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THE EFFECT OF THE COVID-19 ON THE AUTOMOTIVE SUPPLY CHAINS

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Abstract. Securing the high level of performance of the supply chains is a difficult task. The harmonization of different interests, the coordination of the raw material supply and information flow, the cooperation of the partners, forging and maintaining a relationship of trust are challenging even in an ideal world in order to meet the customer demands. The recent outbreak of the COVID-19 presents the members of the supply chains with extreme challenges. Because of the epidemic, the value added activities of the supply chains are getting even more importance. It became clear that the different supply chains connect the whole economy in a global and local scale as well. The choice of the inventory and organizational strategy is a key aspect in a crisis like this. The aim of this study is to present the current challenges and their viable solutions in order to check the possibilities to maintain the operation of the supply chains even in this difficult economic and social period using an automotive case study as an example.

JEL classification: E12, E24.

Keywords: COVID -19, pandemic, supply chain, automotive industry, change, fluctuation, case study.

1. Introduction

Supply chains are the results of the cooperation of organizations, where the different members try to achieve a mutually beneficial, synergic relationship in order to achieve a more efficient operational level. There is a significant amount of material, currency, document and information flow in the extended chains. The

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proper quantity and quality of flow is required in order to rationalize or occasionally optimize the processes, reducing the costs or increasing the profits at the supply chain level. The COVID-19, additionally to its devastating social effects, massively influences the local and global economic status, including the short and global supply chains as well. The bullwhip effect of the epidemic on the automotive supply chainsstarted at that time, when infected people were only registered in China. The short term signs could be detected almost immediately, however is it very difficult to foresee the challenges and the economic effects that the cooperating organizations have to overcome.

2. The supply chains

Supply chains are the results of the cooperation between the different organizations with the same goal. This objective can be profit maximization, process improvements, cost reduction etc. The cohesion of the supply chains is based on trust and mutualism.

These chains cross the boarders of the traditional organizational structures, the relationship between the certain members are much deeper, and the economic and strategic partnership enables them to reach a more efficient level of performance (Szegedi-Prezenszki, 2017).

In case of the global supply chains the procurement of resources and raw materials, processing the components and shipping the end-products to the customers are done by the different members of the supply chain, where they play a crucial role, creating value in their area of expertise. The continuous improvement and cost reduction is getting even more important for every single organization (Zhang et al., 2020).

Purchasing has an important role to achieve these goals at a local and global level, especially in this special, pandemic period (Tátrai-Vörösmarty, 2020). Besides profit and efficiency, the ‘green’ aspect of supply chains is getting an increasing amount of attention because of its environmentally friendly, sustainable nature.

Close cooperation between the members is essential at the automotive supply chains because of the long lead times of the products, and only a fraction of the suppliers have the core competencies, infrastructure and capacity to satisfy the customer demands with the proper quality requirements. The balance of power greatly influences the opportunities of the members (customers and suppliers) within the supply chains. Supply chains can be defined as the collaboration of the internal and external organizations, which can exploit the synergic effects of the cooperation in order to satisfy the customers’ needs. The implementation of this collaboration is highly dependent on both the internal and independent external factors. An extreme example for such an external factor is the Coronavirus.

3. The overview and consequences of the COVID-19

In the last few decades, several pandemic outbreaks occurred, which led to the deaths of many people, the most outstanding one is the COVID-19 (Coronavirus), which caused severe social and economic consequences (Guarner, 2020).

The Coronavirus is disease with human-to-human transmission, which can be originated to a fish market (Harapan et al., 2020).

The number of the COVID-19 infections started to skyrocket at the end of January, 2020, from that point onwards more and more patients were registered being infected.

The Chinese New Year had an immense effect on the rapid spread of the virus, because the vast majority of the people celebrated with their families and friends, and as a result the number of infections have increased exponentially (Liu et al., 2019).

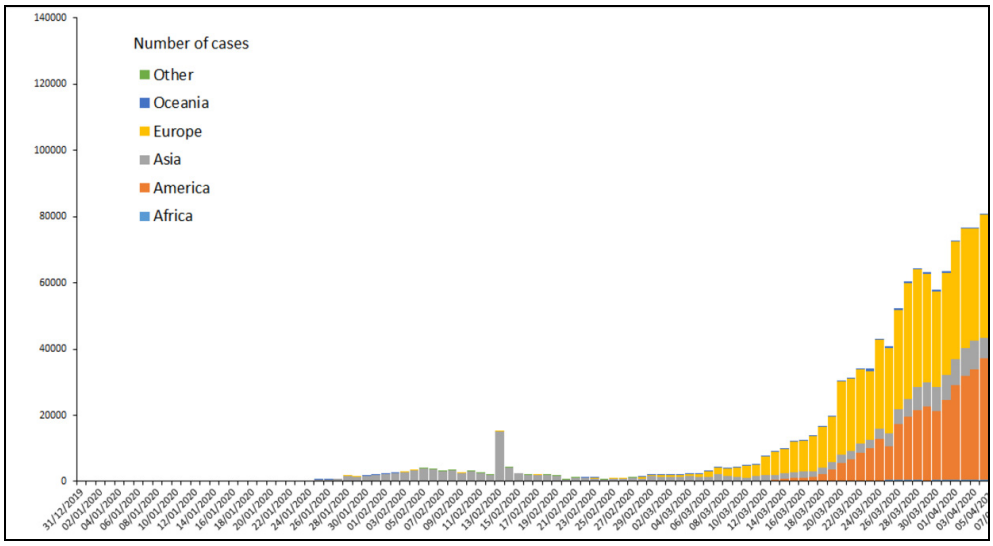

Fig. 1: The global spread of the number of the COVID-19 infections – partial data

Source: https://www.ecdc.europa.eu/en/geographical-distribution-2019-ncov-cases, date of download: 2020.05.31.

At first, the number of infected people only increased in China, but after several weeks, the virus has spread to other countries and continents, it reached Europe and America as well. As this is a highly infectious virus, it can be fatal, numerous protective measures were implemented in order to stop this epidemic.

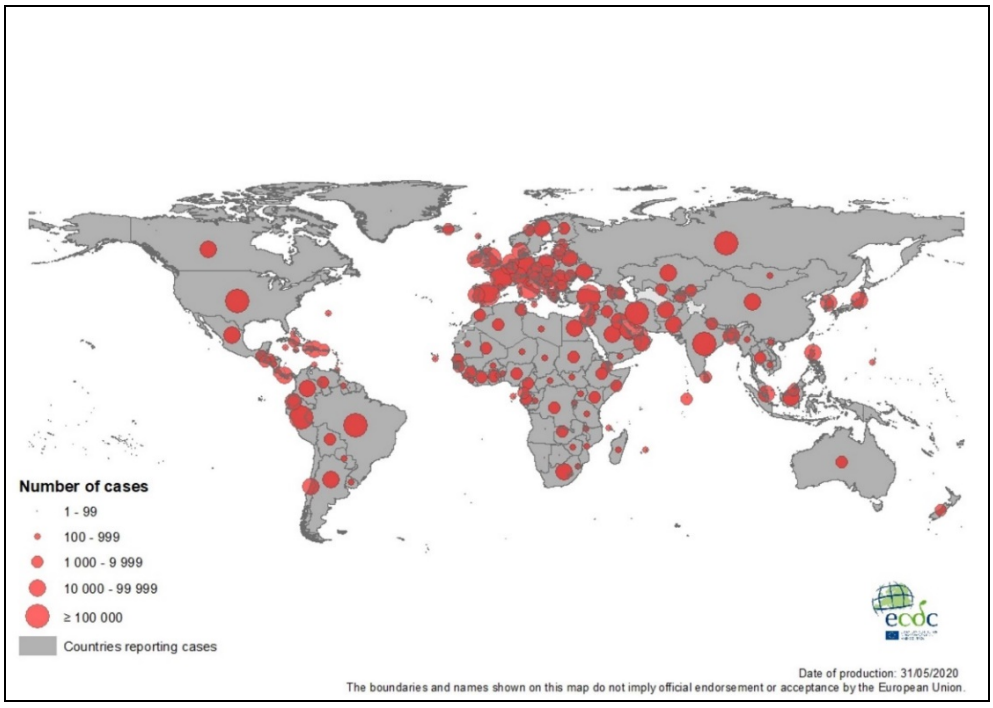

Fig. 2: The geographical distribution of the COVID-19 cases according to the 31.05.2020 data

Source: https://www.ecdc.europa.eu/en/geographical-distribution-2019-ncov-cases, date of download: 31.05.2020.

The limitations of the global logistics services (most of the means of transportations, cancellations of flights), the temporal shut down of production in various factories on behalf of the measures taken by the authorities belonged to these actions. These measures caused massive difficulties in numerous supply chain processes, in some cases even making them impossible to operate. Because of these, the logistic costs were increased, the transport options (sea, train and air freight) were reduced by quite a large margin, and as a result, material shortages, demand reductions and several other unforeseeable consequences were generated at numerous points of the supply chains.

This pandemic influenced the life of the employees as well. Because of the altered economic environment, the decisions of the organizations affected them both directly and indirectly as well. Fear is a decisive factor in this situation, which has an impact on both the individual and organizational performance (Henarath H. D. N. P Opatha, 2020).

Home office was an option at many companies because of the reduced customer demands and to prevent the further spread of the virus. It is important to analyze the personal and organizational performance of the home office option, and the types of jobs, which can be done in this condition (Dingel – Neiman, 2020).

4. The effect of the COVID-19 on the economies and supply chains

The effects on the COVID-19 proved to be a difficult challenge to most of the economic sectors, including the automotive industry as well.

The prevention of the spread of epidemics, which affected a vast number of persons was very critical even in the ancient times and in the early Middle Ages because of different social and economic aspects. Risk mitigation was also crucial in order to prevent further damages (Haldon et al., 2020).

The direct and indirect negative effects of the virus could be seen at the level of countries, industries and organizations. Parallel to the reduction of purchasing intentions and customer demands, material shortages are also getting more and more frequent, and the combination of these effects cause such an economic shock to the different economies and supply chain, which forced them to suspend or shut down their production processes. As a result of these, different levels ofcapacity and labor shredding could be experienced (Kraus et al., 2020).

The effects of the COVID-19 can be compared to a natural disaster, like an earthquake or a volcanic eruption, which strongly influences the processes of the supply chains. The demand fluctuations and material shortages both in short term and long term can cause immense problems (Ivanov, 2020).

Preparing for an epidemic like this is almost impossible, however certain strategies may work, which are flexible enough to proactively respond to the constant changes in an uncertain environment (Kannan et al., 2019).

The recovery of the economies after the virus will be a very difficult challenge because of the extensive damage caused by the epidemic. Certain state interventions will be needed in order to avoid further losses, the growth of unemployment, and the further weakening of the economic sectors. Experts estimate that the economic recovery will need around 9-12 months given the proper support and safety measurements (Mani et al., 2020).

The uncertain duration of the Coronavirus revealed the vulnerabilities of the supply chains, which were not experienced before. The value added activities of the supply chains have been getting more and more crucial recently, and it has become clear, that supply chains connect the economies at a local and global level. The importance of the supply chains can only be seen when they cannot operate properly, or when they have to overcome difficulties, which otherwise wouldnot allow them to play their role effectively. So supply chains can be defined as frameworks, which are the establishments of the efficient and successful economies. These chains are based on mutual trust and cooperation with the common goal of proactively satisfying the customers' needs.

The flexible strategies of the supply chains, which make it possible to smoothly react on the different changes, enable them to have a proactive approach to the demand fluctuations, supply issues and possible quality complaints (Oguzhan – Serpil, 2017).

The close cooperation makes it possible to act together driven by the common interest in order to overcome the difficulties of a bigger economic shock. As a result of the proper quality of communication, collaboration and joint action, the members of the chains can react faster and more effectively to potential risks, and the proactive measurements can mitigate the possible losses.

5. Case study – the effect of the virus on an automotive supplier

In the area of the automotive industry, there are a lot of Chinese components and materials, as many suppliers can only supply the customers from their Chinese factories according to the 9Rs of logistics.

The COVID-19 had severe impacts on not just the automotive area, but on every sectors of the economy. In my cases, the dire consequences will cause further damages to the primary, secondary and tertiary sectors as well (Nicola et al., 2020).

The effects of the initial Chinese safety measurements could be seen very soon. The European customers wanted to start building up their stock levels immediately in order to avoid any material shortages, as initially the epidemic period was expected to end shortly. Many of the substantial suppliers, which outsourced their production to China, and only kept their other functional areas outside of Asia, only calculated with short term issues originally. The long lead time of the automotive components are needed to be taken into consideration, so reacting to the slightest short termdemand fluctuation is a very challenging task.

In order to prevent the further spread of the virus, many international flights have been cancelled, more and more areas have been placed in quarantine, so even though the suppliers had enough stocks to cover the production of the customers, these materials could not be transported due to these limitations.

All the data presented in this section werecollected from the enterprise resource planning system of the chosen organization and from certain organizational reports. These data were prepared and organized by the authors in order to illustrate the cost and transport time changes, the different stock levels in certain periods and the responses to the virus. Table 1 shows the Asian transport changes and the difficulties, that the supplier had to overcome.

Table 1. The Asian international transport changes due to the Coronavirus

	Availability of the mean of transport	**Changes of the transport costs**	**Changes of the transport time**	**Tendency of the usage of the mean of transport**
Road freight	low availability	50 - 300% increase	depends on the infected area	non-preferred
Rail freight	limited availability	20 - 100% increase	50 - 150% increase	preferred
Sea freight	limited availability	0 - 50% increase	0 - 50% increase	less preferred
Air freight	chaotic	100 - 500% increase	100 - 600% increase	strongly preferred

Source: Own construction

As more and more regions were placed in quarantine as a result of the spread of the epidemic, the transportation in those area ceased immediately, and the sea freight, rail freight and air freight options have been gradually decreased. Automotive components could not be picked up from the locked cities, and most of the remaining freight capacities were used for medical equipment, which had the highest priority. Because of these, the air freight prices and transport times increased significantly. Sea freight and rail freight prices have also increased, but not as much as in the case of the air freight (Table 1).

All of the scheduled flights have been booked very soon in short term and long term as well, and the transport companies could not guarantee the original contract prices and transport times.

More and more automotive companies outside of Asia tried to buy as much as possible of the available stock of the suppliers over time in order to prepare for a potentially prolonged crisis period. Because of the bullwhip effectcaused by the Coronavirus, the demand fluctuation and uncertainty had massive effects on the members of the supply chains. The saturated flights caused supply issues at several points of the supply chains even at the first few weeks, the stocks of the suppliers were running out rapidly, they tried to keep up with the increasing demands, but they could only use a fraction of their capacity due to different governmental regulations (Figure 3).

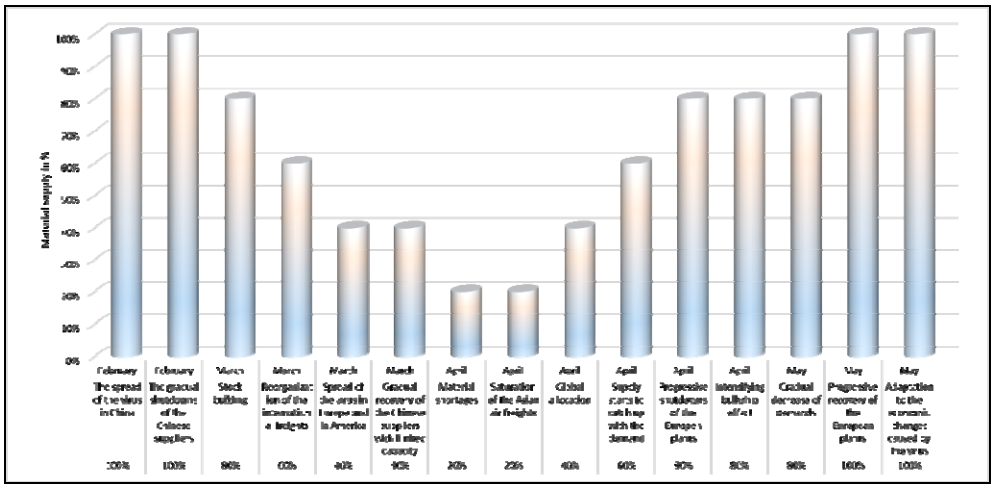

Fig. 3. The change of the material coverage of the analyzed company till May, 2020.

Source: Own construction

In the field of the electronic and mechanic components, which are used in many areas, several supply issues were generated, which could be only solved with close cooperation between the organizations. Multinational companies used global allocations to distribute the available resources to reduce the potential losses as much as possible.

As a result of this “force majeure” situation, most of the costs could not be charged to the other parties, the members of the supply chains had to cover these costs in many cases.

More and more countries started to introduce different safety measures to stop the further spread of the epidemic. While the situation started to look better in China, and the factories could restart their production at almost full capacity, the customer demands were drastically reduced due to the global status, further amplifying the bullwhip effect.

Because of the uncertainty, a standstill period has begun. As a result of the massive demand fluctuations, the members of the supply chains started to be reactive,they waited for each other’s move. This stagnant situation was the perfect time to evaluate their position, opportunities and strategies.

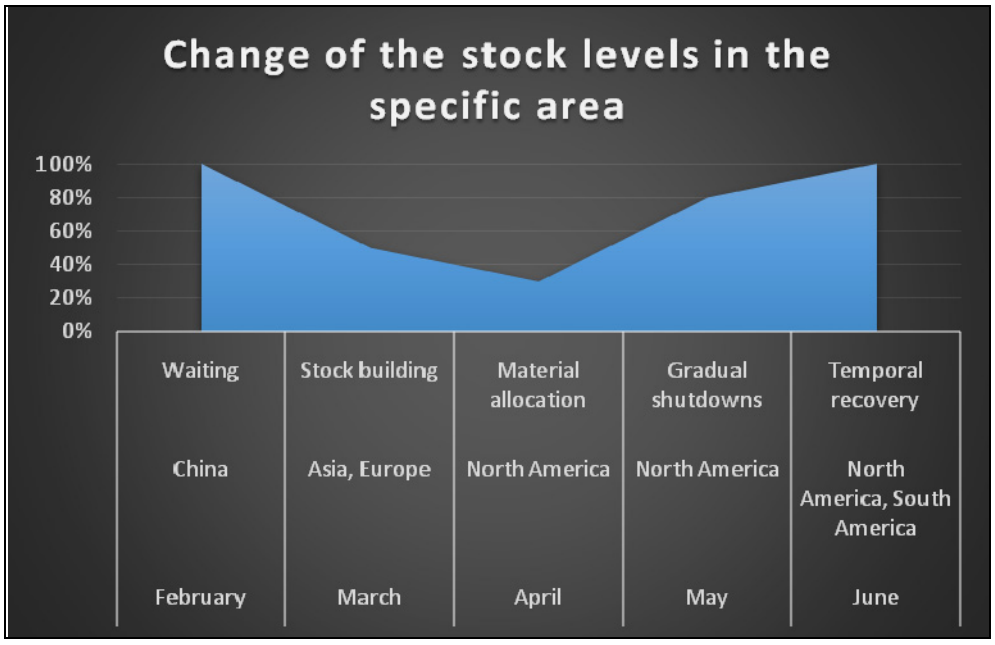

Fig. 4: The fluctuation of the level of stocks of the chosen company during the epidemic

Source: Own construction

When the COVID-19 has been already present in almost every single country, the reduction of demand could be experiences in most of the markets.

The management of uncertainty and risks were handled by the countries in their own way. The closure of the borders, establishment of a state of emergency and curfews or exceptional restrictions – all of these actions had an impact on the economies, and on the supply chains as well (Sharif et al., 2020).

What can be expected in the future? It is very difficult to predict the outcome of this period, although based on the current situation, the following can

be foreseen: in the area of HR: work force reductions; stagnation or reduction of salaries, the reconsideration of career management (Szondi, 2020) and manager responsibilities (Berke-Tóth, 2020); in the area of SCM: reorganization of the supply chains, reconsideration of the projects and their goals (Varga-Csiszárik, 2019), the closure of different companies, the realignment of the balance of power and the economy, new trends and strategies for similar situations like this.

Table 2. The relationship between the spread of the epidemic and the organizational reactions

Time	Centers of infection	Organizational reaction	Stock level
February	China	Waiting	100%
March	Asia, Europe	Stock building	50%
April	North America	Material allocation	30%
May	North America	Gradual shutdowns	80%
June	North America, South America	Temporal recovery	100%

Source: Own construction

6. Conclusion

The automotive supplier, which was chosen for this research, as a member of a supply chain, had to and have to face numerous challenges. With a flexible and suitable organizational strategy, it could quickly adapt to the changes. Building up enough safety stocks and closely cooperating with the partners were crucial to sustain its operations

As to the future, it is necessary to revise the status of the suppliers and customers, the flexibility of the long term organizational strategy based on the economic opportunities. Precautions shall be taken to choose the proper stock levels in order to reach the inventory targets and to be able to react to any bigger changes. Based on the previous experiences, preparing for such big economic shocks is impossible, however the mitigation of risks and damages can be feasible using the rights strategies. The changes in the balance of power and the economic realignment after the epidemic can open up new business opportunities in the area of the automotive industry. As a result of this, the global supply chainscan become evenmore important.

There is certain pattern, which can be observed during other smaller scale crises as well, which was also the case at the chosen automotive supplier. The indecision of the suppliers and customers, a general standstill period, and a high level of demand fluctuation can be experienced at the beginning of these unsettled times in many sectors of the economy.

This case study can serve as best practice to be followed by other organizations, which faced similar issues during this uncertain global period. The results of this study can be used as an example during the creation and implementation of certain inventory strategies in order to prepare for an uncertain period in the automotive industry. Proactive planning is crucial to sustain the production processes while keeping the stock level as low as possible so the relevant organizational KPI targets can be achieved. The challenges and difficulties, their solutions, and the different approaches, which were presented can be vital to prevent or to overcome similar issues and problems in the future.

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