

Analyzing the components of Covid-19 impacting economy: A developing country perspective

Manish Mohan Baral [§]

Subhodeep Mukherjee [†]

Department of Operations

GITAM School of Business

GITAM (Deemed to be University)

Visakhapatnam

Andhra Pradesh

Venkataiah Chittipaka [§]

School of Management Studies

Indira Gandhi National Open University (IGNOU)

New Delhi

India

Surya Kant Pal [@]

Department of Mathematics

School of Basic Sciences and Research

Sharda University

Greater Noida

Uttar Pradesh

Bhaswati Jana [#]

Department of Management

GD Goenka University

Haryana

India

[§]E-mail: manishmohanbaral.31@gmail.com

[†]E-mail: subhodeepmukherjee92@gmail.com

[§]E-mail: venkatchitti@gmail.com

[@]E-mail: suryakantpal6676@gmail.com

[#]E-mail: bhaswati.chk09@gmail.com

^{*}E-mail: anujsmooth@gmail.com (Corresponding Author)

[^]E-mail: wiki1409@gmail.com

Anuj Kumar *

*Department of Management
Apeejay School of Management
Delhi
India*

Vipin Shukla ^

*Department of Business Administration
Shambhunath Institute of Engineering and Technology
Jhalwa
Prayagraj*

Abstract

In the current COVID-19 circumstances, most nations are in crisis and are also building strategies to overcome lockdown losses. Also, it is known that more challenging situations in the economy are coming due to COVID-19. The current research identified factors that will help control the ongoing economic crisis. Also, the research was conducted using the survey method, and the respondents were from various sectors like automobile, IT, construction, textile and hospitality. The current study has used a structural equation modeling approach to validate the model and check the unique contribution hypothesis. Also, this research contributes significantly to the literature review, which will also help in future research.

Subject Classification: 92-XX, 91B02.

Keywords: COVID-19, Organization, Firm policy, Economy, Structural equation modeling.

1. Introduction

Many countries are adopting the lockdown strategy to stop the spreading of COVID-19 (COV19). Approximately one-third of the world population was under strict restrictions. The full-scale lockdown has been implemented in many countries like Brazil, New Zealand, UK, India and many more (Bhattacharya et al., 2020). The Healthcare situation worsened in many countries leading to the deaths of many persons. Analyzing the impact of COV-19 on the economy is very tough now. This pandemic has affected the economy on a massive scale, with many developing and developed countries showing negative economic growth. UNCTAD estimates that global exports will fall by 50 billion US dollars this year and that the 2% reduction in exports in countries such as China is calculated after the lock-out is lifted. This can impact the supply regions in countries where many exports occur from the COV-19 pandemic (Mukherjee, Venkataiah, et al., 2022).

Most of the suppliers to the OEM depend on migrant labourers', where there was a severe issue. The hospitality, travel and tourism industries faced an extreme survival challenge (Baral et al., 2022). Tourists are not travelling, so no revenue is being generated (A. Kumar & Ayedee, 2021). Countries that contribute most of the GDP from the tourism industries have seen that their GDP will fall more than 15% in 2020 (Pu & Zhong, 2020). People are not willing to travel in this COV-19 pandemic. The construction industry is also facing challenges reviving from the COV-19 circumstances (Mishra & Rampal, 2020). Customers are not buying new apartments or houses as the purchasing power of the people has decreased (Mukherjee, Baral, Chittipaka, & Pal, 2022c). In India, the construction industry employs most migrant laborers', and these labourers have migrated to their hometowns due to the unavailability of resources during the lockdown (Bhatia et al., 2022). It resulted in a severe problem as there is a lack of skilled workers in the construction industries (Pal & Pal, 2021). The textile industry faces less demand among the customers as their purchase power has decreased, and purchase behaviour has also changed due to this COV-19 pandemic. In India, sales have dropped a lot due to the lockdown and closure of the shops. The IT sector has not faced such severe risks compared to other industries.

This research is being done to study the impact of COV-19 on different sectors of India and develop strategies to help the economy's recovery in those sectors. The current research is unique as it used a survey method to collect the responses from various sectors. The results were validated with multiple statistical techniques that had not been done in prior studies.

2. Literature Review

Lockdown can't be implemented for a longer time as it is not a long-term strategy because it badly impacts the country's economy. Lockdown is beneficial for a shorter time. This period can prepare health services like buying ventilators, preparing the COV-19 hospitals, isolation centers, and many other things. Due to the market's lack of supply and demand, many sectors are being affected, like manufacturing, agriculture, etc. Due to lockdown in many countries, goods and shipments are being struck in the middle and no movement is happening, affecting the supply side. And also, there is a lack of demand among the customers as they don't want to spend money to buy something new. This pandemic has changed the buying behaviours of the customers. They are purchasing essential products. So, ultimately, there is less demand in the market, resulting in a recession among the different industries.

Three fundamental pillars for running a business are government, owners and employees. Authority rested with most owners or the company's managers, and the government played the role of the regulatory authority. To maximize profits, owners try to decrease operational expenses by cutting employees' salaries, finding alternate or cheaper delivery channels, and minimising the office cost. Firms must overcome this pandemic's challenges to get back on the right track (Ahmed et al., 2021).

2.1. *Work from home and social distancing (WFHSD)*

Previous research has shown that the factors of WFHSD are critical for controlling the virus and breaking its spread among the employees (Roy et al., 2020). Guidelines are being issued for following proper SD on the firms' premises. The seating arrangements should be arranged by maintaining adequate distance between the two employees (Mukherjee, Baral, Chittipaka, Pal, et al., 2022).

H1: WFHSD will positively influence COV19CEC

2.2. *Adoption of the latest technology (ALT)*

Many firms will adopt the latest technology for their operations. The latest technologies of industry 4.0 give companies an edge in this pandemic. Many firms use human-less technology for operations (A. Sharma et al., 2020).

H2: ALT positively influences COV19CEC

2.3. *Reschedule production, supply chain, and enabling digital delivery system (RPSCDD)*

Many manufacturing units are rescheduling the working time and planning to shift the production time to eight hours labourers travelling are not being exposed to the crowd. There will be less chance of contracting the virus (Aday & Aday, 2020). Governments have asked the companies to work with half the workforce or provide accommodation for the employees only. The manufacturing units reevaluate their supply chain networks for the COV19 situation (Belhadi et al., 2021). Many e-commerce companies leave the products outside their home with contactless delivery systems in India. Then it has been collected by the customers (Queiroz et al., 2020).

H3: RPSCDD positively influences COV19CEC

2.4. *Altering the product line (APL)*

These pandemics have changed the customers' demand, and their buying behaviours have changed significantly compared to earlier (Ivanov & Dolgui, 2020). There is an increase in demand for fruits, vegetables, and

grocery items, but there is a decrease in cars, homes, and luxury goods. Many companies in this scenario have adopted products in great demand, like sanitisers, ventilators, and healthcare items (Ivanov & Das, 2020).

H4: APL positively influences COV19CEC

2.5. *Effective communication (EC)*

Proper information sharing is essential in controlling the spread of the virus (Ivanov, 2020). Proper channels of communication need to be activated. And also, adequate monitoring of the information needs to be done on a time-to-time basis (Mukherjee, Baral, et al., 2021).

H5: EC positively influences COV19CEC

2.6. *Modifying the rules and regulations of the workplace (MRRW)*

The firms need some restrictions and precautions to stop the spread of the virus. If an employee gets some symptoms of COV-19, he needs to be consulted by the doctors and remain in quarantine (Kucharski et al., 2020). The employees should have proper health check-ups before entering the office premises. Rules of wearing the mask and using sanitisers should be mandatory for the employees (Queiroz et al., 2020).

H6: MRRW positively influences COV19CEC

2.7. *Developing online purchase behaviour (DOPB)*

Due to COV-19, customers fear visiting the markets or sales offices. The company faces tremendous losses as few customers have to be provided with significant discounts (Mukherjee, Baral, Chittipaka, & Pal, 2022a). The company should make this an opportunity and introduce to sell its products online.

H7: DOPB positively influences COV19CEC

2.8. *Demand for domestic consumption (DDC)*

The COV-19 pandemic has severely hit India's domestic market. There is a severe problem on the demand and supply side. Some goods, like FMCG products, have more demand but less supply (Mukherjee, Baral, Chittipaka, & Pal, 2022b). The hospitality and entertainment sector are also affected as people are not visiting the malls or restaurants (Chowdhury et al., 2020).

H8: DDC positively influences COV19CEC

2.9. *Sealing the state's borders (SSB)*

Various countries adopted complete lockdown where they restricted the movement of people and vehicles, leaving the emergency ones

(Mahmud, Paul, Azeem, & Chowdhury, 2021). This helped in reducing the spread of the virus.

H9: SSB positively influences COV19CEC

2.10. *Strong leadership in the government (SLG)*

A strong leadership can take serious and tough decisions that will benefit the nation's people. The Indian government took a complete lockdown decision that saved many lives and broke the virus's chain in India (Mukherjee, Baral, & Chittipaka, 2022). Several beneficial packages were provided to the weaker section of the society and the migrant labourers.

H10: SLG positively influences COV19CEC

2.11. *Extending the financial year and providing a loan facility (EFYLF)*

Financial year can be extended to 15 months or 24 months to help the industry recover from some of the losses it faced (Sarkis, 2020). This will improve the balance sheets of the companies to some extent. The government should provide a loan facility at cheaper interest rates to the industry to overcome the losses incurred during this pandemic (Kashyap & Raghuvanshi, 2020). Loans should also be provided to small businesses and shops (Mukherjee & Chittipaka, 2021).

H11: EFYLF positively influences COV19CEC

3. Research methodology

3.1 *Sampling*

The data was collected across five different industrial sectors of India: the automobile sector, construction industries, textile industries, IT firms, and the hospitality industry (Mukherjee, Mohan Baral, et al., 2021). The questionnaires were sent to 656 respondents, but only 341 questionnaires, valid for analysis, were returned from the respondents. However, after collecting the data, the research team used the single factor test for each structure. EFA was performed, and the results indicate that the maximum variances for the first factor were 13.146 % below the recommended 50% (P. Sharma & Pal, 2018).

3.2. *Demographics of the respondents*

The survey was conducted in five different industries. Several respondents in IT firms were 24%, the number of respondents in automobile sectors was 22%, the number of respondents in the construction industry was 21%, the number of respondents in the textile industry was 15%, and the number of respondents in the hospitality industry 18%. Respondents'

Table I
Cronbach alpha, factor loadings

Variables	Items	Measurement Items	Cronbach's alpha	Factor Loading
Work from Home and Social Distancing (WFHSD)	WFHSD 1	Work from home strategies can help in decreasing the transmission of the virus.	0.850	0.793
	WFHSD 2	Employees are asked to perform their jobs from home only.		0.82
	WFHSD 3	Firms are following social distance protocols.		0.82
	WFHSD 4	Work from home leads to less expenditure in the firm.		0.738
Adoption of the Latest Technology (ALT)	ALT 1	The latest innovative technology can help in making the work easier.	0.882	0.815
	ALT 2	The latest technology creates transparency in the system.		0.833
	ALT 3	Adoption of the latest technology increases operational excellence.		0.846
	ALT 4	Adoption of the latest technology increases efficiency.		0.839

Contd...

Reschedule of production, supply chain, and enabling digitally delivery system (RPSRDD)	RPSRDD 1	The digital delivery system creates transparency, traceability and tracking of the products.		0.824
	RPSRDD 2	Rescheduling the delivery route keeping in mind the containment zone.	0.850	0.879
	RPSRDD 3	Online delivery systems can be used during disruptions.		0.783
Altering the product line (APL)	APL 1	Altering the product line will solve the problem of human resources.		0.794
	APL 2	Labour problem is one of the major problems faced during the pandemic.		0.821
	APL 3	There will be a decrease in production costs.	0.886	0.83
	APL 4	Production capacity will increase.		0.698
Effective communication (EC)	EC 1	Employees need to have proper communication.		0.846
	EC 2	Communication barriers need to be avoided.		0.885
	EC 3	Negative rumours need to be avoided.	0.861	0.887
	EC 4	Proper communication channel needs to be followed.		0.718
<i>Contd...</i>				

Modifying the rules and regulations of the workplace (MRRW)	MRRW 1	The firm is following the protocols given by the government.		0.849
	MRRW 2	Every employee is following the COVID protocol		0.915
	MRRW 3	Sanitisers and hand washing are provided in the workplace.		0.936
	MRRW 4	The proper social distancing of the labour is maintained.	0.955	0.896
	MRRW 5	Work from home is mainly provided to the employees.		0.89
	MRRW 6	No one is following COVID protocol		0.87
Developing online purchase behaviour (DOPB)	DOPB 1	Online purchasing can help in reducing transmission.		0.943
	DOPB 2	Customers need to understand the benefits of online purchasing.	0.903	0.938
	DOPB 3	Firms need to promote online purchasing.		0.821
	DDC 1	Firms need to increase domestic production.		0.912
Demand for domestic consumption (DDC)	DDC 2	Firms need to advertise more and more in the domestic market.		0.874
	DDC 3	Customers need to buy products from domestic companies.	0.915	0.842
	DDC 4	Firms will face problems in finding customers in the domestic market.		0.835
	<i>Contd...</i>			

Sealing the state's borders (SSB)	SSB 1	Closure of interstate movement can help in decreasing the transmission.		0.791
	SSB 2	This strategy will create a lot of problems for the organization.	0.858	0.882
	SSB 3	Closure of inter-district movements can help in decreasing the transmission.		0.855
Strong leadership in the government (SLG)	SLG 1	Leadership in the government can help in fighting the disruptions.		0.772
	SLG 2	Strong leadership can formulate better strategies.		0.824
	SLG 3	Leadership can help in having a solid lockdown.	0.920	0.869
	SLG 4	Leadership can take firm decisions.		0.866
	SLG 5	Leadership can provide packages to fight the pandemic.		0.836
Extending the financial year and providing a loan facility (EFYLF)	EFYLF 1	An extension of the financial year can be helpful.		0.812
	EFYLF 2	Loan facilities need to be provided with low interest to the firms.		0.842
	EFYLF 3	The extension of the financial year will be a burden.	0.920	0.873
	EFYLF 4	Loan facilities need to be given low interest to the human who loses their jobs or business.		0.808

current position was the number of respondents of HR managers was 38%, the number of respondents of project managers was 21%, the number of respondents of the director was 14%, and the number of respondents of plant managers was 27%.

4. Results

4.1. Reliability and validity

4.1.1. Cronbach's Alpha

The reliability assessment analyses the level of internal consistency and freedom of error of variable measuring items at any moment (Kline, 1999). It is used to measure the reliability of the data (Sahoo et al., 2021).

4.2. Exploratory Factor Analysis (EFA)

The 2nd step in conducting EFA with SPSS 20.0. The present study's Kaiser-Meyer-Olkin (KMO) value is 0.802, higher than the 0.60 minimum standard (Joseph F. Hair et al., 2012). The next step is the rotated component matrix, which also helps cluster the items in a given category. The varimax rotation method is applied. The factor loading for the rotated component matrix can be seen in Table I.

4.3. Confirmatory factor analysis (CFA)

The goodness of fit indices was $\chi^2 = 1524.121$ with $df = 847$, RMSEA = 0.053, IFI = 0.928, CFI = 0.927, TLI = 0.918, and GFI = 0.949, which were within the threshold values (Hu et al., 2009). Table II shows the deiscriamatory validity matix and table III shows the path analysis results.

Table III
Path analysis result of the structural model for the factors

	Estimate	Standard Errors	Critical Ratios	P	Hypothesis
COV19CEC <--- WFHSD	0.12	0.045	2.67	0.00	Supported
COV19CEC <--- ALT	0.23	0.035	6.57	0.00	Supported
COV19CEC <--- RPSCDD	0.08	0.038	2.08	0.00	Supported
COV19CEC <--- APL	0.32	0.033	9.70	0.00	Supported
COV19CEC <--- EC	0.07	0.033	2.09	0.00	Supported
COV19CEC <--- MRRW	0.24	0.07	3.36	0.00	Supported

Contd...

COV19CEC <--- DOPB	0.33	0.048	6.88	0.00	Supported
COV19CEC <--- DDC	0.14	0.049	2.86	0.00	Supported
COV19CEC <--- SSB	0.58	0.075	7.73	0.00	Supported
COV19CEC <--- SLG	0.19	0.066	2.88	0.00	Supported
COV19CEC <--- EFYLF	0.20	0.058	3.45	0.00	Supported

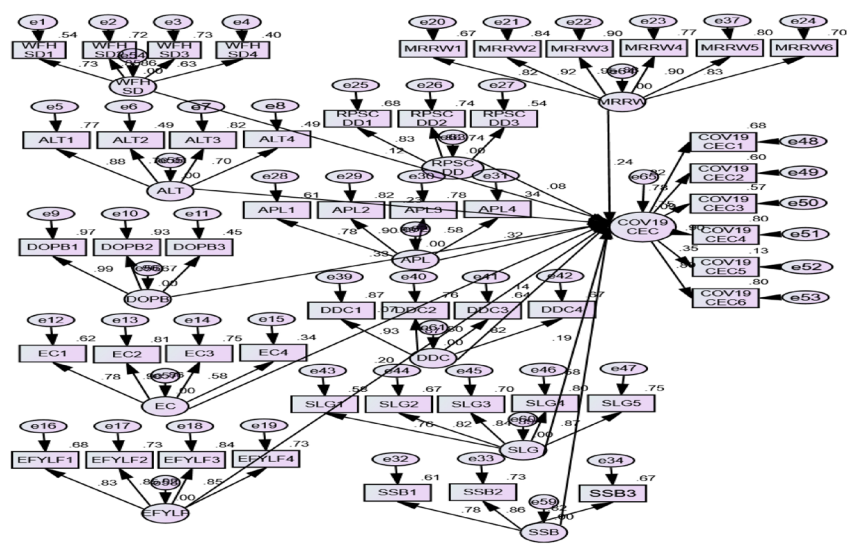


Figure I
Structural model for the COV19CEC model for the factors

4.4. *Structural model and testing of hypothesis*

Figure I represents the structural model for the COV19CEC model for the factors. The goodness of fit indices was $\chi^2 = 2273.185$ with $df = 1164$, $RMSEA = 0.04$, $IFI = 0.949$, $CFI = 0.941$, $TLI = 0.932$, and $GFI = 0.921$, which were within the threshold values suggested by (Joe F. Hair et al., 2014). The structural model explains 67% of COV19CEC variance for the factors.

5. Discussion

As per (Ngonghala et al., 2020), relaxation should be provided for social distancing at present so that life goes on daily. The practice of social distancing and work from home has helped control and reduce spreading the of COVID-19. Also, it helped break the virus chain during the pandemic. But on the other hand, this social distancing and work from home have

deteriorated physical and mental well-being. But during the absence of a vaccine, it was the only method to be safe and secure. Adoption of the latest technology is also an essential element that has been identified in this study. As the organisations have been closed for longer, adopting the latest information technologies will be a boon to the industries. During this pandemic, China has been using AI-powered thermal cameras to identify people with high temperatures within a considerable crowd and recognise the people who are not wearing face masks.

This study has identified a critical element in rescheduling production, supply chain, and enabling digital delivery systems. It means rescheduling the production and supply chain activity due to COVID-19 pandemics (Ahmed et al., 2021). Re-scheduling will also overcome the loss in SC and inventory due to the closing of production units during COVID-19 (Sarkis, 2020). The organisations can have alternative modes like both online and offline modes of delivery to increase the efficiency of the supply chain, which will help reduce the risk of virus spread.

Altering the product line is a critical element in this study (Gautam et al., 2021). The situation is going to be same till everything becomes normal like before. Even in our country, the people who worked in various construction sites returned to their homes or village due to job loss (S. Kumar, 2021). Even they started a business selling vegetables, fruits, etc., to earn their livelihood (Kashyap & Raghuvanshi, 2020). There is a need for an adequate flow of communication to control the COVID-19 virus transmission. The managers or the leaders need to control the flow of information to avoid confusion with the various players involved (M. Sharma et al., 2021).

There is a need to modify the compulsory use of face masks, which will decrease the spread of viruses (P Mahmud et al., 2021). Social distancing and hand sanitization need to be practised for healthy well-being. If sudden symptoms of COVID-19 are visible, the infected person immediately needs to be taken to isolation. These safety precautions have become mandatory in most organisations today (Ali et al., 2021). There is a need to create awareness among the consumers on online purchasing behavior (Xiong et al., 2021). The lesser crowd in the marketplace will reduce the spread of the virus among individuals (Q. Wang & Zhang, 2021).

Demand for domestic consumption has been identified as an essential element in this study. Due to the pandemic, there was an increased demand within the household area. Due to a hurdle in the moving process, transportation was hampered due to lockdown. No outside goods could

enter the state borders. Also, segments like restaurants, hotels, mining, manufacturing, etc., have both demand and supply shocks (Nagarajan & Sharma, 2021).

Sealing the state's borders has been identified as an essential element in this study. It means creating a hurdle in the movement of individuals from one place to the other. The local government has made this hurdle, i.e., rules enforced by various state governments. The move stopped people because most places had no transportation movement (Karmaker et al., 2021). Strong leadership in the government has been identified as an essential construct in this study. A strict government must impose restrictions during pandemic circumstances. Also, the government should have enough control, and it should be able to bring more transparency to the system. Also, the government needs to provide loan facilities with easy instalments to recover the loss due to the pandemic (C. Wang et al., 2020).

6. Conclusion

The research identified essential components utilizing literature review, and statistical methods were used to validate the results and findings. The eleven critical factors identified were administrative staff, firm, and government policy. The identified components will significantly assist the economy of COV-19 in different sectors in a developing country like India. Due to lockdown and current circumstances, there has been a crisis in almost every industry. Hence, with the help of recent research, the identified factors will provide a better understanding to come out of the present situation. India is vulnerable to COV-19 due to a fragile healthcare system, low economic growth rates, poverty, and inequality like any other growing economy. Hence, based on the identified components, this research can be applied in other developing economies by conducting survey-based research for various countries. This research is also unique because no prior study has been undertaken validating these components identified from the literature review.

References

- [1] Aday, S., & Aday, M. S. (2020). Impact of COVID-19 on the food supply chain. *Food Quality and Safety*, 4(4), 167–180. <https://doi.org/10.1093/fqsafe/fyaa024>
- [2] Ahmed, F., Syed, A. A., Kamal, M. A., López-garcía, M. de las N., Ramos-requena, J. P., & Gupta, S. (2021). Assessing the impact of

- COVID- 19 pandemic on the stock and commodity markets performance and sustainability: A comparative analysis of south asian countries. In *Sustainability (Switzerland)* (Vol. 13, Issue 10). <https://doi.org/10.3390/su13105669>
- [3] Ali, M. H., Suleiman, N., Khalid, N., Tan, K. H., Tseng, M. L., & Kumar, M. (2021). Supply chain resilience reactive strategies for food SMEs in coping to COVID-19 crisis. In *Trends in Food Science and Technology* (Vol. 109, pp. 94–102). <https://doi.org/10.1016/j.tifs.2021.01.021>
- [4] Baral, M. M., Mukherjee, S., Nagariya, R., Singh Patel, B., Pathak, A., & Chittipaka, V. (2022). Analysis of factors impacting firm performance of MSMEs: lessons learnt from COVID-19. *Benchmarking: An International Journal*, ahead-of-p(ahead-of-print). <https://doi.org/10.1108/BIJ-11-2021-0660>
- [5] Belhadi, A., Kamble, S., Jabbour, C. J. C., Gunasekaran, A., Ndubisi, N. O., & Venkatesh, M. (2021). Manufacturing and service supply chain resilience to the COVID-19 outbreak: Lessons learned from the automobile and airline industries. *Technological Forecasting and Social Change*, 163, 120447. <https://doi.org/10.1016/j.techfore.2020.120447>
- [6] Bhatia, A., Roy, B., & Kumar, A. (2022). A review of tourism sustainability in the era of Covid-19. *Journal of Statistics and Management Systems*, 1–18. <https://doi.org/10.1080/09720510.2021.1995196>
- [7] Bhattacharya, T., Bhandari, B., & Bairagya, I. (2020). Where are the jobs? Estimating skill-based employment linkages across sectors for the Indian economy: An input-output analysis. *Structural Change and Economic Dynamics*, 53, 292–308. <https://doi.org/10.1016/J.STRUECO.2020.03.003>
- [8] Chowdhury, Md. T., Sarkar, A., Saha, P. K., & Anik, R. H. (2020). Enhancing supply resilience in the COVID-19 pandemic: a case study on beauty and personal care retailers. *Modern Supply Chain Research and Applications*, 2(3), 143–159. <https://doi.org/10.1108/mscra-07-2020-0018>
- [9] Gautam, A. S., Pathak, N., Ahamad, T., Semwal, P., Bourai, A. A., Rana, A. S., & Nautiyal, O. P. (2021). Pandemic in India: Special reference to Covid-19 and its technological aspect. *Journal of Statistics and Management Systems*, 24(2), 387–410. <https://doi.org/10.1080/09720510.2021.1879469>
- [10] Hair, J. F., Sarstedt, M., Hopkins, L., & Kuppelwieser, V. G. (2014). Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. In *European Business Review* (Vol. 26, Issue 2, pp. 106–121). Emerald Group Publishing Ltd. <https://doi.org/10.1108/EBR-10-2013-0128>

- [11] Hair, J. F., Sarstedt, M., Pieper, T. M., & Ringle, C. M. (2012). The Use of Partial Least Squares Structural Equation Modeling in Strategic Management Research: A Review of Past Practices and Recommendations for Future Applications. *Long Range Planning*, 45(5–6), 320–340. <https://doi.org/10.1016/j.lrp.2012.09.008>
- [12] Hu, L., a, P. B.-S. equation modeling;,& 1999, undefined. (2009). Cut-off criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Taylor & Francis*, 6(1), 1–55. <https://doi.org/10.1080/10705519909540118>
- [13] Ivanov, D. (2020). Predicting the impacts of epidemic outbreaks on global supply chains: A simulation-based analysis on the coronavirus outbreak (COVID-19/SARS-CoV-2) case. *Transportation Research Part E: Logistics and Transportation Review*, 136(March), 101922. <https://doi.org/10.1016/j.tre.2020.101922>
- [14] Ivanov, D., & Das, A. (2020). Coronavirus (COVID-19/SARS-CoV-2) and supply chain resilience: A research note. *International Journal of Integrated Supply Management*, 13(1), 90–102. <https://doi.org/10.1504/IJISM.2020.107780>
- [15] Ivanov, D., & Dolgui, A. (2020). Viability of intertwined supply networks: extending the supply chain resilience angles towards survivability. A position paper motivated by COVID-19 outbreak. *International Journal of Production Research*, 58(10), 2904–2915. <https://doi.org/10.1080/00207543.2020.1750727>
- [16] Karmaker, C. L., Ahmed, T., Ahmed, S., Ali, S. M., Moktadir, M. A., & Kabir, G. (2021). Improving supply chain sustainability in the context of COVID-19 pandemic in an emerging economy: Exploring drivers using an integrated model. *Sustainable Production and Consumption*, 26, 411–427. <https://doi.org/10.1016/j.spc.2020.09.019>
- [17] Kashyap, A., & Raghuvanshi, J. (2020). A preliminary study on exploring the critical success factors for developing COVID-19 preventive strategy with an economy centric approach. *Management Research*, 18(4), 357–377. <https://doi.org/10.1108/MRJIAM-06-2020-1046>
- [18] Kline, R. B. (1999). Book Review: Psychometric theory (3rd ed.). *Journal of Psychoeducational Assessment*, 17(3), 275–280. <https://doi.org/10.1177/073428299901700307>
- [19] Kumar, A., & Ayedee, N. (2021). An interconnection between COVID-19 and climate change problem. *Journal of Statistics and Management Systems*, 24(2), 281–300. <https://doi.org/10.1080/09720510.2021.1875568>

- [20] Kumar, S. (2021). The effect of CORONA-COVID-19 on hospitality sector. *Journal of Statistics and Management Systems*, 24(1), 163–174. <https://doi.org/10.1080/09720510.2020.1833450>
- [21] Mahmud, P., Paul, S. K., Azeem, A., & Chowdhury, P. (2021). Evaluating Supply Chain Collaboration Barriers in Small- and Medium-Sized Enterprises. *Sustainability* 2021, Vol. 13, Page 7449, 13(13), 7449. <https://doi.org/10.3390/SU13137449>
- [22] Mishra, K., & Rampal, J. (2020). The COVID-19 pandemic and food insecurity: A viewpoint on India. *World Development*, 135, 105068. <https://doi.org/10.1016/J.WORLDDEV.2020.105068>
- [23] Mukherjee, S., Baral, M. M., & Chittipaka, V. (2022). How to Improve Organizational Performance Using Big Data in the Hotels. In *Integrating Blockchain Technology Into the Circular Economy* (pp. 15–43). IGI Global. <https://doi.org/10.4018/978-1-7998-7642-7.ch002>
- [24] Mukherjee, S., Baral, M. M., Chittipaka, V., & Pal, S. K. (2022a). Addressing the Strategies for the Sustainable Supply Chain in Post-COVID-19 Pandemic. *Making Complex Decisions toward Revamping Supply Chains amid COVID-19 Outbreak*, 69–86. <https://doi.org/10.1201/9781003150084-4>
- [25] Mukherjee, S., Baral, M. M., Chittipaka, V., & Pal, S. K. (2022b). Addressing the Strategies for the Sustainable Supply Chain in Post-COVID-19 Pandemic. In *Making Complex Decisions toward Revamping Supply Chains amid COVID-19 Outbreak* (pp. 69–86). CRC Press. <https://doi.org/10.1201/9781003150084-4>
- [26] Mukherjee, S., Baral, M. M., Chittipaka, V., & Pal, S. K. (2022c). A Structural Equation Modelling Approach to Develop a Resilient Supply Chain Strategy for the COVID-19 Disruptions. In *Handbook of Research on Supply Chain Resiliency, Efficiency, and Visibility in the Post-Pandemic Era* (pp. 242–266). IGI Global. <https://doi.org/10.4018/978-1-7998-9506-0.ch013>
- [27] Mukherjee, S., Baral, M. M., Chittipaka, V., Pal, S. K., & Nagariya, R. (2022). Investigating sustainable development for the COVID-19 vaccine supply chain: a structural equation modelling approach. *Journal of Humanitarian Logistics and Supply Chain Management*, ahead-of-print(ahead-of-print). <https://doi.org/10.1108/JHLSCM-08-2021-0079>
- [28] Mukherjee, S., Baral, M. M., Venkataiah, C., Pal, S. K., & Nagariya, R. (2021). Service robots are an option for contactless services due to the COVID-19 pandemic in the hotels. *DECISION*, 48(4), 445–460. <https://doi.org/10.1007/s40622-021-00300-x>

- [29] Mukherjee, S., & Chittipaka, V. (2021). Analysing the Adoption of Intelligent Agent Technology in Food Supply Chain Management: An Empirical Evidence. *FIIB Business Review*, 231971452110592. <https://doi.org/10.1177/23197145211059243>
- [30] Mukherjee, S., Mohan Baral, M., Srivastava, S. C., & Jana, B. (2021). ANALYZING THE PROBLEMS FACED BY FASHION RETAIL STORES DUE TO COVID-19 OUTBREAK. *Parikalpana-KIIT Journal of Management*, 17(I). <https://doi.org/10.23862/kiit-parikalpana/2021/v17/i1/209031>
- [31] Mukherjee, S., Venkataiah, C., Baral, M. M., & Pal, S. K. (2022). Analyzing the factors that will impact the supply chain of the COVID-19 vaccine: A structural equation modeling approach. *Journal of Statistics and Management Systems*, 1–16. <https://doi.org/10.1080/09720510.2021.1966955>
- [32] Nagarajan, V., & Sharma, P. (2021). Firm internationalization and long-term impact of the Covid-19 pandemic. *Managerial and Decision Economics*. <https://doi.org/10.1002/mde.3321>
- [33] Ngonghala, C. N., Iboi, E. A., & Gumel, A. B. (2020). Could masks curtail the post-lockdown resurgence of COVID-19 in the US? *Mathematical Biosciences*, 329, 108452. <https://doi.org/10.1016/J.MBS.2020.108452>
- [34] Pal, S. K., & Pal, A. K. (2021). The impact of increase in COVID-19 cases with exceptional situation to SDG : Good health and well-being. *Journal of Statistics and Management Systems*, 24(1), 209–228. <https://doi.org/10.1080/09720510.2021.1872691>
- [35] Pu, M., & Zhong, Y. (2020). Rising concerns over agricultural production as COVID-19 spreads: Lessons from China. *Global Food Security*, 26, 100409. <https://doi.org/10.1016/J.GFS.2020.100409>
- [36] Queiroz, M. M., Ivanov, D., Dolgui, A., & Fosso Wamba, S. (2020). Impacts of epidemic outbreaks on supply chains: mapping a research agenda amid the COVID-19 pandemic through a structured literature review. In *Annals of Operations Research* (Issue 0123456789). Springer US. <https://doi.org/10.1007/s10479-020-03685-7>
- [37] Roy, A., Patnaik, B. C. M., & Satpathy, I. (2020). Impact of Covid-19 crisis on Indian MSME sector: A study on remedial measures. *Eurasian Chemical Communications*, 2(9), 991–1000.
- [38] Sahoo, K. K., Muduli, K. K., Luhach, A. Kr., & Poonia, R. C. (2021). Pandemic COVID-19: An empirical analysis of impact on Indian higher education system. *Journal of Statistics and Management Systems*, 24(2), 341–355. <https://doi.org/10.1080/09720510.2021.1875571>

- [39] Sarkis, J. (2020). Supply chain sustainability: learning from the COVID-19 pandemic. *International Journal of Operations and Production Management*, 41(1), 63–73. <https://doi.org/10.1108/IJOPM-08-2020-0568>
- [40] Sharma, A., Adhikary, A., & Borah, S. B. (2020). Covid-19's impact on supply chain decisions: Strategic insights from NASDAQ 100 firms using Twitter data. *Journal of Business Research*, 117, 443–449. <https://doi.org/10.1016/j.jbusres.2020.05.035>
- [41] Sharma, M., Luthra, S., Joshi, S., & Kumar, A. (2021). Accelerating retail supply chain performance against pandemic disruption: adopting resilient strategies to mitigate the long-term effects. *Journal of Enterprise Information Management*, ahead-of-p(ahead-of-print). <https://doi.org/10.1108/JEIM-07-2020-0286>
- [42] Sharma, P., & Pal, S. K. (2018). Estimation of population mean in presence of random non-response. *Journal of Statistics and Management Systems*, 21(6), 1105–1119. <https://doi.org/10.1080/09720510.2018.1478623>
- [43] Wang, C., Cheng, Z., Yue, X.-G., & McAleer, M. (2020). Risk Management of COVID-19 by Universities in China. *Journal of Risk and Financial Management* 2020, Vol. 13, Page 36, 13(2), 36. <https://doi.org/10.3390/JRFM13020036>
- [44] Wang, Q., & Zhang, C. (2021). Can COVID-19 and environmental research in developing countries support these countries to meet the environmental challenges induced by the pandemic? *Environmental Science and Pollution Research*, 1–21. <https://doi.org/10.1007/s11356-021-13591-5>
- [45] Xiong, Y., Lam, H. K. S., Kumar, A., Ngai, E. W. T., Xiu, C., & Wang, X. (2021). The mitigating role of blockchain-enabled supply chains during the COVID-19 pandemic. *International Journal of Operations & Production Management*, 41(9), 1495–1521. <https://doi.org/10.1108/IJOPM-12-2020-0901>

Received November, 2021

Revised June, 2022