. The United States authors partnered with researchers from most of the nations. As an alternative, Chinese researchers have produced numerous joint publications in their field with developed countries such as Germany, Singapore and Australia. Similar is the case with Indian research outputs in this area of research. There is a regional concentration of research collaboration activities that is true for the world.

Table 2. Top Publishing Journals.

Source	Doc	Citation	Total Link
International Journal of Hospitality Management	83	409	4,987
International Journal of Contemporary Hospitality Management	35	351	2,966
Current Issues in Tourism	36	125	2,780
Tourism Management	20	170	2,347
Annals of Tourism Research	33	397	1,654
Technological Forecasting and Social Change	47	252	1,560
Journal of Retailing and Consumer Services	25	161	1,161
Journal of Business Research	32	1016	1,013
Research in International Business and Finance	37	262	900
Worldwide Hospitality and Tourism Themes	21	28	652
Journal of Asian Finance, Economics and Business	50	149	629
Journal of Air Transport Management	41	307	541
Humanities and Social Sciences Communications	37	88	460
Tourism Geographies	28	986	451
Cities	24	81	401
American Review of Public Administration	44	207	357
Gender, Work and Organization	62	238	300
Accounting, Auditing and Accountability Journal	29	35	258
Annals of Operation Research	20	253	258
Public Administration Review	38	491	255

The current study's descriptive analysis reveals a number of captivating results from the body of literature under consideration. However, two points should be made clear. When it came to business- and management-related COVID-19 research, authors primarily used the United States, the United Kingdom and Australia as their primary source countries (places of employment). Co-occurrence analyses revealed six key clusters in the literature on COVID-19: crisis management and technology use for competitive advantage, leadership and risk-management strategies, hospitality, tourism and air transport sectors as well as social impact and corporate social responsibility. These findings can be substantiated and better understood thanks to recently published studies on COVID-19. As a result, this research emphasises how important technology has become in helping companies deal with the COVID-19 crisis. Furthermore, research shows that COVID-19 has had a significant impact on industries like travel and tourism.

Table 3. Ranking of Country.

Country	Documents	Citations	Total in Strength
United States	826	3,517	19092.86
United Kingdom	470	3,197	18786.66
Australia	273	1,858	11086.71
China	234	1,418	10154.95
Italy	171	700	6121.64
France	111	535	5966.17
India	203	339	5578.28
Germany	143	832	5186.27
New Zealand	100	1,233	4753.46
Canada	124	1,273	4602.52
Spain	137	420	4524.99
South Africa	106	461	3867.29
South Korea	78	326	3687.09
Turkey	73	323	3110.87
Malaysia	80	188	3087.48
Finland	52	528	3083.85
Hongkong	55	289	2791.10
Netherlands	78	218	2663.79
Denmark	50	427	2489.27
Pakistan	54	193	2381.94

Conclusion

The purpose of this article was to investigate new research trends on the impact of COVID-19 on business and management by utilising bibliometric and scientific knowledge mapping techniques. Our comprehensive review of the literature indicates some important research gaps that need to be addressed in the future. When dealing with a current or future epidemic or pandemic, these issues will be particularly important to consider. Though the number of studies published during COVID-19 in the area of business and management is good, the academic community anticipates even more contributions in the future. Social scientists, particularly those working in business, economics or related fields, are expected to make significant academic contributions to research on disease or outbreaks, even though scientists typically dominate the field (Aristovnik et al., 2020). In such a crisis, an appropriate economic reaction model would help the government and policymakers maintain adaptability while also ensuring public health and safety.

Declaration of Conflicting Interests

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