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Guest editorial: Value chain collaboration for complicated product innovation and manufacturing excellence by industrial data-driven modeling and optimization

With the rapid advancements in Industry 4.0, manufacturing and innovation processes are experiencing unprecedented transformation. As companies navigate increasingly complex product development and production cycles (Dou *et al*., 2024), collaboration along the value chain has become essential. This collaboration not only enhances operational efficiency but also drives product innovation. Leveraging new technologies, industries can achieve greater precision, customization and adaptability, enabling them to respond swiftly to market demands and technological shifts.

This special issue aims to address key research challenges in implementing value chain collaboration in the context of complex product innovation and manufacturing excellence. By exploring how emerging technologies such as generative AI (Feuerriegel *et al*., 2024), synthetic data (Joshi *et al*., 2024) and machine learning algorithms (Lin and Jamrus, 2024) can optimize both design and production processes, the study offers practical solutions for overcoming barriers to innovation. Through real-world case studies and simulations, we illustrate the impact of industrial data-driven approaches on product lifecycle management (Xie *et al*., 2024), cost reduction (Chien *et al*., 2024) and performance enhancement (Feng *et al*., 2024) across various sectors. In particular, the paper in this special issue is divided into three interrelated categories to address the theme of value chain collaboration for product innovation and manufacturing excellence through industrial data-driven modeling and optimization from different perspectives. The categories include manufacturing and scheduling optimization, data-driven decision-making and fault diagnosis and supply chain and logistics optimization.

The first category focuses on manufacturing and scheduling optimization. This category explores the role of advanced optimization models in enhancing production efficiency and resource allocation. Papers present innovative solutions for optimizing production scheduling, such as the integration of dynamic scheduling frameworks to improve overall process efficiency. The paper by Yuan *et al.* (2024), in their paper Corrected Aggregate Workload approach on order release by considering job's routing position induced variable indirect load, propose an innovative method for order release optimization. Another notable contribution in this category is the work by Xie *et al.* (2024), Simultaneous product platform design and scheduling on unrelated additive/subtractive hybrid machines, which integrates product platform design with scheduling on hybrid machines. Additionally, Ku *et al.*'s (2024) work, titled UNISON Framework for Water Conservation in Dynamic Scheduling of Textile Dyeing Process and an Empirical Study, explores water conservation strategies in textile dyeing through dynamic scheduling.

The second category emphasizes data-driven decision-making and fault diagnosis. In this category, the focus shifts to leveraging industrial data for decision-making. This is crucial for ensuring uninterrupted production to operational excellence. The studies highlight the

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importance of using data-driven methodologies to predict, diagnose and mitigate faults in real time, improving the reliability and sustainability of manufacturing systems. Feng *et al.* (2024) examine the optimal integration decisions in two-sided networks for third-party components in their paper titled Optimal integration decision of industrial internet platform for third-party components in two-sided networks. Lin *et al.* (2024), in their study Industrial data-driven modeling for imbalanced fault diagnosis, focus on industrial data modeling to address challenges in fault diagnosis for imbalanced datasets.

The third category examines supply chain and logistics optimization. This category examines the integration of data analytics and optimization techniques to streamline supply chain operations, enhance logistics efficiency and mitigate disruption risks. This category's emphasis on optimizing supply chain networks complements the collaboration for product innovation and manufacturing excellence. By optimizing logistics and supply chain management, companies can reduce costs, improve delivery times and enhance their overall competitive edge in global markets. The paper by Zhang *et al.* (2024), titled A cold chain logistics distribution optimization model: Beijing-Tianjin-Hebei region low-carbon site selection, proposes an optimization model for cold chain logistics in the Beijing-Tianjin-Hebei region. Lastly, Hou *et al.* (2024), in their work Dynamic pricing strategy for content products considering consumer fairness concerns and strategic behavior, investigate pricing strategies for content products by incorporating consumer fairness and strategic behavior.

In conclusion, this collection of studies serves as a valuable resource for both academic researchers and industry practitioners in Industry 5.0, offering insights into the practical applications of industrial data-driven models as well as the artificial intelligence transformation model (Fan *et al.*, 2024), providing studies on optimizing production workflows and smart production in green production (Lin, 2018), mitigating risks in supply chain operations (Dou *et al.*, 2024) and implementing strategies for reliability. These findings pave the way for future innovations that will further transform product development and manufacturing processes, ultimately fostering collaboration and enhancing the overall performance of the value chain. Moreover, the methodologies and insights presented in this special issue can be expanded to other industries, such as healthcare, where data-driven modeling and optimization are essential for improving operational efficiency, innovation and collaboration across complex value chains. The approaches outlined here provide a foundation for addressing challenges in various sectors that rely on precise, optimized processes and robust decision-making frameworks.

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