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EDITORIAL

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Special issue: Advancing supply chain resilience for excellence in the post-pandemic era

The COVID-19 pandemic has brought unprecedented severe challenges to global supply chains and has triggered discussion about supply chain resilience (SCR). In the post-pandemic era, although residents' consumption has rebounded under the stimulation of the government's financial policies and the disruption of the supply chain has been alleviated, firms still face great challenges of restarting their supply chains. On the one hand, the global supply chain is still fragile. The outbreak of the epidemic may continue, and the risk of supply chain disruption cannot be ignored. On the other hand, the manufacturer's production cost is further increased due to the substantial increase in international raw material prices, labor costs and transportation costs, and the production cycle is further prolonged. Therefore, SCR in the post-epidemic era is subject to multiple challenges from the external environment, as well as both supply and demand sides. As observed in practice, many firms turned out to have poor performances on achieving SCR. Some even hardly displayed any capabilities in coping with this crisis. In such circumstances, properly designing, building, and managing resilient supply chains is imperative to cope with unexpected exogenous shocks.

SCR has been described in the literature as "the intrinsic ability of a system to adjust its functioning prior to, during, or following changes and disturbances, so that it can sustain required operations under both expected and unexpected conditions". During the post COVID-19 pandemic era, many firms who have launched various initiatives to improve resilience show good capacities to cope with the crisis. Several case studies indicate that resource deployment and reconfiguration, supply chain reengineering, decision-making mechanisms, and global network structures designing all contribute to the process of building resilience. In practice, some logistics service providers have exploited new digital technologies (DTs) to building more trusted distributed networks to cope with the uncertainties of delivery performance; digitization can help automate key parts of the supply chain, reducing their reliance on people, and many global firms have designed wider outsourcing networks to cope with the supply chain disruptions and uncertainty in demands. Moreover, blockchain technology can improve trust among supply chain members and promote open collaborations among enterprises on issues such as inventory planning, prediction and replenishment, so as to optimize resource allocation, reduce resource waste and improve SCR. However, most firms still lack understanding of the role of DTs, model innovation, and supply process reengineering in achieving SCR. To this end, we call for new and original engineering management research to support

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decision-making related to SCR with inherent uncertainty about the present and future.

Focusing on the theme of “Advancing supply chain resilience for excellence in the post-pandemic era”, this special issue in *Frontiers of Engineering Management* has collected 11 papers with an aim to construct/advance SCR in the post-pandemic era by employing innovative DTs and methods.

Li et al. explore how digitalization helps build SCR and robustness. Adopting organizational information processing theory, the authors examine the mediating effect of supply chain collaboration and the moderating effect of formal contracts. Using survey data of Chinese manufacturing firms, the authors apply structural equation modeling to test the research model. The results show that digitalization has a direct effect on SCR, and supply chain collaboration can directly facilitate both resilience and robustness.

Li, Feng and Xu propose a blockchain-enabled floating billing management system as an overall solution for cloud warehousing service (CWS) providers to enhance the security, credibility, and transparency of CWS. A one-sided Vickrey–Clarke–Groves (O-VCG) auction mechanism model is designed as the underlying floating billing mechanism to reflect the real-time market value of fine-grained CWS resources. A blockchain-based floating billing prototype system is built as an experimental environment. The results show that the O-VCG mechanism can effectively reflect the real-time market value of CWSs and increase the revenue of CWS providers.

For the relationship between DTs and SCR, **Ning et al.** draw on information processing theory to develop a serial mediation model. The authors analyze a sample set consisting of 264 Chinese manufacturers. The empirical results reveal that digital supply chain platforms (DSCPs), as well as supply chain traceability (SCT) and supply chain agility (SCA), fully mediate the favorable association between DTs and SCR.

Shi et al. examine the strategic options of two competing maritime supply chains consisting of ports and inland logistics providers. The authors investigate the impact of cooperation between ports and inland logistics providers and government regulation on the maritime supply chain by comparing members’ optimal pricing and overall social welfare under centralized, decentralized, and hybrid scenarios. The results indicate that the hybrid scenario is an equilibrium strategy for maritime supply chain, although this strategy is not optimal for governments seeking to improve SCR and maximize social welfare.

To address the logistics networks post-disruption response strategy optimization problem, **Zhuang et al.** propose a novel two-stage stochastic programming model with robust delivery time constraints. The proposed model jointly optimizes the new-line-opening and rerouting decisions in the face of uncertain transport demands and transportation times. To enhance the robustness of the response strategy obtained, the conditional value at risk (CVaR) criterion is utilized to reduce the operational risk, and robust constraints based on the scenario-based uncertainty sets are proposed to guarantee the delivery time requirement. An equivalent tractable mixed-integer linear programming reformulation is further derived by linearizing the CVaR objective function and dualizing the infinite number of robust constraints into finite ones.

Chen et al. combine a literature review with semi-structured interviews to investigate the characteristics of pharmaceutical supply chain (PSC), the key aspects affecting PSC, and the challenges faced by PSC in the post-pandemic era. An Internet of Things (IoT)–blockchain-integrated hospital-side oriented PSC management model is also developed. The authors highlight how IoT and blockchain technology can enhance SCR and provide a reference on how PSC members can cope with the associated risks.

To overcome the impact of insufficient raw material supply on the supply chain in mass disruption scenarios, **Zhang et al.** propose a novel resilient supply chain system (RSCS) considering product design changes (PDC). An RSCS domain model is first developed from the perspective of PDC based on a general conceptual framework. Furthermore, a case study is conducted to demonstrate the PDC strategy and to validate the feasibility and effectiveness of the RSCS domain model. The results show that the restructured RSCS based on the proposed strategy and model can remedy the huge losses caused by the unavailability of raw materials.

Shi, Chen and Lai develop a game-theoretic model to investigate the interrelation between the retailer’s decisions on blockchain adoption and sourcing strategies. The authors consider that a retailer originally orders from a risky supplier while conducting an imperfect inspection to detect infected products before selling. The retailer may speculatively keep on ordering from the risky supplier or adopt contingent sourcing by ordering from an alternative safe supplier. The retailer also has an option to implement blockchain to improve the inspection accuracy and product traceability. The authors derive the optimal retail prices under different sourcing strategies with and without blockchain adoption and then analyze the incentives for sourcing strategy and blockchain adoption.

Liu et al. aim to facilitate the adoption of blockchain technology in a supply chain consisting of a core enterprise and a small/medium-sized enterprise through an effective supply chain contract. The authors analyze the performance of a cost-sharing (CS) contract and a revenue-sharing (RS) contract and propose a new hybrid CS-RS contract for better performance. The results reveal that the hybrid CS-RS contract can more effectively incentivize both parties to reach the highest level of blockchain technology adoption and achieve supply chain coordination.

Liu, Xi and Wang set the cost constraint as a variable quantity, using resilience efficiency and customer satisfaction as indicators, to determine the changing laws of optimal resilience strategies when cost constraints change. These rules can be applied to enterprises with different budgeted costs. The results suggest that companies should prioritize sacrificing resilience measures (RMs) related to adaptive capacity when budget costs gradually decline, and RMs related to absorptive capacity are indispensable at all budget levels.

To explore omnichannel retailing operations in response to supply disruption in the post-pandemic era, **He et al.** investigate whether the adoption of omnichannel fulfillment options (i.e., ship-from-store and ship-to-store options) can mitigate the risk of supply disruption in a supply chain where a retailer orders products from a reliable supplier and a risky supplier. The results show that, under the omnichannel retailing strategy, the retailer's order quantity from the risky supplier may increase or decrease while that from the reliable supplier may increase. Moreover, the entire supply chain benefits from the omnichannel retailing strategy even if it faces a high level of disruption risk.

Finally, we would like to express our sincere gratitude to the contributing authors who generously share their insights and views. We are also grateful to the reviewers, the journal editors and the publisher for their help in facilitating the review and editorial process of this special issue.

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