

Impacts of the COVID-19 Pandemic on Supply Chains of the German Automotive Industry

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Abstract

The COVID-19 pandemic has dramatically changed our daily lives in a very short time. International supply chains, such as those of the German automotive industry, have experienced major disruptions. Measures such as border closures or production stops caused these supply chains to collapse due to increasing globalization on both on supply and demand side and the associated dependency on the global flows of goods. This in turn has led to bottlenecks, fluctuations in demand as well as delays along the entire value chain. The aim of this paper is to illustrate the impacts of the COVID-19 pandemic along the supply chains of the German automotive industry. Based on the literature review, potentials were identified to be able to react more effectively against crises in the future. The solution of previous thesis, various articles of management consultancies and statements of German car manufacturers were consulted. The obvious impact of the COVID-19 pandemic could be seen in the border closures and government measures such as home office obligations and lack of materials. There was a drop in demand in the automotive sector due to a limited processing time. Significantly, fewer vehicles were produced, and companies had to deal with immense drops in sales. The theoretical findings identified four major factors that influence the disruption of supply chains. These include complexity, communication, risk management and geopolitical factors. Due to the low vertical integration of the German automotive industry and the resulting high dependency on suppliers, the optimization of these factors is essential in order to react better to crises in the future. A fundamental step could be the digitalization of supply chains and the transparency of communication between all parties. Furthermore, adjustment of inventories and procurement at national level should be taken into consideration for the disruption of supply chains in the future.

Keywords: Supply Chain, German Automotive Market, COVID-19 Impact

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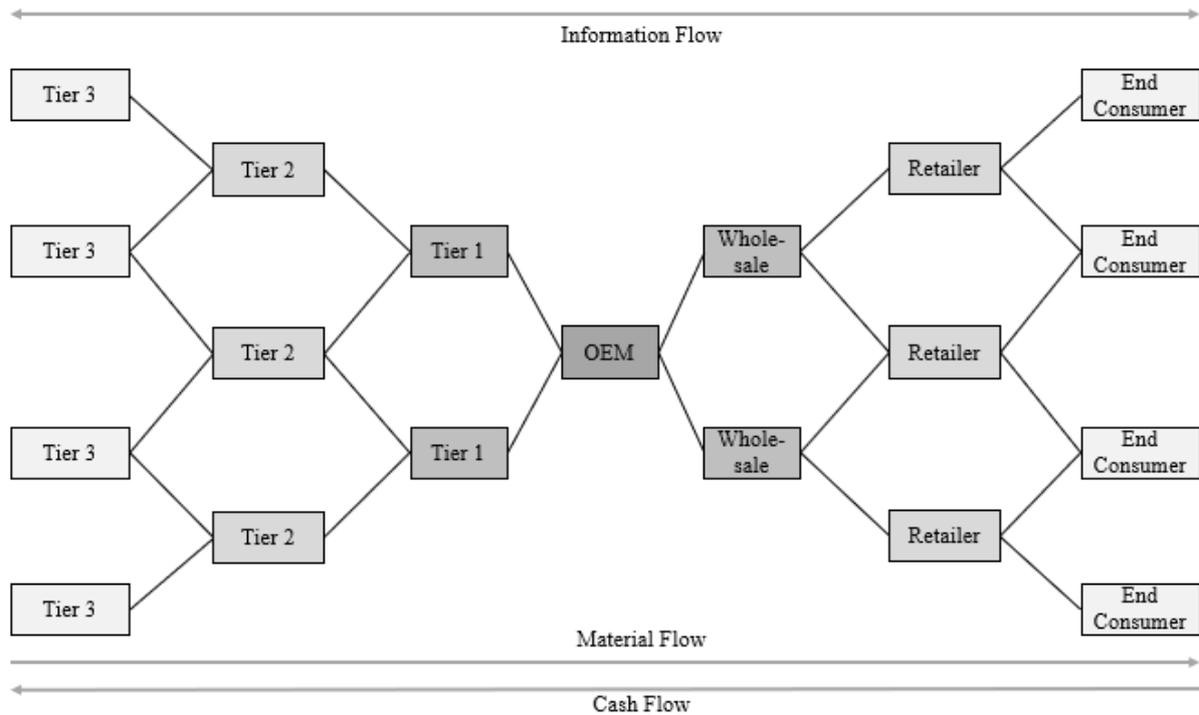


Figure 1 Example of a supply chain and the components (adapted from Hieronimus, 2006, p. 49.)

The figure illustrates different participants of the supply chain by squares, which are connected with edges. These connections show the relationships of the actors. The arrows symbolize the flow of materials, information, and cash flow. Direct relationships can also exist, for example, between raw material suppliers and OEMs or any other combination. There are no limits.

There is also some controversy in the literature about the term supply chain since it refers to a complex network. Sydow (2002) defines the term as a logistics network. An enterprise network with tasks to the operational and strategic logistics management. However, the previous definition of a supply chain goes far beyond the logistics chain as individual participants cannot make decisions in isolation, instead the entire chain is controlled by a collaborative management (Corsten & Gössinger, 2001).

Supply Chain Management

In theory and in practice, there is no standard definition of the term supply chain management. Based on the definition of a supply chain in the previous chapter, Kugeler (2002) defines the supply chain management as the planning, management, execution, and control of the entire value chain from raw material extraction to the end customer, taking into account material, information and financial flows. Werner and Thorn (2003) define supply chain management similarly, but in more detail. Here, the terms order acquisition, order processing and product delivery are used. The two authors also define the term supply chain planning. This includes all planning tasks that occur in the supply chain management and therefore represents a field of activities. The supply chain management also focuses on interfaces between companies. For this reason, it is also referred as interface

management (Kloth, 1999). Internally, this refers to interfaces between different departments. Intercompany interfaces are between suppliers and customers (Melzer-Ridinger, 2005).

The customer demands nearly every product should be available at any time and any place. This is due to the increasing demands of society as well as technological progress (Böhnlein, 2005). Here is one motivation to join forces and align supply chain as efficiently as possible with customer demand (Baumgarten, 2004). Companies are also increasingly focusing on international procurement markets. Value creation is decreasing, while networking between companies is increasing. The complexity of supply chains is increasing as a result of the relocation of work steps to foreign (often Asian or Eastern European) locations. The functioning of the supply chain depends on successful cooperation (Geimer, 2005).

Most goals in supply chain management can be achieved by connecting all actors and synchronizing development, manufacturing, delivery, and information. One of the most frequently mentioned goals is to increase delivery service and to react quickly to changing customer needs. In this context, an improved market position against competing supply chain is targeted (Böhnlein, 2005). To achieve the goals, a constant balance between effort or cost and the benefits of savings associated with the goals is required. For example, the goals of responding quickly to customer needs and market changes while achieving profitable growth are in conflict. The conflicting competitive factors of quality, cost, time, and flexibility must be realized (Keller & Krol, 2004).

German Automotive Market

According to the definition of the German Association of the Automotive Industry (VDA), the automotive industry consists of the production of motor vehicles of all types that are necessary for the transportation of people and goods. This includes the automobile manufacturers and the supplier industry, which produces car parts and equipment (VDA, 2007). Automotive manufacturers (OEMs) are enterprises that combine components, modules and other similar items produced in-house or by third parties into complete vehicles and offer them to the end consumer. The externally sourced components are purchased from suppliers. This includes all economic units that supply intermediate products or provide services for a company downstream in the value chain as part of the inter-company distribution of activities (Wallentowitz et al., 2009). The structure of the actors is shown in Figure 1.

The value chain in the automotive industry is highly diversified. Parts, components, and raw materials are largely purchased for vehicle production. The supplier industry benefits as a result. These include material and parts supplies from the chemical industry, mechanical engineering, or the electrical industry. Furthermore, car dealers, repair shops and gas stations are directly or indirectly dependent on the automotive industry. As mentioned in the research background chapter, the automotive industry has a major significance for the German economy. The German Federal Ministry for Economic Affairs and Energy (BMWi) defines the automotive industry as the largest sector of the manufacturing industry and the most important industrial sector in Germany in terms of sales. This is reflected in the fact that almost 833,000 employees earn their living in this sector. (BMWi, 2021). The largest employers in Germany and in the automotive field are the Daimler AG with

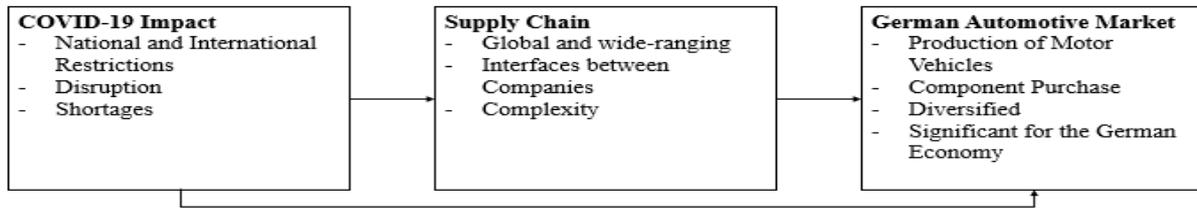


Figure 2 Conceptual Framework Model

(Kumar & Managi, 2020); (Oloruntoba, 2020); (Parsons, 2020); (Zhu et al., 2020); (Werner, 2004); (Corsten & Gössinger 2001); (Melzer-Ridinger, 2005); (Pfohl, 2004); (Kugeler, 2002); (Geimer, 2005); (Keller & Krol, 2004); (VDA, 2007); (Wallentowitz et al., 2009); (BMW, 2021); (Kords, 2021a)

The Coronavirus Impact to Supply Chains

The COVID-19 pandemic had many impacts on supply chains. However, the following impacts have had the greatest impact. As a result of restrictions, delays occurred. The largest delay was found in inventory. This category also includes postponements of projects, which has affected the entire value chain. The type of work has also changed in the form of home office. These changes can be positively attributed to the fact that employees are more flexible in their work. Negative effects, on the other hand, could be seen in the customer relationship or in the reduction of social interaction. A major impact can certainly be attributed to the financial impact. Sales decreased, prices for raw materials increased and, in some cases, production had to be reduced. Another impact was the travel restriction on the supply chains. International travel bans affected production and thus international supply chains. But also, third party verifiers had negative influences. Overall, it can also be observed that smaller firms experienced more delays and sales decline than large firms. Large firms, in turn, have downsized their employees rather than smaller firms (Pedersen & Nylænder, 2021).

Impact to the German Automotive Market

The above-mentioned reasons have a direct impact on the supply chains of the German automotive industry. Plant closures and production stops to protect employees, supply bottlenecks due to interrupted supply chains and a lack of supplier parts. In addition, there was a drop in demand (Köllner, 2020). All these factors can be seen in the sales figures. There was significant drop in automobile production due to corona measures, especially at the beginning of the pandemic, 1st half of 2020. In Germany, over 600,000 fewer motor vehicles were produced as planned by June 1, 2020 (Kords, 2020). According to the German Association of the Automotive Industry, sales fell by approximately a quarter in 2020. Although the Chinese sales market recovered comparatively quickly, the level was still below that of the previous year (VDA, 2021). This is also reflected in the sales figures for the German automotive industry. With sales of €378.17 billion in 2020, that's about €58 billion less than the previous year and the worst figures since 2014 (Kords, 2021c). All manufacturers were affected in addition to production stops of closed registration authorities as well as the decrease in demand of the consumers. Nevertheless, the development of the various car manufacturers was quite different. Daimler and BMW (sales down 7.8%) showed a much lower sales decline than Volkswagen, for instance, with 15.1%

(Autozeitung, 2021). Due to the very complex structure of the supply chain, a large number of automotive suppliers have also been affected. They cover around 70 – 80% of the value chain. They have also been forced to shut down or stop production (Köllner, 2020).

Main Factors to Reduce Coronavirus-Related Supply Chain Disruptions.

Furthermore, due to the disruption of supply chains, factors can be defined that can lead to a resilient response to pandemics and disruptions in the future. Among the factors are complexity, communication, risk management and geopolitical factors. The complexity factor includes the size of supply chains, type of production (among others Lean and Just in Time) as well as the type of production (national or international). The communication factor includes, especially, the transparency within the supply chain. The type of information processing (manual or automatic) and the relationship with suppliers have a great influence. Risk management is characterized by resilience. The risk can be reduced due to redundancy in the form of multiple suppliers or extra resources. Robustness also belongs to this category. The financial situation of a company as well as safety inventory has a great influence in this context. The final factor, geopolitical factors, is very difficult for companies to manage. This category includes restrictions (domestic, international, travel bans, infection control rules and climate conventions) and governmental support (tax packages, support schemes and dispensation) (Pedersen & Nylaender, 2021).

Research limitations

This paper covers various aspects of COVID-19-related impacts on automotive supply chains. The issues are identified through documentary research in theses, journals, articles, books and more. Search engines such as 'Google Scholar' or 'Emerald Insight' and relevant websites are also used to bring together relevant information. The time period under analysis starts with the outbreak date of the pandemic, i.e., December 2019, until the completion of this paper. Potential future changes in supply chains may extend beyond this period.

Research Significance

In recent decades, the global supply chains of the automotive industry have been characterized by the outsourcing of production stages and the sourcing of pre-products from abroad as a profitable strategy. Currently, however, the question arises to what extent the associated risks caused by the pandemic can be justified (Kolev & Obst, 2020). This research study was anticipated to yield at least the following useful significance as following:

1. To provide an overview of the impacts caused by the pandemic. It shows the effects and can help provide more transparency in the supply chain.
2. To highlight the long-term actions. What can we learn from the pandemic to be better protected against crises in the future?

Conclusion and Recommendation

The aim of this paper was to show the short-term and long-term impacts of the COVID-19 pandemic on supply chains in the German automotive industry. Finally, potential changes should be presented in order to be able to handle crises better in the future.

It could be shown that the supply chains were massively affected by the short-term effects such as production stops or border closures. In addition, these effects and the decline in demand led to a huge drop in sales. In this context, the automotive industry was hit hard due to its low vertical range of manufacture and the resulting dependence on a large number of suppliers. The complex structure of the supply chains intensified this effect. This is why the focus on complexity, communication and risk management is essential in order to be able to resist crises in the long term. The implementation of lean principles has increased complexity. Efficiency is often the only focus, and risk management strategies remain on the side-lines. In particular, methods of resilience or robustness should be considered in order to be able to react better to disruptions in the future. Through risk management, potential risks can be identified at an early stage and corrective measures initiated (Chowdhury, Agarwal & Quaddus, 2019). Early communication throughout the supply chain can also significantly minimize vulnerability to disruption. In this context, companies should work to digitize supply chains. Digitized supply chains provide assistance and have many advantages. Among others, it can ensure the real-time tracking of goods as well as uninterrupted communication between all parties involved in the supply chain (Casey & Wong, 2007; Mansfield-Devine, 2017). Digitization also supports the objectives of supply chain management. Companies should also place a high priority on risk management. Plans should be created by all key suppliers and customer. Ivanov & Sokolov (2013) were able to show with their work that this allows a better response to disruption. In the best case, risk management should be digitized in the same way as the supply chains. By integrating a cross-enterprise supply chain monitoring system, companies can also become more flexible, organized, and responsive to disruptions. Another impact of the pandemic could also affect previously established lean management strategies such as keeping inventories as low as possible. Especially for critical materials, higher safety stock levels could compensate missing materials at least over a longer period. (Pató & Herczeg, 2020). However, companies should keep in mind economic factors as the costs due to increased inventories and develop an appropriate strategy. The currently dominating global sourcing of parts could also be affected as a result of the pandemic. In this context, companies could also consider producing critical materials locally, thereby decoupling geopolitical measures from governments such as border closures and avoiding production stoppages due to missing materials.

In the long term, the COVID-19 pandemic is likely to change the automotive industry in many facets. Structural changes in the nature of procurement and fundamental strategies are foreseeable. These measures are essential to ensure sustainable supply chains and procurement in the uncertain and likely more disruptive future (McKinsey Global Institute, 2020).

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