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

Alexander Pflaum
OFU Bamberg
alexander.pflaum@uni-bamberg.de

Freimut Bodendorf
FAU Erlangen-Nuremberg
freimut.bodendorf@fau.de

Günter Prockl
Copenhagen Business School
gp.om@cbs.dk

Haozhe Chen
Iowa State University
hzchen@iastate.edu

Abstract

The following paper describes the mini-track 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 integrated into an overall context. At the end of our paper we add some recommendations concerning future research on the 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 are needed, processes have to be accelerated and made visible in order to enhance supply chain responsiveness and resilience. 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 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, 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. Digitization and digitalization in general are 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 behavior patterns.

In the next chapter, the individual presentations of the mini-track are briefly outlined. At the end of this contribution we provide additional recommendations concerning future research topics.

2. Contributions

The first article addresses the usage of additive manufacturing in supply chains. The starting point is the proposition that the application of additive manufacturing technologies generally reduces the complexity of supply chains. The authors choose a case study approach to verify this thesis scientifically. In the individual cases, the complexity of the supply chain before and after the implementation of the technology is examined. The authors conclude that complexity is reduced in one case, but increased in another. In the third case, neither a reduction nor an increase in supply chain complexity can be observed. At the end of the article it becomes quite clear that a more detailed analysis is needed to identify the framework conditions under which complexity reduction occurs [1].

The second contribution to our minitrack discusses the use of additive manufacturing technology in small and medium-sized enterprises in the automotive supply chain. Again, a case study approach is chosen in order to answer the research question. The authors identify potential benefits of the technology along the entire product life cycle. They conclude that potential

URI: https://hdl.handle.net/10125/64292
978-0-9981331-3-3

benefits occur not only in connection with physical but also with information processes, and point out that digital platforms play an important role here. They understand the identified potentials as starting points for the digital transformation process [2].

The focus of the third contribution is on blockchain or distributed ledger technology (DLT). The scientific goal is to identify and describe the basic characteristics of DLT use in supply chains. In total 136 applications in supply chains are identified and analyzed. A Grounded Theory approach is used in combination with the Gioia method. The results of this first step are then evaluated based on expert interviews. As a result, the author presents seven fundamental characteristics. From our point of view, the article contributes significantly to a better understanding of the use of blockchain technology in value creation systems [3].

The fourth contribution explicitly asks about the determining factors for the use of autonomous vehicles in road transport. The authors correctly assume that autonomous driving will significantly change transport processes and systems. The question is therefore of utmost importance especially for transport and freight forwarding companies. The Scenario Analysis method in combination with expert interviews is used in order to answer the scientific question. The authors conclude that the future use of autonomous trucks will depend mainly on technical maturity and regulation [4].

The fifth contribution to our minitrack addresses digitalization activities in rail transport. The case study approach is chosen to analyse the current situation in the Czech Republic. The article describes digital technologies and solutions which are currently used by the actors involved in the transport chain. Secondly, it tries to assess the current digitalization activities, e.g. the implementation of digital transportation documents in view of the existing legal framework. The article is based on interviews conducted with practitioners [5].

During digital transformation business models of individual companies can change significantly. Effects on the corresponding supply chains are inevitable. Against this background, the last article deals with the concept of the digital business model. The aim is to define the term as clearly as possible. On the basis of a comprehensive literature analysis, the authors compile important aspects, present them in a structured way and generate a working definition [6].

3. Conclusion

In total, the contributions provide answers to relevant research questions. Additive manufacturing, blockchain and autonomous driving are important technologies enabling digital transformation. The usage of digital documents in value creation processes like transport is one of the important preconditions for the digital supply chain. Data-driven services and business models affect supply chain architecture and management and have to be properly conceptualized. A well-defined definition is the first important step.

In addition, there are other topics that have to be addressed in future research on data-driven companies and supply chains. The most important topics from the authors' point of view are listed below: Analysis of drivers of digital transformation of supply chains; supply structures for smart products and smart services; visibility and transparency through the Internet of Things; improved planning and forecasting through modern data analytics methods; decision making based on artificial intelligence; virtualization of supply structures; robots, cobots and other technology drivers for process automation in supply chains; the role of digital platforms in supply chain structures; the impact of digitalization on business performance and industries; changes in the understanding of the terms Supply Chain, SCM, ecosystem; effects of digitization on the target system of SCM; models, methods and tools for the digitalization of companies and supply chains; barriers and challenges for the digitalization of supply chains; legal frameworks 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.

4. References

[1] S. H. Khajavi, I. F. Ituarte, A. Jaribion, J. An, C. K. Chua, J. Holmström, “Impact of Additive Manufacturing on Supply Chain Complexity”, HICSS 2020, Hawaii.

[2] S. Hiller, P. Weber, H. Rust, H. Lasi, „Identifying Business Potential of Additive Manufacturing as Part of Digital Value Creation in SMEs – An Explorative Case Study”, HICSS 2020, Hawaii.

[3] D. Roeck, “The Foundation of Distributed Leger Technology for Supply Chain Management”, HICSS 2020, Hawaii.

[4] H. Sternberg, H. Chen, E. Hofmann, G. Prockl, „Autonomous Trucks: A Supply Chain Adoption Perspective“, HICSS 2020, Hawaii.

[5] P. Kolar, H.-J. Schramm, G. Prockl, „Digitalization of Supply Chains: Focus on International Rail Transport in the Case of the Czech Republic”, HICSS 2020, Hawaii.

[6] M. Ahmad, C. Klötzer, T. Botzkowski, M. Papert, „Behind the Blackbox of Digital Business Models”, HICSS 2010, Hawaii.