Guest editorial: Digital transformation in supply chains: challenges, strategies and implementations

Digital transformation (DT) is topical for supply chain researchers and practitioners (Choi *et al.*, 2018). The primary objective of DT is to create new products and services that help to enhance business efficiency (Saénz *et al.*, 2022). DT is "a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies" (Vial, 2019, p. 118). The term "entity" may refer to an organization, a system, or a supply chain. DT aims to improve an entity's operational performance by impacting its products, business processes, sales channels and supply chains (Matt *et al.*, 2015).

For instance, IBM, SAP, Oracle and Microsoft have developed software applications in analytics, demand planning, warehouse, inventory management, transportation, and distribution operations and a few retailers like Walmart and Carrefour trace the flow of food from farmers to retailers using blockchain technology (Stanley, 2018; Dimitrov, 2019). The application of Industry 4.0 technologies for rebuilding and reconfiguring global supply chains cannot be ignored. Extant recent literature on digital transformation, including big data analytics, artificial intelligence, blockchain technologies and the internet of things (IoTs), advancing knowledge around the application of Industry 4.0 technologies and digital transformation in the supply chain domain (Hartley and Sawaya, 2019; Wamba and Queiroz, 2020; Pournader *et al.*, 2019).

The literature has discussed aspirational goals or potential benefits of digital transformation (projects) in supply chains. For example, DT aims to facilitate seamless supply chain collaboration to reduce cost and improve performance (Stank *et al.*, 2019). Aided by big data, DT may help develop solutions that perform real-time supply chain management and provide proactive, customized data-based solutions (Handfield *et al.*, 2019). An experiment to determine whether high-resolution item-level visibility of products inside a retail store can be achieved by using RFID through information and communication (Morenza-Cinos *et al.*, 2019). Higher supply chain quality management through reducing mass manufacturing variability can arguably be achieved using 3D printing (Sasson and Johnson, 2016). Supply chain agility could be improved by applying rapid prototyping and tooling (Dwivedi *et al.*, 2017) and additive manufacturing that directly integrates customers and manufacturers in decentralized, local manufacturing (Durach *et al.*, 2017). It is easier to find statements about the potential benefits of all these new technologies than to find efforts to conceptualize and theorize different mechanisms to realize such advantages.

Research of DT of supply chains is nascent in many aspects. There are questions about the definition and understanding of DT strategies; characteristics of DT; characteristics and maturity of different DT technologies, relationships between various entities, capabilities, uncertainty and risks when implementing DT initiatives; addressing reluctance to change; and the mechanisms used to achieve sustainability, competitiveness, performance and create value when implementing DT. Despite extensive research in the recent past, digital transformation studies in supply chains lack diversity, theoretical applications and explanations that can fully answer the above questions.

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This special issue recognizes supply chain digital transformation journey is neither easy nor without challenges. The possibility of full supply chain integration using digital technologies is still at a distance (Preindl *et al.*, 2020). DT failure risk is regarded as the first concern for practitioners, as 70 percent of all DT initiatives do not reach their goals (Tabrizi *et al.*, 2019). Why DT initiatives fail is not clear. It could be because of the technologies, the people, or the transformation processes. If people and digital technologies do not integrate well, DT can magnify the flaws of the disconnection (Tabrizi *et al.*, 2019). The pandemic's disruptive influences on global supply chains require organizations to capitalize on digital technologies and real-time visibility across the supply chain to respond quickly to market uncertainty. It is more important to understand the managers' perspectives and how they address different challenges, strategies and implementation issues.

This special issue focuses on exploring and understanding at least three main challenges facing logistics and supply chain managers when considering or implementing DT in supply chains. The first challenge is determining whether DT in supply chains is the right option (i.e. to be digital). DT is not about technology; it should be guided by a broader strategy and a mindset of change (Tabrizi *et al.*, 2019). This is related to applying the right strategy to match DT, focal firms and supply chain actors (such as multi-tier suppliers and customers) based on different approaches at different development stages. This means identifying which supply chain capabilities are required and which DT technologies and existing technologies can be combined to build new capabilities and making a choice and appropriate use of the right DT technologies for each type of supply chain. Another issue is whether all DT technologies are readily purchased and adopted. Some are not. Some are still in their early technology readiness stage. This raises whether DT is about technology acceptance, adoption, diffusion, or innovation. This requires identifying which DT technologies require further development and whether it is better to be the pioneer developer or wait until other supply chain members prove or develop the technologies.

The second challenge is determining which solution/technology providers, research institutions, suppliers, customers and other channels are valuable sources of new knowledge about DT technologies. How can managers access these knowledge sources and learn from them? How can managers manage the relationships between the DT designers or solution/technology providers and the users before, during, and after DT in supply chains? The strategies and related problems of DT in supply chains are unique for the focal firm and its supply chains. However, DT designers, developers and solution providers are often experts biased toward technology rather than in aspects of functional domain expertise like supply chain management (Trkman, 2013). Therefore, it is critical to consider how the two parties can be efficiently and effectively involved earlier and integration and collaboration improved dramatically.

The third challenge is related to the implementation processes and the performance measurement of DT in supply chains. DT is not a simple IT-enabled organizational transformation; DT in supply chains needs to solve difficulties, such as understanding how DT technologies work, integrating new and existing technologies, experimenting and testing different technologies and configurations, alignment of DT with different supply chain members, and with organizational strategic objectives, structures, core values; and structuring and implementing supply chain processes reengineering (Wessel *et al.*, 2021). After the strategies and decisions for DT in supply chains have been made, the next decision is how DT is to be implemented and leveraged to revamp operations and supply chain management (Stank *et al.*, 2019). The Adidas Russia/CIS case study is an excellent example how IT and supply chain issues are addressed simultaneously (Cordon *et al.*, 2017). In a supply chain setting, how transaction cost, uncertainty, power asymmetric and unwillingness to share information should be addressed during a DT project.

To overcome such challenges, this special issue acknowledges the need to research DT in supply chains on the strategy level. For example, we can explore the firm's ability to make

strategic changes to its business model and the impact of such changes on business performance (Galindo-Martín *et al.*, 2019). Meanwhile, as part of the digital transformation strategy, firms develop DT technologies such as big data and predictive analytics to transform logistics and supply chain functions to create new value. While big data business analytics (BDBA) and supply chain analytics are considered strategic assets that must be integrated to achieve strategic benefits (Wang *et al.*, 2016), many organizations still struggle with data integrity and accuracy issues. On the other hand, research must explore the mechanisms used to achieve different potential benefits of integrating digital technologies to transform supply chain management. While studies show blockchain technology is employed to improve traceability and transparency can broadly achieve supply chain social sustainability (Venkatesh *et al.*, 2020), more research is required to distinguish which supply chain members gain which benefits and why. There are claims that artificial intelligence (AI) can mitigate supply chain risk and achieve supply chain resilience under unpredictable situations (Baryannis *et al.*, 2019), but what sort of AI can mitigate unpredictable disruptions?

Based on twelve cases of IT and information providers offering AI-based scouting solutions, Guida *et al.* (2023) study the role of AI in supporting the supplier scouting process. The novel research finds that information processing needs (IPNs) in supplier scouting are high. Meanwhile, IT and information providers can meet the needs of buyers through information processing capabilities (IPCs) enabled by AI-based solutions. In this way, the fit between needs and capabilities can be reached.

Herold *et al.* (2023) comprehensively review the digital procurement transformation (DPT), identify micro foundations (digital sensing, seizing and reconfiguring capabilities) required for DPT and performance outcomes, and highlight the investment in advanced digital technologies. Chief Procurement Officers (CPOs) must assess the organizational capabilities resulting in the digital transformation of procurement functions to achieve expected performance outcomes.

The study by Lang *et al.* (2023) primarily examines the perspective of digital transformation in Small- and Medium-sized enterprises (SMEs) based on human capital and structural social capital. SMEs should consider DT strategies to improve the firm's performance. Entrepreneurial competence and SME innovativeness are crucial in technology adoption processes facilitating DT and driving business growth.

Further, Zhou *et al.* (2023) provide another angle to examine the DT from third-party logistics (3PL). The authors confirm that digitalization transformation and logistics digitalization positively influence 3PL's financial and service performance by improving customer collaboration. Government support improves the positive effect of customer collaboration on service performance rather than financial performance. 3PL firms need to improve the digitalization level and strengthen the overall capability of information processing. The DT helps 3PL firms create the business potential for customer collaboration, leading to enhance financial and service performance.

The work of Opazo-Basáez *et al.* (2023) focuses on smart manufacturing (SM) as a critical enabler in improving manufacturing competitiveness. The authors collect 351 Spanish manufacturing firms in an SM context. The SM implementation is positively related to operational and customer-focused performance. However, the geography of production is not demonstrated to influence customer performance resulting from SM implementation.

Further, Fang *et al.* (2023) conceptualize the DT strategy in a supply chain context and identify the key drivers from intra–and inter–organizational perspectives. The authors collected 200 manufacturing firms in China and found that supply chain connectivity positively affects DT adoption and routinization. Data analytics capability and organizational learning positively influence DT adoption, not routinization. DT strategy is strategic decision-making, which should not have a one-size-fits-all solution. Launching a detailed and structured plan helps to provide tailored operations. Data analytics capability,

organizational learning and supply chain connectivity are critical drivers for DT adoption. Firms need to engage the DT strategy and develop reliable information systems to build close relationships with suppliers and customers.

Finally, Ronchini *et al.* (2023) discuss the ten case studies investigating additive manufacturing (AM) adoption by Original Equipment Manufacturers (OEMs) in five industries. Make, buy, make and buy, and vertical integration as four patterns of AM adoption influence upstream supply chain design. AM technology is adopted with a centralized supply chain configuration.

In summary, this special issue presents studies from literature review to practical implementation across different regions, revealing the key drivers for DT adoptions and practical implications of DT in various industries. It illuminates the future and emerging digital transformation stories in supply chain management.

Yangyan Shi
Macquarie Business School, Macquarie University, Sydney, Australia

V.G. Venkatesh
Metis Lab, EM Normandie Business School, Caen, France

Mani Venkatesh
Department of Strategy and Entrepreneurship, Montpellier Business School, Montpellier, France

Samuel Fosso Wamba
Department of Management, Toulouse Business School, Toulouse, France, and

Bill Wang
College of Business and Public Management, Wenzhou-Kean University, Wenzhou, China

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