

The Digital Supply Chain of the Future: From Drivers to Technologies and Applications

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Abstract

The following paper describes the mini-track on the digital supply chain of the future. After an introduction to the topic, different contributions are addressed and integrated into the overall context. At the end of the text we add some recommendations concerning future research on the digital transformation of companies, business models and supply chains.

1. Introduction

Digitization in general is expected to play an increasingly important role for global supply chains. The digital supply chain of the future will be based on technologies like cyber physical systems, cloud and mobile computing, data analytics, additive computing, blockchain, etc. The list of innovative information and communication technologies is long and still growing. The combination of such technologies implies totally new IT infrastructures which allow the creation of new powerful data-driven supply chain services. In the future, data must be understood as an additional and important value carrier. Descriptive, predictive, and prescriptive data analytics, pattern recognition as well as machine learning and deep learning methods can be used to make supply chains more efficient, flexible and agile. Thus, the new information and communication technologies mentioned above will on the one hand eventually enable supply chains to cope with increasing vulnerability and rapidly changing economic environments; on the other hand they will change the structure of existing supply systems fundamentally. Emerging digital platforms are becoming more important, turning the traditional pipeline into a platform-based network, changing the rules of competition and paving the way for a paradigm shift in supply chain management.

Up to now the scientific literature on the digital supply chain of the future is still limited. Our minitrack tries to contribute to this emerging field of research and provides an outlet for articles focusing on digitization

of supply chains, on corresponding applications and emerging technologies. In the following section we shortly summarize the different contributions of our mini-track on the digital supply chain of the future.

2. Contributions

The first contribution's focus is on drivers for digitalization processes. The authors argue that digital transformation of processes and business models must be understood as an in-principle innovation activity and that it is important to understand the motivation and underlying drivers. A review of the business informatics literature shows that scientific publications with a clear focus on the drivers of digital transformation are still missing. Following this line of thinking, the authors use the grounded theory approach to identify such drivers. During 16 interviews conducted, they identify 12 drivers, some of them internal and some external. Internally, digital transformation is driven by the need to improve processes and workplaces, to integrate information systems vertically inside the company and horizontally with partner organizations, to enhance management support and to reduce costs. From the external perspective, customer demands, supply chain management needs, innovation push, market pressure as well as laws and regulations play a major role. With employee support the authors add another driver which is relevant from the individual perspective of the worker. Generally speaking, the drivers identified do not differ significantly from drivers that have been described for IC technology innovations in the existing literature. In spite of the fact that digital transformation has an in-principle character due to the fusion of different technological innovations, it adds a new quality to the ongoing discussion [1].

While Internet of Things technologies like radio frequency identification (RFID), low power wide area networks (LPWA), wireless sensor networks (WSN), cyber-physical systems (CPS) etc. enable the vertical integration of information and material flows in supply chains, the blockchain technology gains in importance

as far as the horizontal integration of information systems between companies is concerned. Due to the disruptive role of the bitcoin in financial applications, scientists as well as industry representatives actually think about the possibility to adopt the basic concept of the bitcoin technology in the context of supply chain management. The blockchain has to be understood as a further development of the bitcoin technology. In its core, it is a distributed ledger technology characterized by decentralized consensus. The second contribution of our mini-track provides a short introduction to the blockchain technology and describes the state of the art its supply chain applications from both the scientific and the industrial perspective. The results are based on a comprehensive literature analysis as well as on expert interviews. The authors state that the maturity level of the technology is low, that there is a lot of potential but that there are also factors which speak against a disruptive effect of the technology on supply chains. They also propose a research agenda concerning the application of blockchain in logistics and supply chain management [2].

Data analytics is at the core of digitalization. While Internet of Things technologies create data and help to enhance data granularity and data quality, the Internet of Services, blockchain, in memory computing, data lakes etc. contribute to a higher availability of data at the point of use. From a management point of view, scientific literature on the value of data analytics is limited. The third contribution in our mini-track tries to reduce this research gap by analyzing the link between Business Intelligence and Industry 4.0. The authors state that especially the large amounts of data provided by Cyber-Physical Systems and the requirements for real-time analytics is challenging for existing Business Intelligence architectures and systems. They carry out a comprehensive literature analysis to understand value creation of Business Intelligence in the Industry 4.0 context to describe the main research contributions and to identify research gaps. The results of the study show that the largest part of the literature addresses real-time applications as well as the integration of structured and unstructured data. Publications on business model transformation in the digital world, implementation methods for data-driven services as well as guidelines and frameworks for human resource training are still missing [3].

3. Conclusion

The different contributions of our mini-track address several relevant research questions. The answers presented during the conference help to refine the list of research themes we already presented in the call for papers. Following this line of thinking, we would like

to propose the following research topics for next year's conference:

Smart products (Internet of Things) and their impact on supply chains; location based services for suppliers, manufacturers and consumers; innovative tracking and tracing technologies and applications; application of blockchain technology in supply chain management contexts; autonomous transportation technologies (drones, self-driving vehicles etc.); software and IT for the supply chain of the future; smart factories and smart supply processes; analytics of sensor and social media data in manufacturing and logistics; data-driven applications to support the realization of agile supply chains; innovative smart services for the customer based on smart products; mobile solutions for white and blue collar workers along the supply chain; impacts of digitization on decision behavior in industrial companies; effects of product virtualization on supply chain management; business models based on smart object technologies in supply chains; methodologies, models, frameworks for the digital transformation in manufacturing; regulatory, privacy, and security issues with smart products and services; analysis of drivers and barriers for the digital transformation in manufacturing; maturity models for digital transformation in manufacturing and logistics; analysis of digitization strategies in different industries; effects of digitization on cooperation behavior; relationship between corporate culture and digital transformation; impacts of digitization on organizational, structural and process design; technological trends related to Cyber-Physical Systems; complementary innovations for and architectures of smart product based solutions; impacts of digitization on product and service offerings; relationship between digitization and value creation; impacts of digitization on decision-making structures; impacts of smart products/services on consumer behaviors; cross-country analysis of digitization of products and services.

4. References

- [1] K. Liere-Netheler, S. Packmohr, K. Vogelsang, "Drivers of Digital Transformation in Manufacturing", HICSS 2018, Hawaii
- [2] H. Sternberg, G. Baruffaldi, "Chains in Chains – Logic and Challenges of Blockchains in Supply Chains", HICSS 2018, Hawaii
- [3] F.-E. Bordeleau, E. Musconi, L.A. De Santa-Eulalia, "Business Intelligence in Industry 4.0: State of the art and research opportunities", HICSS 2018, Hawaii