# DIGITAL SUPPLY CHAIN AS A HOLISTIC APPROACH TO MANAGING THE COVID 19 CRISIS

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***Abstract:*** *In recent years, many companies have already used a hybrid of manual and digital process approaches to manage their business processes. However, such hybrid models are no longer sufficient to cope with the COVID 19 crisis. In contrast, a digital supply chain approach consistently exploits all the benefits of continuous electronic connectivity, full integration of all systems, and data from smart components. Ideally, this approach can monitor inventory levels, all customer interactions, and the locations of transportation facilities in real time. Building a digital supply chain requires a far-reaching strategy that must fit into the existing organizational structure, operations, systems, physical infrastructure, and all other business processes.*

***Key words:*** *global supply chains; digital supply chain; hybrid supply chains; optimization of transport routes; potential in the new technology clusters.*

## 1. INTRODUCTION

Since the beginning of the Corona crisis, it has become apparent that the global supply chains have not insignificant weaknesses. This was particularly evident in the supply problems with respirators, which often had to be diverted or were even lost completely. However, potential for improvement was also identified in other sectors. In the results of a study conducted in 2020 by the management consultancy Staufen AG, it can be seen that thirty percent of 730 companies

surveyed from Germany, the USA, China, Brazil, Mexico, Switzerland, Italy and the Eastern European region admit to major problems in their supply chain (Speck 2020). In another study by IT consulting firm Orange Business Services, 320 executives from various international companies in the manufacturing, transportation and logistics sectors were asked what impact the Corona pandemic was having on their companies. As a result, it was found that forty percent of the companies surveyed could not withstand the stresses of the pandemic. Various risks were identified, for example supply bottlenecks, interruptions to production or complete production stoppages (Hermes Germany GmbH 2020).

Hybrid supply chains, which consist of manual and digital process approaches, are used in most companies to this day. However, the results of the two studies mentioned above show that the use of such hybrid models is no longer sufficient to cope with crisis situations. The digital age demands fast time-to-market and agility in planning and ordering processes, which in turn requires efficient, data-driven processes and end-to-end supply chain transparency (Leitenberger 2019, 3). The objective of this research is to present a fully digital supply chain approach with end-to-end electronic networking in order to monitor the supply chain in real time as much as possible. The following research question can be generated from the formulated objective:

In the case of pandemics - especially the current Corona pandemic - can full supply chain digitization lead to real-time supply chain monitoring and thus minimize supply crises?

From this, the following hypothesis can be derived:

Supply crises in pandemic situations such as the Corona pandemic can be minimized and supply chain resilience and sustainability can be actively strengthened through real-time supply chain digitization.

The formulated objective and the research question generated from it as well as the hypothesis derived from it require the following approach: In the second part, the term "digital supply chain" and "digital supply chain management" are first introduced. In the third part, relevant technologies of the digital supply chain as well as their value creation potential and success factors are analyzed and discussed. The study concludes with a conclusion that summarizes the results of the study and draws a summary.

## 2. DIGITAL SUPPLY CHAIN – AN APPROACH

In recent years, conventional logistics with its transport, handling and warehousing function has developed into a modern and cross-company supply chain. This development resulted from the increasing requirements of companies to make the entire value creation process more reliable and efficient. In this way, an overall optimum of the value chain can be aimed for, to make all processes as seamless as possible from the supplier to the end customer (Müller 2021). Thus, Digital Supply Chain Management integrates all material, product, people and information flows across different logistics channels from raw materials to the end customer using information and communication technologies to increase efficiency in terms of costs, synergies and sustainability and effectiveness in terms of meeting customer expectations, for example a seamless customer experience and thus sales. Digital Supply Chain Management makes use of Logistics 4.0 technologies and enables supply chain visibility, omni-channel management and fulfillment. Digital Supply Chain helps to partially replace physical flows of goods with information flows or to avoid them by using, for example, real-time information about stock levels or transport routes at different locations (Wirtschaftslexikon Gabler 2021).

## 3. TECHNOLOGIES AND VALUE CREATION OF DIGITAL SUPPLY CHAIN

In the future, the digital supply chain will be able to make use of various technological approaches that can develop a high potential for the transformation of the supply chain in order to generate the best possible value creation potential. In the following, a selection of relevant technology clusters will be analyzed in order to show the value creation potential of digital supply chain technologies.

### 3.1. Analysis of relevant technology cluster

Relevant technology spectra can be taken from various scientific studies and practice-oriented analyses such as DHL Trend Research and KPMG and summarized in ten technology clusters. The analysis focuses in particular on those technology clusters which are forecast to have a specific influence on the material, information and financial flows of the supply chain in the coming years (Hoberg et al. 2019, 2 f. and Müller 2021).

Integrated planning and execution

The central objective of the supply chain is to transport the right product to the end customer at the right time. To achieve this, flexibility on the one hand and process reliability and efficiency on the other must be ensured. Digital tools for supply chain segmentation, integrated material requirements planning by means of vendor-managed inventory, consignment warehouses as well as comprehensive inventory overviews, holistic logistics transparency by means of end-to-end tracking, and multi-level demand forecasts by means of Big Data and artificial intelligence help in this.

Procurement 4.0 as a holistic procurement solution

Procurement 4.0 as a holistic procurement solution involves the emergence of new procurement categories by integrating suppliers into product development and electronic contracting. This approach increases the importance of procurement

for the strategic success of Supply Chain 4.0. However, it is essential to integrate upstream and downstream players along the entire value chain.

Robotic in intralogistics

Robotic in intralogistics consists of the use of automated conveyor vehicles and racking systems for storage, transport, provisioning and picking of internal flows of goods. They are used by means of Robotic Mobile Fulfillment Systems (RMFS) or automated picking systems.

Autonomous means of transport

Autonomous means of transport are defined in the automation of transport vehicles outside intralogistics. They are used by means of platooning, autonomous trucks or drones.

Virtual Reality and Augmented Reality

Virtual reality and augmented reality are used to support logistical processes through computer-aided enhancements of existing reality and the creation of new worlds. They are used in head-up displays, smart glasses or digital twinning.

Internet of Things and Sensor Technology

The Internet of Things and Sensor Technology is applied through the use of sensors and communication technologies to independently collect and transmit data along the supply chain. They are applied by means of sensors and smart devices.

Supply Chain Analytics

Supply chain analytics deal with the acquisition and integration of new data sources as well as extended use of existing data sets through the use of powerful analytical methods. They are applied by means of machine learning and predictive analytics.

Process automation

Process automation deals with the automation of internal and cross-company information processes and flows of goods. It is applied by means of no-touch order processing or blockchain.

Digital manufacturing processes

Digital manufacturing processes involve the immediate production of original digital designs without the use of additional tooling and setup. These processes are performed using digital printing or 3D printing.

Platforms

In the case of platforms, cloud technologies are used to network a wide variety of players throughout the value chain. They are applied for cloud-based collaboration and communication as well as for crowdsourcing platforms.

### *3.2.* Value creation potential of digital supply chain technologies

A wide range of value creation potentials can be derived for companies from the technology clusters shown. However, companies must carefully consider which technology approach offers the best possible added value. In principle, added value can be measured by degressive costs or increasing revenues (Hoberg et al. 2019). For example, Hoberg et al. (2019) forecast the following revenue increases and cost reductions as a result of digital transformation (see Table 1).

**Table 1. Forecast on the added value of digital transformation**

| Business sector | Revenue increase | Cost reduction | Added value result |
|---|---|---|---|
| Manufacturing sector | 22.6% | 17.6% | 39.6% |
| Logistics services | 33.6% | 34.2% | 17.8% |
| Commerce | 33.3% | 7.8% | 33.3% |

Source: Hoberg et al. (2019).

The value-creating design of the supply chain can be achieved through various approaches, which will be discussed in the sequel.

Optimization of processes

The warehouse as the starting point of the supply chain has an essential optimization function because it is there that the goods to be shipped are prepared, packed and made available for transport. The number of employees must be reduced, especially in the picking area, where the individual components of an order are assembled. Likewise, the walking distances of employees must be reduced, especially since a large number of the items stocked in the warehouse are often distributed over large storage areas. A transport robot can help bring the goods to the employee who picks them (Hoberg et al. 2020).

Another technology for increasing process efficiency and process effectiveness is automated planning processes using machine learning (Hoberg et al. 2020). This can often increase efficiency by over thirty percent (Hoberg et al. 2019). Furthermore, mandatory status information must be provided for specific product groups. For example, in the case of refrigerated products such as food or pharmaceuticals, the cold chain must not be interrupted, which is why the data transmission to the individual stations must be transmitted with the appropriate time lead (Huth 2020).

In addition, suppliers and customers must be integrated into the entire digitization process and can collaborate via cloud-based platforms (Müller 2021). The success of a supply chain lies in an early and comprehensive exchange of information, which must take place between the companies. This enables disruptions in the supply chain to be identified and counteracted in good time and the overall benefit to be maximized (Huth 2020, Müller 2021).

Increasing flexibility and performance

Supply chain flexibility can be increased through technologies that enable fast and flexible responses to changing conditions. This can be demonstrated, for example, by monitoring process performance in real time and adjusting target values, cross-company planning, and additive manufacturing of slow-moving or discontinued spare parts (Hoberg et al. 2019). To increase performance, concrete targets must be defined and key performance indicators developed to demonstrate success within the supply chain (Müller 2021).

Utilization of data

For a smoothly functioning supply chain, technologies must be available that enable data-driven process design. This is done in the optimization of transport routes, condition-based maintenance of machinery and equipment, and micro-segmentation (Hoberg et al. 2019). This requires specialists who have a comprehensive understanding of the individual components of the value chain and at the same time know how to successfully integrate and organize digital concepts into operational processes (Müller 2021).

Improving the customer experience

As part of the supply chain, technologies must also be in place that enable a better customer experience. These are retail channel integration, automated reordering, and reduction of shipping times through predictive shipping (Hoberg 2019 et al.).

## 4. CONCLUSION

This study was designed to answer the question of whether, in pandemic situations - particularly the current Corona pandemic - full supply chain digitization can lead to real-time supply chain monitoring and thus minimize supply crises. From this, the hypothesis was formed that supply crises in pandemic situations such

as the Corona pandemic can be minimized and the resilience and sustainability of supply chains can be actively strengthened through the real-time digitization of the supply chain.

Basically, it can be seen that digitization with its value creation potential offers a wide range of potential for the further development of supply chains. All processes in planning, purchasing, production, warehousing, sales and transport offer considerable potential for the use of new digital technologies. It is already clear today at what a high level today's digital supply chain is compared to the conventional supply chain. It is more efficient, more customer-specific, faster and safer. However, each company must identify its own focus areas where it sees the greatest potential in the new technology clusters presented. To do this, companies must develop a structured process as well as acquire qualified human capital (Hoberg et al. 2019). As a result, it can be stated that the hypothesis is affirmative and that supply crises in pandemic situations such as the Corona pandemic can be minimized through the real-time digitization of the supply chain and the resilience and sustainability of supply chains can be actively strengthened.

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