Agility in Resilient Supply Chain Risk Management Design to Cope with Supply Shortage under Covid-19 Pandemic: Simulation-Based Supplier Strategy

Sheren Aurelia Dyka Chandra
Department of Industrial and Systems Engineering
Faculty of Engineering
The Hong Kong Polytechnic University, Hung Hom, HKSAR, CHINA
sheren-aurelia-dyka.chandra@connect.polyu.hk

C.K.M. LEE[1,2]
[1]Associate Professor, Department of Industrial and Systems Engineering, The Hong Kong Polytechnic University, Kowloon, Hong Kong
[2]The Laboratory of Artificial Intelligence in Design Limited, The Hong Kong Science Park, New Territories, Hong Kong
ckm.lee@polyu.edu.hk

Abstract

Growing global supply chain trends across different industries have driven enormous changes and complexity of traditional supply chain management (SCM). Simultaneously, unprecedented disruptions impacting worldwide commerce further add more vulnerabilities to current SCM practices. The most recent Covid-19 pandemic is a major global catastrophe that has created unpredictable disruptions towards supply chain activities and caused interruptions, especially in supply or sourcing activities. This low-frequency and high-impact disruption have created severe ripple effects in SCM, resulting from propagation of disturbance from upstream point of supply to downstream part of production and distribution. While traditional SCM focuses more on developing initial strategies to avoid forecasted future risks, Covid-19 phenomenon has forced SCM practitioners to propose modern SCM with agile and resilient risk management capability to adapt and respond quickly to unpredictable risk. However, it is found that only a scarce number of academic papers have suggested appropriate supply chain risk management (SCRM) solutions for the commercial sector while most addressed the issues in humanitarian SCM. Hence, this paper aims to investigate the phenomenon of supply shortage as the root problem of ripple effects in the supply chain caused by Covid-19 pandemic and propose effective SCRM to build an agile and resilient commerce supply chain for responding to the disruptions. Beyond that, the objective of this research is to also provide a clearer picture of the critical role of SCRM in the future post-pandemic world that is advantageous for supporting agile and resilient decision-making processes to turn risks into opportunities.

The study first provides a comprehensive review of existing literature related to SCM and SCRM as the basis to define measurements in assessing and improving supply chain agility and resilience. Based on this preliminary study, a simulation modeling approach based on real-life case study is designed, and experimental results are presented to depict more conceptual and realistic illustrations. This paper implements a combination of agent-based and discrete-event simulation methodology with AnyLogic simulation software. Through this proposed approach, the paper finally concludes with providing managerial insights on SCRM, particularly for strategic sourcing and identifying possibilities for potential research areas. The findings and recommendations from this paper can be further exploited for advancing SCRM based on simulation technology in real-life practices as an integral part of modern supply chain capabilities. In turn, this paper contributes to help supply chain practitioners accumulate better understanding on the importance role of agile and resilient SCRM, especially in sourcing activities during disruptions period, and effective methodology for its real-world implementation that supports making investment decisions in priority settings.

Keywords

Supply Chain Risk Management, Agility in Supply Chain Resilience, Ripple Effects of Covid-19, Agent-based Model, Discrete-event Model

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Biographies

Sheren Aurelia Dyka Chandra. Sheren is a final year undergraduate student at The Hong Kong Polytechnic University, where she is pursuing in a degree in BSc (Hons) Logistics Engineering with Management. In her final year studies, Sheren conducts a capstone project focusing on the concept and practices of agility in resilience global supply chains. Inspired by her internship experiences in several logistics and supply chain companies, she is interested to deploy digital technology in optimizing traditional supply chain management to deliver greater productivity and ensure long-term sustainability. By acquiring extensive theoretical and practical understandings from her project and engineering studies, she intends to apply the gained knowledge into real-world industry.

C.K.M. LEE. Dr C.K.M. LEE is currently an associate professor in the Department of Industrial and Systems Engineering, The Hong Kong Polytechnic University, Hong Kong. She is the program leader of BSc(Hons) Enterprise Engineering with Management. She obtained her PhD and BEng degree from The Hong Kong Polytechnic University. Her main research areas include Industrial Engineering, Enterprise Resource Planning (ERP), Logistics and Supply Chain Management, Industrial Internet of Things (IIoT), Wireless Sensor and Actuator Network (WSAN), Cloud Computing and Big Data Analytics. As of now, Dr Lee has published over 130 articles in various international journals and seminars. She was awarded Silver Medal in the 47th International Exhibition of Inventions of Geneva in 2019 and Outstanding Paper Award of Emerald Network Awards in 2019. Dr Lee also serves as the Lab-in-Charge of the Department of Industrial and Systems Engineering, The Hong Kong Polytechnic University, Cyber-Physical Systems Laboratory.