

# IMPACT OF GLOBAL CRISIS ON SUPPLY CHAIN MANAGEMENT QUALITY: CASE STUDIES

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## ABSTRACT

*Once the pandemic was brought under control in February 2022, the ongoing conflict between Russia and Ukraine started, which has additionally affected the operations of a number of companies and a number of countries as well. Supply chain interruption poses a risk for companies with long-term impacts, particularly in a highly globalized era in which companies tend to have long and complex chains. The poor preparedness of companies, with no alternative solutions, has brought changes in business processes and supply chains worldwide. The ways the global crisis caused by COVID and the war in Ukraine impacted the supply chains and the business process modifications in domestic companies, will be demonstrated by two case studies: Defining the criteria for supplier selection on the national market and Comparative analysis of exporting the same product by a manufacturer in the automotive industry before and during the global crisis.*

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## 1. INTRODUCTION

The global pandemic caused by COVID-19, declared at the beginning of 2020, initiated significant changes in both society and business (Bapuji et al., 2020, Brammer et al., 2020, Bansal et al., 2021). COVID. In a very short period, market conditions and business models, as well as many other factors, with digitalization being the one that stood out the most and the one that has become increasingly important in modern business, drastically changed (Ratten, 2021).. Business organizations had to adjust rapidly to the newly emerging circumstances, so that they could adapt to the radical changes that were taking place. Once the pandemic was brought under control in February 2022, the ongoing conflicts between Russia and Ukraine began, which has additionally affected the operations of a number of companies and a number of countries. The increased uncertainty on a global level forced both large and smaller companies to

find alternative solutions in terms of trading partners and become even more aware of the significantly regarding the source of raw material, component and other production and service material stocks. It is evident that today's companies, through successful cooperation with suppliers and other actors in supply chains, can achieve certain benefits that often result in significant savings, which on the other hand is one of the goals every company strives to achieve. Supply chain interruption poses the risk that can have a long-term effect, particularly in a highly globalized era in which most companies have long and complex chains (Zhu et al., 2020; Zhang et al., 2021). The poor preparedness of companies, with no alternative solutions, has brought changes in business processes and supply chains worldwide. Closing borders led to the disruption in the structure of multinational companies, due to the fact that there were a number of problems during not only the production process, but also the supply chain and logistics. All these factors led to the

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collapse of the global economy and the establishment of predominantly national companies. Therefore, the supply chain in which the goods, processes and structures can easily be replaced needs to be foreseen as a response to changing condition (Zekhnini et al., 2020). These changing conditions and disruptions bear significant negative consequences on sales return, profit, share yield, brand image, recruitment in companies, customer safety and the total supply chain impact (Chovdhuri et al., 2019; Elliott et al., 2019; Paul & Chowdhury 2021).

This paper aims at reviewing the impacts of the global crisis caused by COVID 19 and the war in Ukraine on supply chains and business process modifications in domestic companies providing two case studies as examples: Defining the criteria for supplier selection on the national market and Comparative analysis of exporting the same product by a manufacturer in automotive industry before and during the global crisis.

The first study deals with the analysis of the delayed raw material delivery caused by the closure of borders due to the COVID 19 pandemic, which resulted in the failure to comply with the production deadlines and therefore with the deadlines for the delivery of a final product to its customer. All the above forced companies to seek raw material suppliers on the domestic market.

The second study deals with the analysis of the observed period from 2020 to 2022, in which the total business interruption occurred, followed by the reduced scope of business in the analyzed manufacturing company. For research purposes, the comparison of the reference unit export in 2022 and the export carried out in 2018 has been demonstrated.

## **2. SUPPLY CHAINS**

Supply chain management (SCM) has broadly been defined as the “systematic, strategic coordination of the traditional business functions and tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole” (Payán-Sánchez et al., 2021, Mentzer et al., 2001: p. 18).

Supply chain is an integrated system that starts from raw material or semi-finished goods, continues with the production, packaging, storing goods and their distribution, and finishes with the delivery of the final product to the end customer (Toygar & Yildirim, 2023). The relations within the chain are not limited only to manufacturers and suppliers. There are a number of various parties across the supply chain such as service and logistics providers, retailers, insurance companies, customs brokers and customers (Cooper et al., 1997; Min & Zhou, 2002; Chopra & Meindl, 2007; Toygar & Yildirim, 2023.).

Supply chains are the processes you use to deliver your product to customers. The chain encompasses everything, from obtaining the raw material necessary for your product manufacturing to its delivery to the customer (Ray, 2009). A supply chain is the network of all the individuals, organizations, resources, activities and technology involved in the creation and sale of a product. A supply chain encompasses everything from the delivery of source materials from the supplier to the manufacturer to its eventual delivery to the end user.

The supply chain activities imply the transformation of natural resources, raw material and components into a final product and its delivery to the end user. Supply chain management is the essence of business since it is one of the important added values of trading companies, in which a product is transferred from its place of origin (Manufacturer) or other source (Supplier) to its place of consumption (Buyer).

### **2.1 Production Company Supply Chains**

Supply chain is characterized by the flow of material and information within and between the business subjects including suppliers, manufacturers and buyers. The ultimate goal of supply chain management is to satisfy customer requirements in a more efficient manner. For a production company, the goal is to create the right product, for the right customer, in the right amount and at the right time (Wang et al., 2005). This requires carefully devised supply chains.

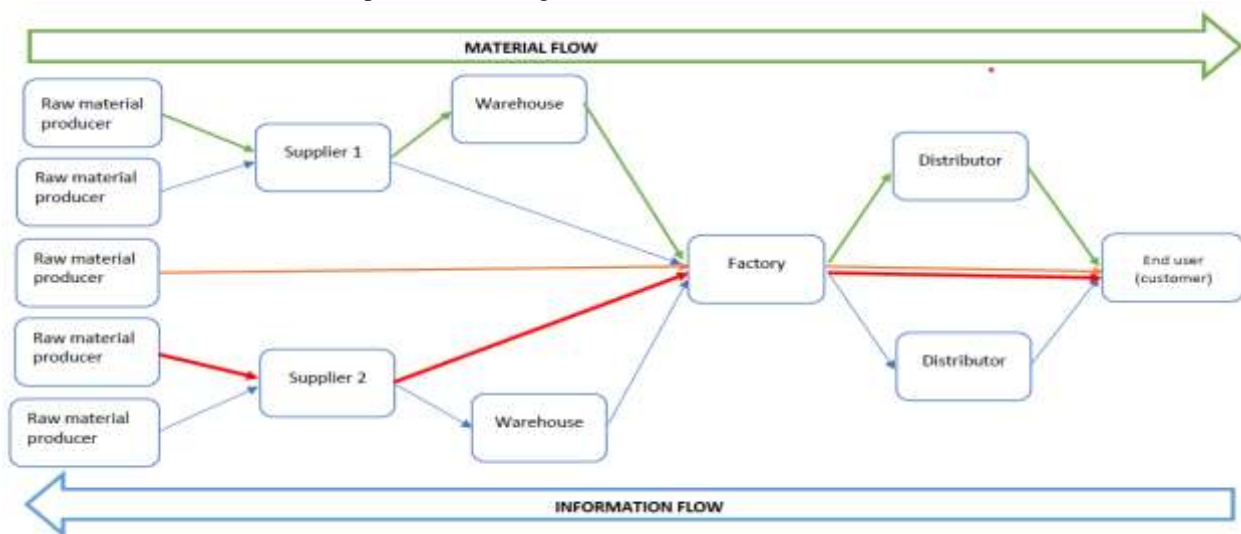
A manufacturer obtains raw material and components for final goods production from its suppliers. The material may be delivered directly to the factory or they may be handed to an external warehouse where they are consolidated and only then delivered to the factory. The material is processed in the factory, converted into a final product, and then packaged and eventually delivered to warehouses and distribution centers from which the goods are delivered to end users.

The supply chain concept refers to the flow of material (Figure 1):

- 1) from the source (supplier) to the warehouse, from the warehouse to the company (manufacturer); within the company, to the place it is needed; from the company-manufacturer (factory) to the distributor-trader; to the end user (customer)
- 2) from the source (supplier) to the company (manufacturer); within the company to the place where it is needed; from the company-manufacturer (factory) to the end user (customer)
- 3) from the source to the company (manufacturer); within the company to the place where it is needed; from the company-manufacturer (factory) to the end user (customer)

A typical production supply chain includes the following processes:

- The inbound supply chain that includes: sources, incoming quality control, inbound transportation from the supplier to the production unit, import documentation / customs processes in case the material is imported, receipt of goods and their storage, the management of production raw material stocks;
- The production and internal processes that include: production planning, timetable and production, quality control process, inventory management during the work process, plant maintenance;
- The outbound supply chain/distribution that includes: outbound transportation, final goods quality control, final goods storage in the company factory, external storages and distribution centers, packaging, problems with goods, final product inventory management;
- Customer service that includes: defining the level of services for customers, order management, return management, packaging, defining the distribution channels, product development;
- Other supply management functions that include: backup logistics, supply chain exception management, outsourcing logistics (which is usually conducted at the company headquarters);



**Figure 1.** Possible material flow in supply chains

## 2.2 Supply Chain Participants – Suppliers

A supply chain additionally encompasses production and supply (Min et al., 2019). Therefore, it has a significantly wider focus since it includes a number of businesses (including suppliers, manufacturers and traders) that work together in order to satisfy the user requirements for a product or a service (Grabs & Carodenuto, 2021; Li et al., 2021).

According to (Hugos, 2018), there are four types of participants in every supply chain. They perform the activities that make the supply chain work and give the reason for its existence. These participants are: 1) producers; 2) distributors or wholesalers; 3) retailers; and 4) customers or consumers.

If we observe supply chains through their simplest form, we may say that it consists of a company, its suppliers and customers. By combining these actors (supplier, company, customer) we obtain a simple supply chain.

Companies today have become aware that successful cooperation with suppliers can lead to certain benefits that often result in significant savings, which is one of the goals that every company strives to achieve.

According to the definition (Akamp & Muller, 2013) supply relationship management (SRM) is the practice of planning, implementing, developing and monitoring the relationship of a company with both current and potential suppliers. The key supplier management activities are the selection and evaluation of suppliers, their monitoring, development and integration.

According to (Ray, 2009), supplier relationship management is the key factor that includes all the processes that refer to supply management such as supply planning and execution, source analytics, the selection of suppliers, monitoring their performance, the cooperation with suppliers and all other processes that enable analyzing, controlling and optimizing a source.

Suppliers are an integral part of every business, production in particular. The selection of suppliers is the process of finding the right supplier for business, which includes the steps taken for a supplier discovery, selection and cooperation with them. If we talk about a product quality or its success, the supplier selection is an essential part, since the process of selecting the right supplier is the crucial one.

There are many different types of criteria used for supplier selection. They include price, quality, service,

delivery, reputation etc. Certain companies will use all these criteria, whereas some may focus only on one or two of them.

### 3. CASE STUDY

#### 3.1 Defining the Criteria for Supplier Selection on the National Market

This part of the paper will demonstrate a case study that analyzes a company which, like most companies in Serbia, was not ready for the challenges in supply chain caused by the global pandemic. The analysis deals with the delay in the raw material delivery caused by the closure of borders due to the COVID 19 pandemic and the consequent inability to import the raw material, which led to a non-compliance with the production deadlines, and therefore with the deadlines to the final product delivery to its customers. All the above forced the company to seek a raw material supplier on the domestic market.

The case study analyzes the company that produces rubber technical goods, including the production of semi-pneumatic wheels, rubber rollers, metal rims, plastic mass and silicon products, compression pressure, injection and die-cutting technologies. The accent is on the semi-pneumatic wheels for agricultural machinery. The company had imported the raw material from Slovenia and Austria until 2020, when the COVID 19 pandemic began, causing the closure of borders, which led to the production decline and the drop in the final product export to the foreign market in the following months, since the company exports more than 90% of the wheels to the foreign market (Germany, Russia, Austria, etc.).

The company values and selects its suppliers based on their ability to meet the requirements from the agreement/specification, including the requirements that refer to the quality management system, as well as any other specific quality requirement.

The Procurement Officer along with his or her team defines the criteria and the method of the evaluation and selection of suppliers that include the suppliers of raw material, material and components, as well as service providers – external providers, in order to create the “List of Verified Suppliers”, with the goal to ensure adequate reliability with respect to harmonizing the procurement of material and goods or the contracted service with the agreement/specification requirements, including the requirements that refer to quality management system.

The basic criteria for supplier rating are: quality control, certificate of analysis, supplier reliability, complaints and meeting the standard requirements. Each of these criteria is broken down into sub-criteria, i.e. levels, and each level is evaluated by the correspondent number of points. The company defines various evaluation criteria for:

- The suppliers of raw material and services that directly affect the product quality;
- The suppliers of hazardous material and other services (consulting, legal work, safety and health at work, laboratory tests, etc.);
- The suppliers of consumables.
- At the end of the financial year, the procurement – sales officer reviews individual deliveries according to suppliers and type of goods/services.

Every supplier is awarded the appropriate number of points, according to all 5 evaluation criteria. The average annual rating for each supplier is obtained by adding up the number of points according to the defined criteria. The Procurement – Sales Officer defines the supplier status based on the determined criteria that can be (Figure 2):

- A –approved supplier (> 70 points)
- B –temporarily approved supplier (from 50 to 70 points)
- C –unreliable supplier (below 50 points)

Evaluation is conducted by:			Evaluation criteria:			Date of evaluation:			Approval changes:			
	Supplier code:	Supplier	Quality	Delivery time	Price	Evaluation	Category	Range	Category	Range	Approved	Date
1						0	A	Approved				
2						0	B	Temporarily approved				
3						0	C	Unreliable				
4						0						
5						0						
6						0						
7						0						
8						0						
9						0						
10						0						
11						0						
12						0						
13						0						
14						0						
15						0						
16						0						
17						0						
18						0						
19						0						

Figure 2. Supplier-Provider Rating Scheme

The team formed to find a solution to the circumstances that affected the company had to make a decision on which raw rubber supplier on the domestic market may provide the raw material of approximately the same quality as the one the company had imported until the moment when the level of raw rubber stocks fell below the permitted level. The team concluded that the method they had been using to evaluate the suppliers was not sufficient and, as a solution to the problem, they defined the *checklist* (Table 1) with the criteria and sub-criteria for the selection of the domestic market suppliers. Then

**Table 1.** Supplier checklist

Criteria	Description of criteria	Check
1. Basic data about supplier company	Basic information about the supplier company through the chosen portal( <a href="http://www.infopoint.rs/usluga-checkpoint">http://www.infopoint.rs/usluga-checkpoint</a> which monitors operations of buyers and suppliers in the country, provides insight into their credit rating and business rating and information on blockages accounts, court cases, etc.)	
2. Certificates	1. Certificate ISO 9001:2015 2. Other certificates (ISO 14001:2015, OHSAS 18001:2015, etc.)	
3. Material quality	1. Possession of a certificate on the origin and quality of the material 2. Compliance with a query 3. Delivery of samples for control and testing quality	
4. Fulfillment of obligations defined through contract	In order to ensure the fulfillment of the contract obligations, from our suppliers or customers we may require several instruments: 1. Authorized Promissory note* 2. Bank guarantee* 3. Other	
5. Price	Price quality ratio Lowest price/quality on request Market price/quality on request High price/quality offered on request	
6. Fulfillment of company's requirements	1. Type and quantity 2. Applicable specifications, drawings, process requirements and other important technical characteristics 3. Statement on the purpose of the goods and other necessary data 4. Flexibility and delivery deadlines 5. Method of packaging and labeling 6. Method and place of delivery 7. Method of payment 8. Offer validity period	
7. Communication	1. Good service 2. Poor service	
8. References of the supplier	1. Business cooperation, clients	
Note:		

In order to maintain the quality level of its products, the company had to choose among three domestic raw rubber suppliers by means of the defined checklist and the conditions determined by the new procedure, as an additional method and with the aim of satisfying the raw material quality requirements, as well as the product quality, so as to satisfy the needs of very demanding customers.

### 3.2 Comparative Analysis of Exporting the Same Product by a Manufacturer in Automotive Industry Before and During the Global Crisis

The case study relates to a micro-enterprise in the automotive industry field, or more precisely to a manufacturer of special purpose trailers and semi-

they also added the new procedure *Defining procurement conditions and requirements* to the Quality Regulations.

Depending on the type of a product, service, raw material that is ordered as a new or a standard product, as well as on whether they are verified or unverified suppliers, in order to make the best decision, the Procurement Officer checks the supplier through the checklist presented below (table 1).

trailers. The company is a micro-enterprise with up to 10 employees and an annual turnover lower than 2 million euros. It manufactures two types of special units intended for on-road and off-road driving. The company carries out the production operations outside the EU zone not taking the advantage of the possibilities, i.e. benefits of an exporting company (VAT refund), nor the opportunities of working in a duty-free zone (the opportunity of temporary import and refinement).

The observed period relates to the period from 2020 to 2022. Within that period, there was even a total interruption of the company operations in a certain number of months, followed by the reduced scope of business operations. For research purposes, the comparison of the reference unit export in 2022 and the

export carried out in 2018 has been demonstrated. The comparison significance lies in the following:

- It is the same product type/variation/version;
- In both cases the destination EU country was the same, with the same central place of unloading;
- In both cases the buyer, i.e. end user was the same.
- In both cases the services of the same transport company were used for the transportation to the country/destination.

The importance of the study lies in the fact that the homologation requirements (ECE regulations) do not allow the replacement of one component with another unless it has priority been defined in homologation documentation (the so-called alternative components). Or in other words, only the goods that have been pre-defined or approved can be purchased or acquired. Otherwise, additional tests, which require both time and costs, need to be carried out.

The company defined the following four categories: chassis, superstructure (extension), light and signalization and functional equipment. The following elements were defined as the critical purchase elements: brake axle, traction control device, wheels, led light signalization.

However, the observed comparison has certain limitations:

- In the supply chain, only the road transportation was observed as the only form of transportation the company carries out within EU;
- The critical elements like the brake axle was on stock and for the comparison purposes the first offer by the supplier was included;
- For the comparison financial aspect purposes, the cut-off was made after the critical elements had been received and customs-cleared (control device, wheels) and it did not include the subsequent leveling of element or service prices by a manufacturer or a supplier.

The company could not avoid the supply chain disruptions as the consequence of the global crises caused by COVID 19 and the military conflict in Ukraine. The observed product unit that was taken as a reference due to the relativity of the comparison with the period prior to 2020 contains 32% of the components that were obtained from abroad either by direct import or by import through other suppliers. For the purpose of exporting to the EU countries, all components were obtained from 8 EU countries. The comparison of the two above-mentioned export cases emphasizes the following facts:

- At the moment when the cut-off was made, the total increase in the product element purchase prices was 36% as compared to the prices before the global crises, i.e. before February 2020;

- The global crisis caused the crucial element delivery time upon purchase to be extended by 4 weeks on average. In the case of the control device, the manufacturer was not able to define the delivery date;
- The unavailability of the elements at the manufacturer caused the creation of alternative supply channels, focusing on sales agents or more precisely dealers. However, the total transport of product elements and key elements from EU did not increase by more than 10%, counting the price per km or square meter;
- When the purchase was made on the domestic market, the deferred payment terms were either canceled or reduced due to the new circumstances;
- Given the good workshop positioning in terms of transport conditions and the allocation of human and material resource, the workshop level of equipment in the domain of tools and micro-climatic conditions, as well as the proximity of the service providers, there were no significant increases in labor and service costs, nor the disruption in the production and service realization;
- The increase in the fuel prices caused by the leveling of prices at a global level led to the increase in operating costs;
- There was an increase in the bulk transport price (including the transport insurance) by 212%.

#### **4. CONCLUSION**

The global crisis caused by COVID 19 and the war in Ukraine has transformed the whole world. All over the world, companies faced huge business losses. The change in market conditions caused by the global crisis forced many companies to transform their operations. Production companies encounter a number of challenges due to supply chain disruption on a global level, therefore many companies had to modify their operations on the domestic market and seek suppliers in their own countries. This paper and the conducted case studies aim at answering the question of how domestic manufacturing companies have responded to the current global crisis and the disruptions in supply chains they came across.

The significance of the first case study lies in the discovery that companies similar to the analyzed one need to have alternative solutions regarding the raw material procurement, and they should not be limited only to their global suppliers, but should instead foster the cooperation with the local market suppliers as well, thus avoiding the challenges arising from unpredictable circumstances, the import suspension caused by the global pandemic being one of them.



The second study leads us to the conclusion that following business strategy changes need to be carried out: to replace “delivered at place” (DAP) by “ex-works” strategy so that the production could meet the given deadlines, to reorganize the assembly process in accordance with new conditions, i.e. new procurement period, to reduce the number of elements within functional equipment with the aim to harmonize new retail price with the market demands, to improve the superstructure modularity in order to increase the sales offer, to carry out the additional selection of alternative components, principally in the critical element domain, with the goal to absorb the potential negative trends and changes in supply chains.

The analyzed studies make us conclude that the companies succeeded in adjusting their supply chains to

the modified operation conditions caused by the global crisis. There were no significant differences among companies in terms of the supply chain disruptions, and the experience forced them to redesign their supply chains, which even resulted in the modifications regarding the supplier selection processes, procurement and production processes, and company strategies.

Based on the experience of the analyzed companies, the research findings may be practically used and implemented by managers, procurement and logistics officers to identify and develop efficient supply chain management measures during unpredictable circumstances. Further studies may aim at identifying efficient solutions for supply chain risk management.

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