
Guest editorial: Emerging trends in supply chain engineering towards global sustainability

Guest editorial

149

The present state of affairs

The difficulties in getting the daily essentials to customers promptly during the COVID-19 pandemic have exposed major gaps and risks in the conventional supply chains. The crisis and the issues exposed, however, provided an opportunity for companies to reassess and remodel their supply chains by taking a more scientific and methodological approach (Queiroz *et al.*, 2020). Before COVID-19, the focus was mostly on supply chain optimization to reduce overall waste and increase overall operational efficiency. The COVID-19 crisis has now forced companies to work on building resilience, reducing risk, identifying shortages at the earliest during sudden spikes in demand and adopting sustainable strategies to ensure success in their supply chain operations (El Baz and Ruel, 2020).

Emerging advancements in technologies provide an opportunity to improve end-to-end supply chain performance (SCP) in response to situations such as COVID-19, and support organizations to increase supply chain resiliency, sustainability and agility (Ivanov and Dolgui, 2020). The supply chain risk indicators are more important in transforming a linear supply chain into a digital supply network (Manavalan *et al.*, 2020; Manavalan and Jayakrishna, 2019a, 2019b). It will allow organizations to improve the flow of information and collaborate easier than before. Supply chain engineering (SCE) is the use of mathematical models and methods to determine optimal strategies for managing the supply chain (Ravindran and Warsing, 2013). SCE intersects with multiple engineering specialties such as production engineering, industrial engineering, information systems engineering and software engineering (Goetschalckx, 2011). The methods followed in SCE practices are essential to build supply chain resiliency, collaboration and operational excellence. In addition, SCE enables optimally interconnecting IT, human resources, manufacturing centres, warehouses and logistics to achieve performance goals. One of the main sectors in the supply chain is the transportation sector. Heavy freight transportation and the efficient and strategic management of sea routes from an economic and environmental perspective has become a major concern (Jayakrishna *et al.*, 2022). Transportation is an important keystone in improving the supply chain resiliency. The most important qualities for supply chain resilience are responsiveness, readiness, flexibility and adaptability (Echefaj *et al.*, 2022). Also, commitment and communication are the highest maturity factors influencing resilience capabilities. With a proper hierarchical vision of capabilities and practices, the industries can increase the resilience. Strategic decision-making of management, accurate forecasting of demand, advanced manufacturing system in the organization and data integration tools are the critical drivers (Sathyan *et al.*, 2022). There is also the need to examine the environmental risks and benefits associated with any product or process so that improvements can be made during supply chain resilience (Vinodh and Jayakrishna, 2012). Supply chain resilience depends on sustainability of the product or process. Green SCM (GSCM) is one of the key concepts in sustainability. It was identified that “sustainable packaging” under the traits of GSCM had the best performance compared to other sustainability methods (Sahu *et al.*, 2022).



Journal of Global Operations and
Strategic Sourcing
Vol. 17 No. 2, 2024
pp. 149-155
© Emerald Publishing Limited
2398-5364
DOI 10.1108/JGOSS-05-2024-124

The special issue

This special issue contains 13 articles pertaining to supply chain, sustainability, production and, supply chain resilience, supply chain engineering using mathematical models and approaches.

Contributions to the special issue

The articles published in this special issue set the tone by summarizing the extant literature on strategies to improve supply chain and supply chain engineering. The contribution of each section is presented in Table 1.

Echefaj *et al.* (2022) studied the supply chain resiliency during an unexpected disruption. The purpose of the study was to determine and rank the capabilities and practices necessary to maintain a resilient supply chain in the face of unforeseen disruptions. Key findings revealed that responsiveness, readiness, flexibility and adaptability were deemed the most crucial capabilities for ensuring supply chain resilience. Bandaranayake *et al.* (2022) developed a meta-model incorporating significant perspectives required for cross-border logistics (CBL) processes. The capacity of role activity diagrams (RADs) to depict all perspectives, including interactions in a single diagram, makes them particularly suitable for modelling CBL processes. RADs have been complemented with physical flow diagrams and methods to capture temporal dimension, enabling a comprehensive view of CBL processes and laying the foundation for insightful analysis.

Manuscript title	Author
Application of AHP and G-TOPSIS for prioritizing capabilities and related practices for a mature and resilient supply chain during disruption	Echefaj <i>et al.</i> (2022)
Capturing cross-border logistics for analysis and improvement	Bandaranayake <i>et al.</i> (2022)
Modelling the drivers of responsiveness of automotive supply chain using an integrated fuzzy DEMATEL-ISM approach	Sathyan <i>et al.</i> (2022)
Can circular healthcare economy be achieved through implementation of sustainable healthcare supply chain practices? Empirical evidence from Indian healthcare sector	Vishwakarma <i>et al.</i> (2022)
Analysis of performance of COVID-19 vaccine supply chain in India	Nagarajan <i>et al.</i> (2022)
Improving the waste to energy supply chain through increased overall equipment effectiveness	Wijesinghe and Illankoon (2022)
Intertwining green SCM- and agile SCM-based decision-making framework for sustainability using GIVTFNs	Sahu <i>et al.</i> (2022)
The effect of supplier sustainability risk management strategies on supply chain performance	Silva <i>et al.</i> (2023)
Planning of a distribution network utilizing a heterogeneous fixed fleet with a balanced workload	Hettiarachchi <i>et al.</i> (2023)
Identifying the key influencing factors for the growth of air cargo demand	Karunathilake and Fernando (2023)
Artificial intelligence an enabler for sustainable engineering decision making in uncertain environment: a review and future propositions	Wankhede <i>et al.</i> (2023)
Achieving sustainability through multifaceted green functions in manufacturing	Rashid <i>et al.</i> (2024a, 2024b)
Role of information processing and digital supply chain in supply chain resilience through supply chain risk management	Rashid <i>et al.</i> (2024a, 2024b)

Table 1.
Accepted
manuscripts and
author

Sathyan *et al.* (2022) identified seventeen drivers for enhancing supply chain responsiveness and among them, the critical drivers are strategic decision-making, demand forecasting accuracy, advanced manufacturing systems and data integration tools. This integrated methodology will benefit the supply chain practitioners and automotive manufacturers to develop management strategies to improve responsiveness. Nagarajan *et al.* (2022) delved into the structure of the Indian vaccine supply chain during the Covid-19 pandemic. Through quartile and cluster analyses of secondary data, it was revealed that distinct responses among states during the pandemic waves, attributed to demographic variations and administrative efficiency affecting supply chain characteristics. The findings underscore the need for improved supply chain and last-mile delivery in large-scale vaccination efforts, offering vital insights for government and state-level initiatives.

Wijesinghe and Illankoon (2022) aimed to enhance the overall equipment effectiveness (OEE) of ABC Company's shredder operation, which supplies pre-processed industrial waste to a cement plant. Through a case study approach, the research identified availability and performance losses affecting the shredder system's OEE, using root cause analysis and Pareto analysis to pinpoint underlying issues. Three major loss factors were identified, and practical solutions were proposed to mitigate their effects, ultimately improving the machine's OEE and productivity. This OEE and productivity will have a direct impact on their supply chain engineering.

Sahu *et al.* (2022) developed a decision-support framework for identifying dominating measures in SCM. The degree of similarity approach and distance approach under the extent boundaries of GIVTFNs, are implicated in data analytics. The best performance score is identified by the "sustainable packaging" under the traits of GSCM. "Reutilization (recycling) and reprocessing" under GSCM in manufacturing and "Responsiveness and speed toward customers' needs" under ASCM are found difficult to attain. Silva *et al.* (2023) evaluated the adoption of four types of supplier sustainability risk management (SSRM) strategies, namely, risk avoidance (RA), risk acceptance (RAC), collaboration-based risk mitigation (CBM) and monitoring-based risk mitigation (MBM) in Sri Lankan apparel and retail industries, and to investigate their effect on SCP. Sri Lankan apparel and retail firms adopt RA and MBM strategies relatively more than CBM and RAC strategies, whereas there is no significant difference between the two industries in terms of the use of SSRM strategies.

Hettiarachchi *et al.* (2023) compared the performance of generic algorithms using a paired *t*-test, and results indicate that the GA outperforms in solution quality. Further scenarios are tested to explore alternative fleet compositions, with analysis conducted using ANOVA and Hsu's MCB methods, revealing that removing trucks with the lowest capacities improves average vehicle utilization and reduces travel distance. The adoption of metaheuristics, statistical analysis and scenario analysis offers significant methodological contributions to solving NP-hard distribution problems in supply chain engineering.

Karunathilake and Fernando (2023) pinpointed the factors influencing both passenger and cargo demand-driven networks, aiming to streamline the global supply chain. Using the analytical hierarchy process and regression analysis, a model was crafted using chosen variables to predict air cargo demand growth. Airport capacities and facilities are predominantly impacted by the air cargo transported by combi carriers. The model took into account variables such as the air connectivity index and air cargo demand at the destination.

Wankhede *et al.* (2023) analysed the current research trends to see the research collaboration between researchers and countries concerning the circular supply chain. Emerging research areas were identified by using structural topic modelling (STM). Rashid *et al.* (2024a, 2024b) findings illustrated that green supply chain practices positively

influence all used variables and provided a practical insight to practitioners to implement green practices in their supply chain networks for social, economic and environmental sustainability and compliance with SDG-12 and SDG-13. [Rashid et al. \(2024a, 2024b\)](#) also found that information processing capability and digital SC significantly and positively affect SC risk management and resilience. Also, supply chain risk management positively mediates the relationship between information processing capability and digital SC.

Thus, this special issue provides some valuable wisdom for supply chain researchers, practitioners and students by offering a narrow perspective of supply chain engineering, supply chain resilience and the importance of mathematical models in developing a resilient supply chain.

Concluding remarks

This special issue contributes to the sustainable supply chain literature by compiling a collection of interesting studies that describe the emerging trends in SCE towards global sustainability. Achieving resilience in supply chain management requires a multifaceted approach encompassing responsiveness, readiness, flexibility and adaptability. Furthermore, commitment and effective communication play pivotal roles in enhancing resilience capabilities, highlighting the importance of organizational culture and collaboration. Strategic decision-making, accurate demand forecasting, advanced manufacturing systems and data integration tools are identified as critical drivers by [Sathyan et al. \(2022\)](#), underlining the significance of proactive planning and technological integration.

Moreover, sustainability emerges as a fundamental aspect of supply chain resilience, with GSCM practices playing a crucial role. Sustainable packaging, in particular, is highlighted as a high-performing trait within GSCM, demonstrating the potential for environmentally conscious practices to enhance overall resilience. Integration of digital technologies into the supply chain is identified as another key factor in enhancing resilience, as it improves risk management and facilitates sustainability initiatives. Additionally, the impact of demographic variations and administrative efficiency during crises such as the COVID-19 pandemic underscores the need for adaptable and agile supply chain strategies. To address emerging challenges and optimize supply chain management, innovative analytical techniques such as STM and mathematical modelling are increasingly used. In essence, the convergence of responsiveness, sustainability, digital integration and operational efficiency forms the cornerstone of resilient supply chain management, enabling organizations to navigate uncertainties and disruptions while fostering long-term sustainability and competitiveness.

Jayakrishna Kandasamy

*School of Mechanical Engineering, Vellore Institute of Science and Technology,
Vellore, India*

Fazleena Badurdeen

*Department of Mechanical Engineering, University of Kentucky,
Lexington, Kentucky, USA, and*

Tharanga Rajapakshe

*Information Systems and Operations Management, Warrington College of Business,
University of Florida, Gainesville, Florida, USA*

References

- Bandaranayake, N., Kiridena, S. and Kulatunga, A.K. (2022), "Capturing cross-border logistics for analysis and improvement", *Journal of Global Operations and Strategic Sourcing*, Vol. ahead-of-print No. ahead-of-print, doi: [10.1108/JGOSS-05-2022-0037](https://doi.org/10.1108/JGOSS-05-2022-0037).
- Echefaj, K., Charkaoui, A., Cherrafi, A., Kumar, A. and Luthra, S. (2022), "Application of AHP and G-TOPSIS for prioritizing capabilities and related practices for a mature and resilient supply chain during disruption", *Journal of Global Operations and Strategic Sourcing*, doi: [10.1108/JGOSS-05-2022-0040](https://doi.org/10.1108/JGOSS-05-2022-0040).
- El Baz, J. and Ruel, S. (2020), "Can supply chain risk management practices mitigate the disruption impacts on supply chains' resilience and robustness? Evidence from an empirical survey in a COVID-19 outbreak era", *International Journal of Production Economics*, Vol. 233 No. 2021, p. 107972, doi: [10.1016/j.ijpe.2020.107972](https://doi.org/10.1016/j.ijpe.2020.107972).
- Goetschalckx, M. (2011), "Supply chain engineering", *International Series in Operations and Management Research*, Vol. 161, ISBN: 978-1-4419-6511-0.
- Hettiarachchi, P., Dharmapriya, S. and Kulatunga, A.K. (2023), "Planning of a distribution network utilizing a heterogeneous fixed fleet with a balanced workload", *Journal of Global Operations and Strategic Sourcing*, Vol. ahead-of-print No. ahead-of-print, doi: [10.1108/JGOSS-05-2022-0045](https://doi.org/10.1108/JGOSS-05-2022-0045).
- Ivanov and Dolgui (2020), "Exploring supply chain structural dynamics: new disruptive technologies and disruption risks", *International Journal of Production Economics*, Vol. 229 No. 2020, p. 107886, doi: [10.1016/j.ijpe.2020.107886](https://doi.org/10.1016/j.ijpe.2020.107886).
- Jayakrishna, K., Simon Peter, N., Anil Kumar Vimal, K.E.K., Hrishikesh Bedekar, N. and Nikhilkumar Himatlal, S. (2022), "Economic and environmental feasibility of re-routing the indo-Sri Lankan shipping channel: a green initiative of sustainable development sustainable", *Sustainable Development*, Vol. 30 No. 4, pp. 726-750, doi: [10.1002/sd.2269](https://doi.org/10.1002/sd.2269).
- Karunathilake, A.N. and Fernando, A. (2023), "Identifying the key influencing factors for the growth of air cargo demand", *Journal of Global Operations and Strategic Sourcing*, Vol. ahead-of-print No. ahead-of-print, doi: [10.1108/JGOSS-06-2022-0072](https://doi.org/10.1108/JGOSS-06-2022-0072).
- Manavalan, E. and Jayakrishna, K. (2019a), "An analysis on sustainable supply chain for circular economy", *Procedia Manufacturing*, Vol. 33 No. 2019, pp. 477-484, doi: [10.1016/j.promfg.2019.04.059](https://doi.org/10.1016/j.promfg.2019.04.059).
- Manavalan, E. and Jayakrishna, K. (2019b), "A review of internet of things (IoT) embedded sustainable supply chain for industry 4.0 requirements", *Computers and Industrial Engineering*, Vol. 127, pp. 925-953, doi: [10.1016/j.cie.2018.11.030](https://doi.org/10.1016/j.cie.2018.11.030).
- Nagarajan, C., Indira, A. and Ramasubramaniam, M. (2022), "Analysis of performance of covid-19 vaccine supply chain in India", *Journal of Global Operations and Strategic Sourcing*, Vol. ahead-of-print No. ahead-of-print, doi: [10.1108/JGOSS-08-2022-0096](https://doi.org/10.1108/JGOSS-08-2022-0096).
- Rashid, A., Rasheed, R. and Ngah, A.H. (2024a), "Achieving sustainability through multifaceted green functions in manufacturing", *Journal of Global Operations and Strategic Sourcing*, doi: [10.1108/JGOSS-06-2023-0054](https://doi.org/10.1108/JGOSS-06-2023-0054).
- Rashid, A., Rasheed, R., Ngah, A.H., Pradeepa Jayaratne, M.D.R., Rahi, S. and Tunio, M.N. (2024b), "Role of information processing and digital supply chain in supply chain resilience through supply chain risk management", *Journal of Global Operations and Strategic Sourcing*, Vol. ahead-of-print No. ahead-of-print, doi: [10.1108/JGOSS-12-2023-0106](https://doi.org/10.1108/JGOSS-12-2023-0106).
- Sahu, A.K., Kottala, S.Y., Narang, H.K. and Rajput, M.S. (2022), "Intertwining green SCM- and agile SCM-based decision-making framework for sustainability using GIVTFNs", *Journal of Global Operations and Strategic Sourcing*, doi: [10.1108/JGOSS-06-2022-0060](https://doi.org/10.1108/JGOSS-06-2022-0060).
- Sathyan, R., Palanisamy, P., G, S. and M, N. (2022), "Modelling the drivers of responsiveness of automotive supply chain using an integrated fuzzy DEMATEL-ISM approach", *Journal of Global Operations and Strategic Sourcing*, doi: [10.1108/JGOSS-05-2022-0039](https://doi.org/10.1108/JGOSS-05-2022-0039).

- Silva, C.W.C., Rathnayaka, D.D. and Fernando, M. (2023), "The effect of supplier sustainability risk management strategies on supply chain performance", *Journal of Global Operations and Strategic Sourcing*, Vol. ahead-of-print No. ahead-of-print, doi: [10.1108/JGOSS-06-2022-0076](https://doi.org/10.1108/JGOSS-06-2022-0076).
- Vinodh, S. and Jayakrishna, K. (2012), "Assessment of product sustainability and the associated risk/benefits for an automotive organisation", *The International Journal of Advanced Manufacturing Technology*, Vol. 66 Nos 5/8, pp. 733-740, doi: [10.1007/s00170-012-4361-3](https://doi.org/10.1007/s00170-012-4361-3).
- Vishwakarma, A., Dangayach, G.S., Meena, M.L., Gupta, S., Joshi, D. and Jagtap, S. (2022), "Can circular healthcare economy be achieved through implementation of sustainable healthcare supply chain practices? Empirical evidence from Indian healthcare sector", *Journal of Global Operations and Strategic Sourcing*, doi: [10.1108/JGOSS-07-2022-0084](https://doi.org/10.1108/JGOSS-07-2022-0084).
- Wankhede, V.A., Agrawal, R., Kumar, A., Luthra, S., Pamucar, D. and Stević, Ž. (2023), "Artificial intelligence an enabler for sustainable engineering decision-making in uncertain environment: a review and future propositions", *Journal of Global Operations and Strategic Sourcing*, Vol. ahead-of-print No. ahead-of-print, doi: [10.1108/JGOSS-06-2022-0057](https://doi.org/10.1108/JGOSS-06-2022-0057).
- Wijesinghe, P.B. and Illankoon, P. (2022), "Improving the waste to energy supply chain through increased overall equipment effectiveness", *Journal of Global Operations and Strategic Sourcing*, Vol. ahead-of-print No. ahead-of-print, doi: [10.1108/JGOSS-06-2022-0068](https://doi.org/10.1108/JGOSS-06-2022-0068).

About the Guest Editors

Dr Jayakrishna Kandasamy is a Professor in the School of Mechanical Engineering at the Vellore Institute of Technology University, India. Dr Jayakrishna's research is focused on the design and management of manufacturing systems and supply chains to enhance efficiency, productivity and sustainability performance. More recent research is in the area of developing tools and techniques to enable value creation through sustainable manufacturing, including methods to facilitate more sustainable product design for closed-loop material flow in industrial symbiotic setup, and developing sustainable products using hybrid bio composites. He has mentored doctoral students, graduate and undergraduate students (3 PhD, 3 MTech Thesis and 36 BTech thesis) which have so far led to 95 journal publications in leading SCI/SCOPUS Indexed journals, 42 book chapters and 92 refereed conference proceedings, 4 authored books, 12 edited books in CRC/Springer Series. Dr Jayakrishna's team has received numerous awards in recognition for the quality of the work that has been produced. He teaches undergraduate and graduate courses in the manufacturing and industrial systems area and his initiatives to improve teaching effectiveness have been recognized through national awards. Notably, he is ranked among the top 2% most influential researchers globally in the prestigious 2023 Stanford University World Ranking. He has also been awarded *Global Engineering Education Award* from the Industrial Engineering and Operations Management (IEOM) Society International, USA in 2021, *Institution of Engineers (India)-Young Engineer Award* in 2019 and *Distinguished Researcher Award* in the field of Sustainable Systems Engineering in 2019 by International Institute of Organized Research, *Best Faculty Researcher Award* for the year(s) 2016–2021 consecutively. *Coordinator* – Circular Economy Club, VIT University, Academic Editor – *Mathematical Problems in Engineering*, Wiley-Hindawi Publications and Editorial Board Member – *Journal of Operational Research for Engineering Management Studies (JOREMS)*, *Green and Low-Carbon Economy*, Area Editor – *Operations Management Research*, Associate Editor – *Circular Economy*, *Frontiers in Sustainability*, Book Series Editor – *Industrial Engineering*, Systems and Management, CRC Press. Jayakrishna Kandasamy is the corresponding author and can be contacted at: mail2jaikrish@gmail.com

Fazleena Badurdeen is an Earl Parker Robinson Chair Professor in Mechanical Engineering, Director of Graduate Studies for Manufacturing Systems Engineering at the University of Kentucky and also serves as the Director of Graduate Studies for the Manufacturing Systems Engineering MS Program. Dr Badurdeen's research is focused on the design and management of manufacturing systems and supply chains to enhance efficiency, productivity and sustainability performance. More recent research is in the area of developing tools and techniques to enable value creation through

sustainable manufacturing, including methods to facilitate more sustainable product design for closed-loop material flow. Her research has been supported by more than \$10.7m in external funding as PI or Co-PI from NSF, AFRL, NIST, DOE, US Army and DMDII as well as from industry. She has mentored undergraduate and graduate students (4 PhD, 17 MS Thesis and 8 MS non-thesis), which have so far led to 35 journal publications, 13 book chapters and 80 refereed conference proceedings. Dr Badurdeen's team has received numerous awards in recognition for the quality of the work that has been produced. She teaches undergraduate and graduate courses in the manufacturing systems area and her initiatives to improve teaching effectiveness have been recognized through national awards.

Tharanga Rajapakshe is an associate professor of Information Systems and Operations Management at the Warrington College of Business, University of Florida. She holds a PhD in management science, a Master of Science in Supply Chain Management and a Master of Business Administration, from Naveen Jindal School of Management, University of Texas at Dallas. She obtained her Bachelor's degree in Production Engineering from the University of Peradeniya, Sri Lanka. Tharanga's research interests are twofold, Socially Responsible Operations Management and Production/Service Operations Management. Her work in Socially Responsible Operations Management, investigates the impact of government policies and influence of other social organizations on firms' operational decisions. Her work in Production/Service Operations Management analyses challenging real-world operation management problems and provide optimal or near-optimal solution methodologies. She has published her work in flagship journals such as Operations Research and Production and Operations Management. She has taught both bachelor and master-level courses including Operations Management, Managerial Quantitative Analysis, Project Management and Principles of Logistics/Transportation Systems. She also serves as an editorial review board member of *Production and Operations Management Journal* and *International Journal of Integrated Supply Management*.