



## RESEARCH IMPACT SUMMARY

*December 15, 2021*

### **Breakdown Alert! Finding Solutions for the Global Supply Chain Crisis During COVID-19**

*Researchers develop models that could help tackle pandemic-related disruptions to supply chains and make them resilient*

**The COVID-19 pandemic has not only caused the loss of lives but also had a severe impact on the economy. Lockdowns and labor shortages due to infections have disrupted manufacturing, logistics, and supply chain systems across sectors. In the wake of this global crisis, a simulation model developed by researchers from India could help to maintain the supply chains for essential goods and develop a robust supply network for the future.**

Natural calamities are known to disrupt logistics systems and supply chains, causing a shortage of essential goods, such as food, medicine, and personal protective equipment. Since 2020, the COVID-19 pandemic has necessitated several lockdowns and movement restrictions globally, resulting in large-scale impacts on the world economy. Manufacturing and logistics have been affected across diverse sectors, resulting in a global supply chain crisis.

Now, as we slowly inch toward a post-pandemic future, a forward-thinking approach to create more robust supply chains is required. In a [study](#) published in the *International Journal of Production Research*, researchers from India have proposed strategies to mitigate supply chain problems and urgently fulfill demands for essential items. They have described systems that could enable the smooth functioning of supply chains even under major crises like the COVID-19 pandemic. Professor Manoj Kumar Tiwari, who led the study, comments, *“The COVID-19 pandemic has exposed the current weaknesses in the supply chain system. But now, we have an opportunity to fix these problems and create a better system that will not just help us during this pandemic but also in the future.”*

In their paper, Prof. Tiwari and his team highlight the severe economic impact of the COVID-19 pandemic, especially in “hot zones”—areas with high rates of infection and strict movement restrictions. Based on a comprehensive literature review, they recommend the use of a synchronized truck–drone delivery system to rapidly reach customers living in hot zones while also maintaining social distancing. This delivery system for essential goods consists of one truck with two types of drones, one for food items and the other for medicines. As the truck drives by, the drones can take off, fly along optimized scheduled paths, make multiple deliveries—even to quarantined individuals on the top floors of high rise buildings—and return to the truck upon successful completion of the deliveries.



The researchers also simulated operations of the Public Distribution System (PDS)—the Indian government’s essential food supply chain for those in lower socioeconomic groups—under three scenarios across a six-month period: normal operation, shutdown of one central facility due to COVID-19, and use of a backup facility to maintain service levels during disruptions. The simulations show that during the shutdown of a central facility, the expected lead time for food supply—the time taken from order to delivery—increases significantly, reducing revenue and resulting in unmet customer needs. However, the use of a backup warehouse at this time, and a system wherein warehouses are integrated, can help maintain efficiency and revenue.

*“Our study provides action plans for tackling disruptions to the supply of food grains, ingredients, medicine, PPE, and other essential items, which are occurring not only in India but around the world,”* explains Prof. Tiwari, adding that the focus of their study was COVID-19-specific. Nevertheless, the findings from their study could be helpful during diverse global crises that affect supply chains.

Indeed, as signs of supply chain problems become more common worldwide, this study offers a beacon of hope, laying the foundation for robust, crisis-proof logistics and supply chain systems.

## Reference

Authors	Sube Singh <sup>a</sup> , Ramesh Kumar <sup>b</sup> , Rohit Panchal <sup>c</sup> , Manoj Kumar Tiwari <sup>a,d</sup>
Title of original paper	Impact of COVID-19 on logistics systems and disruptions in food supply chain
Journal	<i>International Journal of Production Research</i>
DOI	10.1080/00207543.2020.1792000
Affiliations	<sup>a</sup> Department of Industrial and Systems Engineering, Indian Institute of Technology Kharagpur, Kharagpur, India <sup>b</sup> Department of Industrial Engineering and Manufacturing System, National Institute of Industrial Engineering (NITIE), Mumbai, India <sup>c</sup> Department of Environmental Engineering and Management, National Institute of Industrial Engineering (NITIE), Mumbai, India <sup>d</sup> National Institute of Industrial Engineering (NITIE), Mumbai, India



Empty grocery store shelves have become a common sight worldwide owing to pandemic-related logistics disruptions and the resultant global supply chain crisis.

Photo courtesy: WeStarMoney on Pexels

### **About Professor Manoj Kumar Tiwari**

Prof. Manoj Kumar Tiwari (FNAE, FNASc, FIIE, FIIE, and FIETI) is the Director of the National Institute of Industrial Engineering, Mumbai, and a professor at the Indian Institute of



Technology, Kharagpur. He completed his PhD from Jadavpur University, and his research career has been dedicated to studying manufacturing systems and supply chain management using optimization, simulation, and computational intelligence. He has published more than 320 papers and served on the editorial board of several international journals. His honors include the Most Influential Researcher Award (Operations and Supply Chain Management) as well as the Mahalanobis Distinguished Educator Award.