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

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Abstract

The following paper provides an overview to the minitrack on the digital supply chain of the future. The mini track addresses research questions concerning drivers and challenges of digital transformation, relevant basic technologies, applications and smart services, digital platforms, cultural and organizational change etc. After a short introduction the different contributions are described and embedded into an overall context. Towards the end of our paper we add some recommendations concerning future research on digitalization of firms, business models and supply chains.

1. Introduction

Supply chains have to cope with increasingly dynamic customer demands and a broad variety of external disturbances. More flexibility and agility, process acceleration and visibility are seen as keys to enhance supply chain responsiveness and resilience. Currently, the Covid19 pandemic puts even more pressure on supply chains in this regard and might even imply alternative paradigms for the future. Additionally, there is still long term efforts towards more sustainability within supply chains. Innovative technological solutions such as the internet of things, cyber-physical systems, autonomous or collaborative robots, automated guided vehicles and drones, cloud and mobile computing, data analytics and machine learning, artificial intelligence, digital cloud platforms and blockchain as well as virtualization of the physical world or digital twins and additive manufacturing can help to master the aforementioned challenges and are increasingly being used in practice. Eventually the implementation of these technologies leads to the fundamental digital transformation of companies, supply chains and industry structures. Data has to be understood as a new source of value creation. From our point of view, the technologies mentioned above in

combination with data-driven services pave the way for a paradigm shift in supply chain management (SCM), leading to more self-organizing and self-optimizing ecosystems. In our minitrack we try to understand how digital transformation effects traditional product-oriented supply chains and the corresponding management activities and thus leads to the digital supply chain of tomorrow. Digitalization in general is expected to play an increasingly important role for global supply chains. The reasons for this include: the shift in values from the physical artefact to the data created by smart products, the emerging importance of digital platforms, services and business ecosystems, the displacement of industry borders, the radical change of competitive structures and power distribution, the transformation of business models and, at the end of the day, the symptomatic creative destruction of established structures and behavioral patterns.

In the next section, the individual presentations of the minitrack are briefly outlined. At the end of this contribution we provide additional recommendations concerning future research topics.

2. Contributions

The first contribution by Freichel et al. deals with digital platforms in supply chains. In view of the increasing dynamic and volatility of markets the authors propose a goal conflict for production processes between efficiency on the one hand side and effectiveness on the other. Digital marketplaces or platforms connecting professional manufacturers with product design companies are discussed as solutions to this conflict in the future. The authors point out that technical implementation concepts for such platforms do exist, but that there is a lack of corresponding and promising business models. The aim of their contribution to our minitrack is to develop and evaluate such a business model, using additive manufacturing as an example [1].

Sustainability plays an increasingly important role in supply chains. Moreover, there is obviously a close

connection between the sustainability of such chains and their digitalization. In the second contribution Peng et al. pursue this line of thinking. They develop an IT-supported tool to measure the maturity level of Sustainable Supply Chain Management activities in companies. Based on extensive literature analysis the authors identify four relevant IT-dimensions and elaborate upon seven capabilities that companies need to master for realizing sustainable supply chains. In a further step, the individual results are merged into a five-step maturity model. The maturity model is evaluated in a first case study. With the help of the maturity model, companies should be enabled to evaluate and develop their own capabilities in future and thus create the conditions for Sustainable Supply Chain Management processes and activities [2].

The third article remains within the domain of sustainability and puts it into the context of food supply chains. Here, digital platforms can help to significantly reduce waste. Products whose appearance, size and weight do not comply with existing standards and which would normally be scrapped, find a new distribution channel via digital platforms and can be merchandized outside of the classic distribution structures for food. Schröder et al. use a multiple case study approach to categorize digital platforms in the food industry and describe their role and position within the food chain. In addition, they identify key dimensions for the description of governance structures and sustainability impact. Finally, they attempt to clarify how digital platforms in food supply chains can successfully reconcile sustainability and profit [3].

Sustainability is also addressed in the fourth article by Batulan et al. The authors see cross-company cooperation as an essential prerequisite for sustainable design of supply chains. Accordingly, they focus primarily on the leadership capabilities required for coordination. They report on the initial results of a publicly funded project. Here, the goal is to establish a cooperation platform that supports companies in developing the necessary leadership capabilities and additionally provides access to the relevant resources. The authors present initial findings on capabilities and technologies used in connection with sustainability initiatives. They also describe in more detail the role that for example governmental organizations must or should play in this context [4].

3. Conclusion

In summary, the minitrack contributions create a perfect link between the topics of digitalization and sustainability. It becomes obvious that in particular digital platforms of various kinds may play a very

important role here. It is also clear, however, that the existing contributions only touch on the complex relationship between digitalization and sustainability of supply chains. In all four contributions, the authors formulate new question for future work within and across the related scientific communities.

In addition, there are more topics that have to be addressed in future research on data-driven companies and supply chains. The following list contains some of these, in our view, highly important topics: Analysis of drivers of digital transformation of supply chains; supply structures for smart products and services; visibility and transparency through the Internet of Things; improved planning and forecasting through data analytics; decision making based on artificial intelligence; virtualization of supply structures; robots, cobots and other technology drivers for process automation; the role of digital platforms in supply chain; the impact of digitalization on business performance and industries; changes in the understanding of the terms Supply Chain, SCM, ecosystem; effects of digitalization on the target system of SCM; models, methods, tools and legal frameworks for the digitalization of companies and supply chains; barriers and challenges for the digitalization of supply chains; relationship between data security and digitalization of supply chains; requirements for the digitization of supply chains in the extended enterprise. A more structured research agenda on the digital supply chain of the future can also be found in Hofmann et al. [5].

4. References

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