

Supply Chain Management in Pandemic Times: An Experience from Macedonian Automotive Industry

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Abstract: The automotive industry is one of the sectors that has been hardest hit by the pandemic crisis. The pandemic's effects have resulted in multiple disorders, which led to loss of important suppliers and the inability to obtain vital parts, exposing the vulnerability of current Lean Just in Time supply chains. This paper provides a brief analysis of the COVID-19 pandemic's impact on the automotive sector in the Republic of North Macedonia. The provided findings are based on a research study conducted simultaneously in eight automotive organizations in the Republic of North Macedonia. This study sought to investigate the extent of the pandemic's influence on organizations' supply chains, what preventive steps have been implemented to minimize the virus's transmission, and what are the most prevalent obstacles that organizations have experienced during the pandemic.

Keywords: automotive industry; pandemic; supply chain

1 INTRODUCTION

Following the initial COVID-19 outbreak in early 2020, concerns about a destabilization in Chinese parts exports quickly transitioned into massive manufacturing disruptions across Europe, as well as the world's other industrial leaders. As the coronavirus spread from China, the world's second-largest economy, to the other countries in Asia, Europe, the Americas, and the Middle East, the global economy and international markets suffered. [1] Policies aimed at preventing the virus's spread, such as travel restrictions and quarantines, have had the unfortunate effect of disrupting international supply chains, restricting business operations, and decreasing revenues.

Due to the rapid spread of COVID-19 throughout the world, on March 11, 2020 the World Health Organization declared it as a pandemic. [2] Countries around the world have also been shutting down their economies in order to slow the spread of the disease and avoid overcrowding in hospitals. Closing borders was also one of the first defensive measures implemented. As a result, the movement of goods and materials was temporarily suspended. In such a situation, the normal operation of even more organizations' supply chains around the world becomes a significant challenge.

COVID-19 has had a rapid and significant impact on today's integrated automotive sector and has presented unexpected challenges to the entire automotive supply chain. The first shock was caused by containment measures designed to slow the rate of infection. These measures explicitly reduced output by keeping workers away from work. Supply-chain contagion also amplified immediate supply shocks as manufacturing sectors in less-affected countries found it more difficult and/or expensive to obtain necessary imported industrial inputs from hard-hit nations, and then from each other. [3]

The pandemic caused by the coronavirus is still disrupting social and human interactions, while also having a significant impact on complex, global production networks. Waves of localized outbreaks, regional or national blockages, and ongoing supply and demand disruptions continue to present organizations with new and unexpected challenges that must be addressed by making adjustments on their

business operations in order to maintain and protect their supply chains.

In accordance with the discussion above, the aim of this research is to provide critical insights and identify the most critical barriers into the reactions of Macedonian automotive companies and lessons learned in relation to the COVID-19 pandemic. To begin, as far as the authors are aware, this is the first preliminary study that looks specifically at the possible consequences of COVID-19 for the automotive sector in the Republic of North Macedonia.

Second, the paper aims to present the immediate actions of primarily organizational decisions made by automotive companies, taking into account the complexity of the automotive sector's real-world responses and their impact on supply chain resilience. The rest of this paper is organized as follows: Section 2 provides insights and explains the significance of the automotive industry in the Republic of North Macedonia.

Following that is a description of the research methodology. Section 4 presents the findings based on the data analysis of the results from the questionnaires. The authors reach the conclusion by summarizing the key points and emphasizing the study's limitations, as well as making recommendations for future research.

2 AUTOMOTIVE INDUSTRY IN NORTH MACEDONIA

The automotive industry is absolutely essential to the Macedonian economy, both in terms of exports and the number of jobs it provides. The high quality products manufactured in these factories in accordance with the highest automotive standards ensure that the Macedonian automotive component production is ready for export. The latest reports state that the automotive sector employs over 28000 people, while also provides the largest number of newly created jobs in the last 3 years compared to any other sector in the economy. In the period 2017-2019, more than 16,000 employees were created in the automotive industry, which shows that this industry is reaching its greatest progress in recent years. [4]

In addition, according to the recent data from the State Statistical Office, 65% of the country's total exports in

January 2021 were made by companies in the automotive industry.

The country's auto parts manufacturing companies are heavily integrated into the European automotive industry's supply chains. These are companies that are primarily export-oriented and account for a significant portion of the country's exports. In the last few years, the Macedonian economy has become much more deeply integrated into global supply chains through these companies for the production of automotive parts, but it has also completely changed the export structure, particularly in favor of products with higher technological finishing.

As the European car industry was heavily affected by the pandemic and decreasing demand for automobiles, the high concentration of exports to this industry resulted in a sharp drop in exports. The significant decline in the number of companies in this industry has a negative impact on the Macedonian economy and employment. The Macedonian economy has been experiencing extremely difficult times in the past period because of the negative impact of the global pandemic's health and economic crisis.

In 2020, the economy contracted by 4.5%, with a 10% drop in exports, as well as a drop in industrial production and employment. Many businesses were affected by the crisis, and the period of stabilization will last longer because the development dynamics of some businesses in the post-crisis period will be delayed. As a result, the companies in this industry have appealed to all state institutions to take a serious approach to supporting this industry in order to overcome this challenging situation without major layoffs. [5]

3 RESEARCH METHODOLOGY

Comparative method was used for conducting this research. Data collection was performed by using questionnaire surveys. The flexibility provided by the survey process, which can be used to obtain a large number of different types of information at the same time, is the main advantage of this way of gathering information. [6] The survey conducted through an electronic questionnaire significantly reduces the costs and time required to conduct the survey. Additionally, at a time when employee health is a priority, online questionnaire surveys provide a safe, risk-free environment for interaction.

The process of planning and preparing the questionnaire is of great importance in this way of gathering information. When developing the questions, special care was taken to ask clear and understandable questions that are not ambiguous or suggestive. Moreover, it was essential for the questionnaire to ensure the anonymity of all respondents, which would result in greater objectivity of the results.

The first section of the questionnaire asked general questions about the respondent, such as their current position in the organization and their experience in the automotive industry. The main part of the questionnaire, consisting of 6 questions, aimed to determine the impact of the COVID-19 pandemic on the organization's supply chain, what preventive measures have been taken to deal with the spread of the virus, and what were the most common challenges that organizations have faced in the past period. The third part

included 15 separate statements and each of the statements was answered within the offered answers: I completely disagree (1 point), I do not agree (2 points), I neither agree nor disagree I agree (3 points), I agree (4 points), I completely agree (5 points).

Before distributing the survey to respondents, a pilot survey was conducted as part of the questionnaire development process. This pilot survey was used to change and eliminate variables. Academics and industry experts were also consulted. Although no changes to the questionnaire were made during this phase, it was necessary to obtain approval that the questionnaire was understandable and acceptable for data collection.

The survey was conducted during May 2021, and according to all recommendations for working in conditions of COVID 19 pandemic. Respondents from eight different companies in the automotive sector in Republic of North Macedonia contributed to answering this survey questionnaire. The automotive companies involved in this study are all considered to belong to the category of large enterprises. According to the State Statistical Office of North Macedonia, large enterprises are those companies that have full time employees more than 251. The automotive companies who were involved in this study ranged from 300 employees to 6500 employees. The total number of employees in the companies included in the study is 12630.

The questionnaire was developed on the Google Forms platform and all respondents answered it online. For a better overview of the obtained results, they are presented in tabular or graphical form

The initial invitation to participate in the survey was sent to contact persons from 10 different automotive companies. A total of 8 positive responses were received, while the remaining 2 stated that they can't participate and provide the requested information. To the companies who chose to participate in the survey, an online link was provided, who was later distributed to the employees who fit our target categories (managers, team leaders, supervisors). When analyzing the received responses, first all responses from each company were summed up and later analyzed at group level by having one average answer per company.

A qualitative analysis of the results was used to analyze the complex phenomena and concepts of the research, as well as the topics listed as key in the thesis. Quality instruments should lead to an introduction and explanation of the problems, an understanding of the differences between the various strategies used to reduce disruption levels, as well as a description of the experiences, benefits, and challenges that occurred during the pandemic.

4 RESULTS AND DISCUSSIONS

4.1 Respondent and Company Profile

The first aspects to be investigated were the general background of the respondents such as the job position and years of employment in the company. The sample of respondents to the survey questionnaire included employees from different areas in the organizations and from different levels of the hierarchy: managers, production leaders, planners, but for the most part they were coordinators and leaders for continuous improvement. Most respondents

(75%) stated they have between five and ten years of experience in the automotive industry. Regarding the quality system certification, all respondent companies have at least one certification in the relevant field. Over 90% of respondents said their organization uses the ISO 9001 standard, a quality management system standard. Additionally, more than two-thirds use ISO 14001, the environmental protection system standard. Other types of quality certification such as ISO 13053, ISO 45001 and ISO 5001 were owned by 8% of respondent companies respectively.

4.2 Data Analysis

At a time when employee health is prioritized, in addition to mandatory measures imposed by the government, many organizations are also forced to close their facilities or work with a reduced number of employees in order to meet the requirements to customers in a timely and quality manner. In this questionnaire, respondents were asked what precautions their organizations had taken to protect their health and prevent the spread of the virus. Fig. 1 depicts the results.

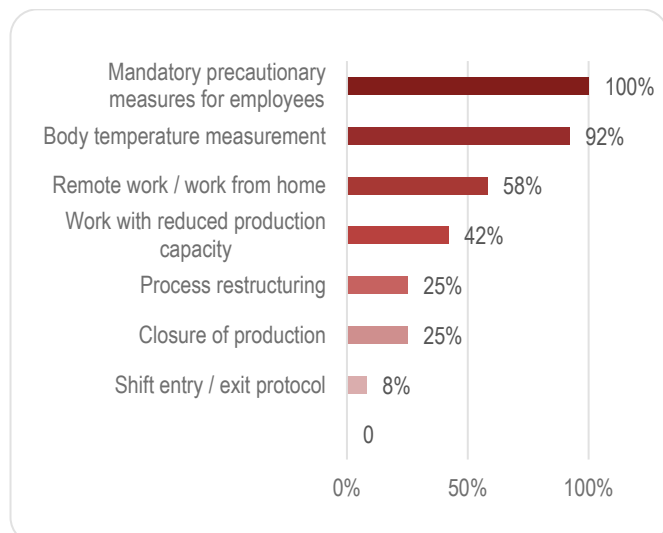


Figure 1 Responses to question: What preventive measures has your organization taken to deal with the spread of COVID 19?

While supply chain disruptions have a negative impact on the overall functioning of the organizations, some sectors within the companies have been more severely affected than the others.

According to the responders of this questionnaire, the disruption in Sources and Procurement was the source of the most significant challenges. Procurement is the process of acquiring goods, inputs, and materials that an organization requires for its operational activities, whereas sourcing is the process of establishing and maintaining vendor relationships, vetting suppliers, and developing and maintaining a supply chain of vendors who are ideal for the needs of the organization. Both processes involve dependence on other third entities, so in times when this third companies are also

affected by the pandemic and have disruptions in the way they function themselves, it's clearly how this can cause the biggest challenge. Following that are the difficulties in managing International Logistics and Transportation, as well as Supply Chain Planning. The closure of borders, as well as other pandemic-related disruptions in the normal movement of products across the world were resulting in record-high freight prices and perhaps increasing costs of transportation damage. According to certain studies the pandemic has a statistically negative and significant influence on air and land freight, while it has a statistically inconsequential effect on ocean freight. [7] In addition, although the supplier capacity is not directly connected to the supply chain, by monitoring and proactively minimizing supplier capacity risks, supplier capacity management helps companies in preparing for unavoidable interruptions.

The total results are presented on Fig. 2.

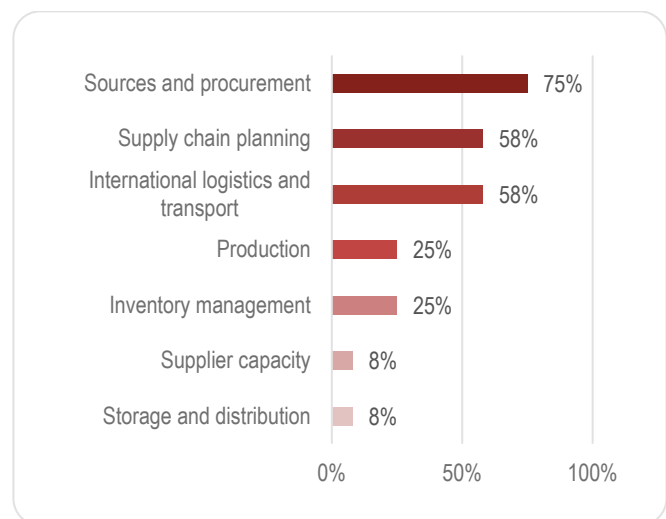


Figure 2 Responses to question: Which areas of your supply chain were most affected by the COVID-19 pandemic?

Although it is used to improve production efficiency and flexibility, the "just-in-time" inventory model - which keeps only the minimum additional inventory required to meet customer demand - is a process that is vulnerable when subjected to high operating stress caused by a crisis [8].

The challenges that organizations have had to face are numerous, but according to the sample of respondents to this questionnaire, the majority of the organizations have had to deal with delayed or canceled orders, both from suppliers and to customers. Fig. 3 portrays the other challenges listed by the respondents.

The challenge for organizations is to strengthen their supply chains without jeopardizing their competitiveness. To meet that challenge, managers must first understand their vulnerabilities before considering a number of steps, some of which should have been taken long before the pandemic struck. A year after the beginning of the challenges posed by COVID-19, over half of the sample respondents stated that their organizations had already recovered from the disruptions caused by the pandemic. Fig. 4 displays the

organizational division based on the current situation and the phase of response to disruptions.

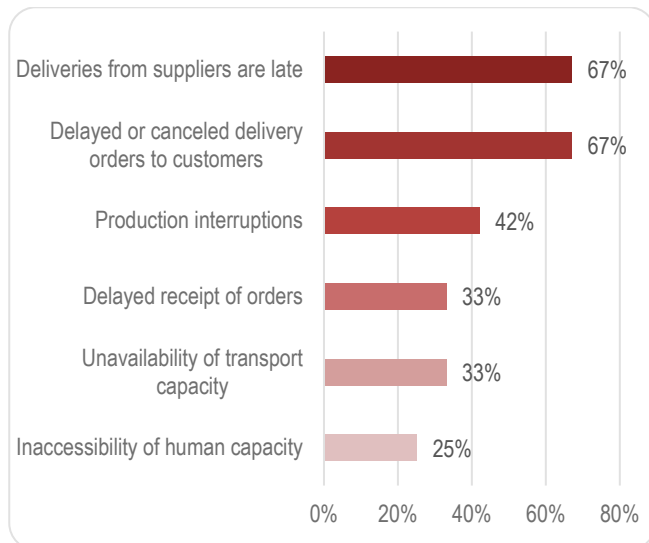


Figure 3 Responses to question: What are the most common challenges your organization faced during the COVID 19 pandemic?

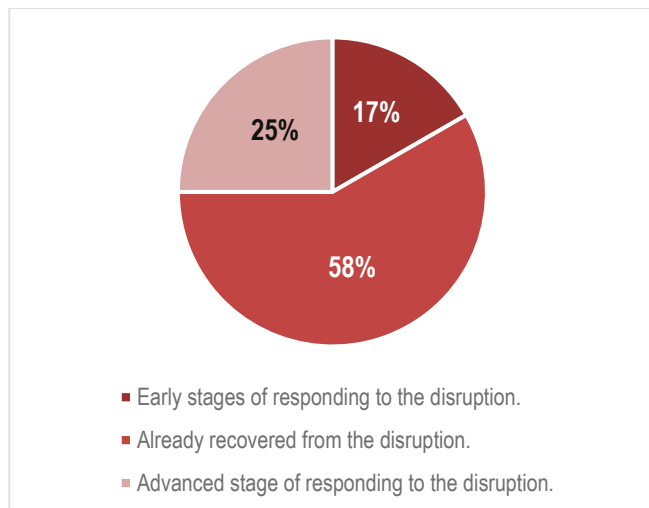


Figure 4 Responses to question: What is the current state of your supply chain in relation to COVID 19?

Once the immediate supply chain risks have been identified, leaders must design a resilient supply chain for the future. This begins using scenario analysis to assess the structural resilience of critical logistics nodes, routes, and modes of transportation, followed by the risk assessment task, the constant updating of risk impact assessments, remediation strategies, and risk management oversight. Processes and tools developed during the crisis management period should be formalized. Stronger collaboration with suppliers can help to strengthen a supplier's entire ecosystem over time, resulting in greater resilience. According to the sample of respondents to this questionnaire, the necessary reinforcements mostly refer exactly to the level of preparedness, planning and risk management.

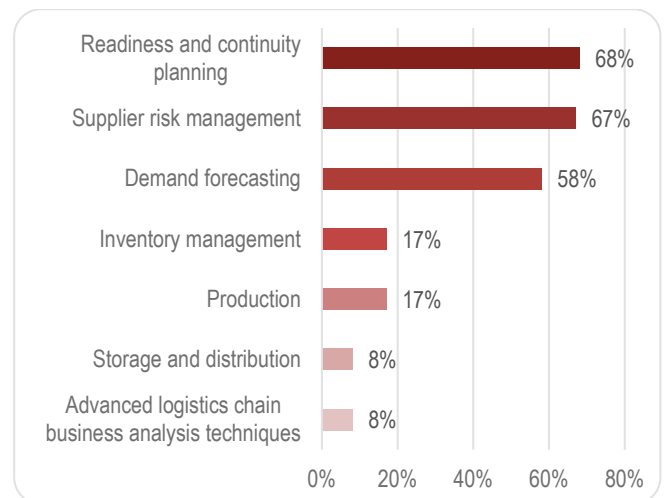


Figure 5 Responses to question: Which areas need changes to strengthen the supply chain of the future disorder?

As more organizations rely on global suppliers from China or other locations affected by COVID-19, supply chain continuity activities are critical. This huge supply disruption highlights the importance of creating or updating business continuity plans that identify key and secondary suppliers as well as alternative resources. A company's ability to quickly and effectively respond to interruptions can be improved by identifying and contracting with vendors and other providers prior to a crisis, where applicable. As evidenced by the ongoing pandemic, organizations must carefully and constantly analyze the impact of new threats on their existing processes and their supply chain business continuity plan reaction. The essential phases in risk management are identifying business interruption risks, evaluating the possible implications on the company, devising mitigation solutions, and preplanning ahead of a circumstance like COVID-19. Companies will be best positioned to tackle the challenges ahead and prosper in the long run if they take steps to stabilize supply chain operations and execute business continuity strategies.

5 CONCLUSION

The goal of this paper was to investigate the COVID-19 pandemic's impact on the Macedonian automotive industry. The authors used a research approach based on primary data from questionnaire surveys to gain an understanding of the implications and reactions.

A very encouraging finding was that almost 60% of the respondents' companies had already recovered from the pandemic's disruptions. While black swan events like the coronavirus cannot always be forecasted, the ability to understand supply chain risks and opportunities allows organizations to plan ahead while maintaining customer relationships in times of crisis. The authors also discovered that the most common issue they have encountered were late or cancelled deliveries from both from their suppliers and to their customers. The analysis results also revealed that the most improvements are necessary in the areas of preparedness and planning. The majority of the respondents'

companies faced similar challenges and took similar actions, according to the findings of this study.

The authors are confident that their approach produced interesting and valid results in the context of COVID-19, but the authors are also hesitant to generalize the findings. The sample size of eight companies is not only small, but the authors also limited the research to a single industry. Also in order to improve and enrich the research findings, it is also necessary to improve and strengthen the collaboration between the academic institutions and the companies from the specific industry, as well as develop new motivational methodologies for future collaboration. As a result, the authors encourage future studies to expand the sample size and diversify the respondents' industrial sectors, resulting in unique and complementary insights.

Notice

The paper was presented at MOTSP 2021 – 12th International Conference Management of Technology – Step to Sustainable Production, which took place in Poreč/Porenzo, Istria (Croatia), on September 8–10, 2021. The paper will not be published anywhere else.

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