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STRATEGIC IMPLICATIONS OF WAR-RELATED EVENTS ON THE SUPPLY CHAINS

СТРАТЕШКЕ ИМПЛИКАЦИЈЕ РАТНИХ ДЕШАВАЊА НА ЛАНЦЕ СНАБДЕВАЊА

Summary: *The paper examines the strategic impact of Ukraine-Russian conflict on supply chains. The strategic aspect of this impact is analyzed by referring to the supply chain design and structure. The initial research question is: "How do managers reconfigure supply chains in conditions of the intense geopolitical changes?". A cross-industry analysis of supply chain design is conducted in order to identify common (global) challenges, but also certain specificities for each industry. In addition to the results of the aforementioned comparative analysis, the paper also offers certain solutions for mitigating the economic and political events negative impacts on supply chains design and structure. Also, measures were proposed to overcome bottlenecks and stagnation in supply in the analyzed industries, including: development of more flexible, efficient and resilient supply chains, diversifying supply through cooperation with new suppliers, finding new export routes, building new partnerships. In this context, the paper provides a useful framework for managers to make decisions in a complex and volatile business environment.*

Keywords: *supply chain, design, crisis, risks, disruptions*

JEL Classification: *N44, N70, Q17, Q41*

Резиме: *У раду се испитује стратешки утицај украјинско-руског конфликта на ланце снабдевања. Стратешки аспект овог утицаја је анализиран упућивањем на дизајн и структуру ланца снабдевања. Почетно истраживачко питање гласи: „Како менаџери реконфигуришу ланце снабдевања у условима интензивних геополитичких промена?“. Спроведена је међуиндустријска анализа дизајна ланца снабдевања како би се идентификовали заједнички (глобални) изазови, али и одређене специфичности за сваку индустрију. Поред резултата анализе, рад нуди и одређена решења за ублажавање негативних економских и политичких утицаја на дизајн и структуру ланца снабдевања. Такође, предложене су мере за превазилажење уских грла и стагнације у снабдевању у анализираним индустријама, попут развијања флексибилнијих, ефикаснијих и отпорнијих ланца снабдевања, диверзификације снабдевања кроз сарадњу са новим добављачима, проналажење нових извозних рута, изградње нових партнерстава. У овом контексту, рад пружа користан оквир за менаџере за доношење одлука у сложеном и променљивом пословном окружењу.*

Кључне ријечи: *ланац снабдевања, дизајн, криза, ризици, поремећаји*

ЈЕЛ класификација: *N44, N70, Q17, Q41*

INTRODUCTION

Supply chains are the blood flows of the economy, so managing them affects the economy and the society as a whole. Supply chain management is firms' capability crucial for their competitiveness (Fawcett et al. 2009; Raja Santhi and Muthuswamy 2022). Complex internal structure characterized by a large number of participants, each of which represents a system for itself, makes managing supply chains not an easy management task (Raja Santhi and Muthuswamy 2022). In addition to these internal challenges that are immanent to the supply chains themselves, the uncertainty which further complicates their management increases when large and unwanted events occur, including pandemics, wars and natural disasters (Allam, Bibri, and Sharpe 2022; Bechtold, Cruz, and Kaziny 2021; Raja Santhi and Muthuswamy 2022).

Embedded in certain external environment, supply chains are inevitably influenced by the events from that environment. Generally, supply chains' risks can be operational or disruption ones (Raja Santhi and Muthuswamy 2022). The former ones refer to day-to-day events and they are typically low-impact and high-frequency events. On the other hand, the disruption risks are major political, natural or public health-related events with low-frequency but high impact on supply chains. And as with the former ones, it is not the question whether the later ones will happen, but when will they happen (Handfield, Graham, and Burns 2020). Or as Allam, Bibri, and Sharpe (2022) say, these are ongoing events of our reality. These disruptive events affect both, the upstream and the downstream flows in the supply chains. Through various restrictions on mobility and trade, they lead to rising prices, input and output shortages. All of these are caused by disruptions, and at the same time they cause further disruptions in the supply chains.

In addition to regular strategic decisions, the design of supply chains also depends on managerial decisions and responses to the disruptive events. These responses are part of the evolution of supply chains that are changing to adapt to the environment (Handfield, Graham, and Burns 2020). So, as like the river can change its flow when it encounters an obstacle, these major disruptive events have strategic influence on the future design of the supply chains. For example, Covid-19 pandemic influences the supply chains to be designed less based on the purely cost principle (sourcing and manufacturing a low-cost locations), and more taking into account factors such as sustainability and better risk-recovery strategies.

Great challenges often caught the supply chains unprepared to react (Allam, Bibri, and Sharpe 2022). The bigger, the more intense, the more sudden the events, the greater is their impact on the supply chains. This not only because of the event itself, but also because of the fact that there are no routines and experiential practices to respond to them. Traditional supply chains management practices include risk identification and mitigation activities, but they are focused on the expected events. It is especially difficult to react to the unpredictable and sudden events, such as the Covid-19 pandemic and now Ukraine-Russia war conflict.

Given the importance of the disruptive events for the functioning and structure of the supply chains, the general purpose of this paper is to examine the basic aspects of the influence of Ukraine-Russia war conflict on the design and structure of the supply chains. With an aim to identify general challenges and supply chain management responses, but also possible industry-specific aspects, the paper is reporting the results of the analysis of Ukraine-Russia war on supply chains in oil and gas industry, food industry and pharmaceutical industry.

The remainder of the paper is structured as follows. After discussing the general implications of the disruption risks (such as war conflicts, pandemics and natural disasters) on supply chain management, the effects of the ongoing Ukraine-Russia war conflict on global supply chains from the selected industries will be analyzed. Then, the analysis is shifted towards identifying the similarities and differences in the challenges that this war conflict imposes on global supply chains in different industries, as well as in the ways in which they are responding to them. Finally, certain concluding remarks are presented.

1. UKRAINE-RUSSIA WAR CONFLICT AND SUPPLY CHAINS

1.1. Disruptive events and consequences for supply chains

Changes in the external environment such as: pandemics, geo-political changes and natural disasters usually require change of the structure and design of the supply chains. Supply chain design is a process of making decisions regarding the number, location and capacity size of production and storage facilities, the choice of suppliers, the choice of markets and the method of transporting goods (Roscoe et al. 2022). Recent developments in

the global environment raise one very important question: "*Why and how do managers redesign global supply chains under the influence of complex geopolitical and social disturbances?*" To illustrate the importance of this question, some of the main recent global challenges referring to the environmental and sustainability issues, technological disturbances and public-health related issues as well as their impact on supply chains will be elaborated.

Changes in the global market requires faster response from companies in order to adequately meet various demands of consumers, to retain them and to build a competitive advantage. Offering high-quality products, increasing added value and rapid innovation are some of the paths which companies should take in order to survive in a highly competitive market (Raja Santhi and Muthuswamy 2022). One of the changes that intensively affects the business is a sustainable development. For example, the growing importance of environmental problems has influenced the development of consumers' environmental awareness and their concern about the movement of waste (Plaza-Úbeda et al. 2020). In order to cope with all changes in the environment in an efficient and effective way, managers should first identify and analyze all the threats; and then develop ways to overcome them.

According to Grzybowska and Stachowiak (2022), modern supply chains differ significantly in terms of their structure, design and way of functioning compared to supply chains before the period of major social and geo-political changes. Noorbakhsh Samani et al. (2022) refer to three types of *new* supply chains, that is: green supply chains, sustainable supply chains and closed supply chains. Green supply chains are emerging in response to increasing consumer demands for green products and government pressures to introduce stricter environmental standards. *Greening* of the supply chain means designing all of the supply chain activities (selecting raw material suppliers, product design, production, distribution, transfer, delivery to consumers, recycling, reuse of products) in accordance with the eco-environmental criteria (Plaza-Úbeda et al. 2020). Managing a green supply chain must include a control of its impact on the environment. The goal of sustainable supply chains is to minimize the flow of materials in production and consumption processes and to reduce waste and pollution levels along the entire supply chain. The main advantages of this kind of supply chains are: increased customer satisfaction and trust, improved product quality, innovation, process flexibility, more effective cost control and reduced delivery time. Finally, closed supply chains are defined as: "the design and control of supply systems to maximize value throughout the entire product life cycle" (Zhang et al. 2021). Their focus is on the main product stream, not the waste stream. It is a network of partners that work together on product design, generation and delivery in order to improve its sustainability (Noorbakhsh Samani et al. 2022).

The fourth industrial revolution, or the Industry 4.0, has a great impact on the business world. Information technology, IoT, Cyber Physical Systems in the Enterprise Architecture (EA) and AI are some of the elements of the Industry 4.0 that change the existing business structures (Djunaedi 2019). Industry 4.0 has a major impact on supply chain structure and design as well. Although it requires major changes including horizontal and vertical integration along the entire supply chain and system automation, the final results are expected to be positive and lead to a sustainable culture in industrial supply chains (Mastrocinque et al. 2022). Supply chains based on Industry 4.0 use modern IT tools to manage supply processes, thereby maximizing their effectiveness and efficiency. In addition to improving the company's operations, modern digital and analytical tools allow simulations of the future events. In this way, business risk can be reduced and competitive advantage improved (Cyplik and Zwolak 2022). Some of the advantages of integrating the Industry 4.0 technologies along the supply chain refer to: more efficient vertical and horizontal integration of information and real-time communication, higher revenues and accomplishment of other business goals (Mastrocinque et al. 2022). The 5V's of the Big Data concept (volume, velocity, variety, veracity, and value) impact the supply chains as well (Hong, Young-Chae, and Jing Chen 2022). One of the differences between the *traditional* and the Industry 4.0 supply chains is related to the

complexity of the relationship between the participants of the supply chain. In traditional supply chains, the relationship is represented in a straight line and usually it is unidirectional (Shao et al. 2021). On the other hand, modern supply chains of the Industry 4.0 are networks of partners interconnected in all different ways. Industry 4.0 supply chains presuppose stronger relations with customers, they use digital technology and AI for developing products; and generally, there is a strong presence of the digital component in all of the supply chain activities.

The Covid-19 pandemic and the global lockdown have led to serious economic consequences, among which is the general disruption of the international supply chains (Orlando et al. 2021). The Covid-19 pandemic has had an impact that has not been seen before on the global level industry. As a response, the supply chains are restructured to be able to cope with such unexpected events. Researchers have advocated the importance of some factors to increase resilience in supply chains, emphasizing integration, collaboration and communication (Lopes, Gomes, and Mané 2022). The main tenets of the supply chain's resilience are collaboration, supply chain reengineering, agility, innovation, flexibility, visibility, sharing and trust.

The Covid-19 induced global disruption has affected every part of the supply chains. On the one hand, there has been an increase in demand for certain products, such as: pharmaceutical and medical products, food, products for primary needs. On the other hand, there was a sharp decrease in demand in other sectors; tourism and leisure, for example. These events have created an imbalance between supply and demand. Additional problems in supply chains were caused by the closure of national borders (Vanany et al. 2021). The emerging crisis has shown companies the need to design more robust, resilient and smarter supply chains. Some of the effective ways to overcome the obstacles caused by the Covid-19 pandemic are capacity decentralization, multiple sourcing, small batch production and shortening of the supply chain (supply of domestic raw materials) (Fonseca and Azevedo 2020; Lopes, Gomes, and Mané 2022). Potential solutions for redesigning the supply chains in response to the Covid-19 pandemic were also addressed by Kohl et al. (2022). They list the following: active and continuous risk management and collaborative risk management with suppliers and customers; collaborative and rapid alignment solutions with supply chains partners and real time monitoring and information sharing; collaborations with customers; a demand-driven and adaptive flow management and alternative and backup suppliers.

1.2. The impact of Ukraine-Russia war on supply chains in oil and gas, food and pharmaceutical industries

The importance of Ukraine-Russia war conflict for operation and design of supply chains is great, as of every other war conflict. But, even more, the potential of this particular war conflict to negatively influence the supply chains and the economies is even bigger because it primarily causes disruptions in two key markets; markets for primary products and resources (food), and the market for energy products. While the former *drive* the people, the later *drive* the economies.

There is no doubt about the significance of these two countries for the global economic activity. And now they are in war. Hostility between the two countries escalated into a war in February 2022. The sanctions imposed on Russia by the USA, the EU, Australia and other parts of the world already have an impact on the financial sector, the real estate sector, import and export and global supply chains (Allam, Bibri, and Sharpe 2022; Minh et al. 2022). Moreover, despite of the sanctions, a significant part of the EU imports of oil and natural gas comes from Russia. European countries still rely heavily on oil and related products from Russia, not only for fueling automobiles, but also for heating, manufacturing industries, and so on (Allam et al., 2022). And this additionally affects the EU located supply chains.

The conflict in Ukraine highlights the complex, global and interconnected nature of modern supply chains (Allam, Bibri, and Sharpe 2022). A total of 70% of Ukraine's export is realized by sea transport and the sea in Ukraine is now inaccessible as Ukrainian and Russian military forces have blocked the entrance. The areas around the Black Sea and the Sea of Azov are currently very dangerous or impassable. The danger of these areas is evidenced by reports of attacks on passing commercial ships and arrests of crews. Many companies in the supply industry have suspended delivery services from Russia and Ukraine. Container transport operations are currently at a standstill with a lot of cargo stuck in these ports. The air transport situation faces similar difficulties. Ukrainian airspace is also closed to civilian flights and airlines avoid flying over Russian airspace (Minh et al. 2022). The disruption of transport in Russia is affected by the imposed sanctions and export restrictions that the country's economy is facing (Rose, Chen, and Wei 2023). The US announced that it would ban imports of Russian oil, liquefied natural gas, and coal, while the EU declared that it would reduce its natural gas imports from Russia by two-thirds to achieve energy independence. As one of the largest energy exporters in the world, Russia is adversely affected by blockages in terms of economic growth. Additionally, blocking Russian energy resources is expected to intensify pressures on energy supply sources in other countries. These sanctions and pressures may bring about higher inflation and sluggish global economic recovery, which is likely to exert complex and far-reaching effects on global energy trade and political and economic patterns (Cui et al. 2023).

It is expected that the effects of the war will be long-term and extend along various sectors. Similar to the Covid-19 pandemic, this war conflict rises the issues such as disruptions, instability in food supply, reduction of GDP, instability in energy production (Allam, Bibri, and Sharpe 2022). When confronted with geopolitical disruptions, managers are likely to respond to risks in different ways (Roscoe et al. 2022). In order to illustrate the nature of the challenges that this conflict has imposed to the global supply chains, the analysis of three industrial contexts is performed.

1.2.1. Oil and gas industry

The war between Russia and Ukraine is becoming one of the biggest challenges for the logistics industry, affecting international supply chains by implementing various restrictions on the movement of various goods. For the supply chain partners it becomes increasingly difficult to connect with suppliers located near the war zone (Dieaconescu, Belu, and Gheorghe 2022). Russia is one of the world's largest crude oil producers and exporters (Borodin et al. 2023). Ukraine-Russian war conflict is a suddenly enacted event which has caused bottlenecks in global supply chains negatively affecting the economy around the world.

This conflict-initiated bottlenecks in the global energy supply chain is particularly felt in Germany, which relies heavily on energy supplies from Russia via Eastern Europe (Minh et al. 2022). Due to limited oil and gas exports from Russia, the EU turned to new sources of supply. In particular, the EU managed to compensate for the lack of Russian oil by restructuring traditional supply chains and connecting with suppliers from Norway, Algeria, and Azerbaijan (McWilliams et al. 2023). The negative consequences of the Ukraine-Russian war are felt on the global oil market. Disruptions in the supply of Russian and Ukrainian oil require cooperation with alternative suppliers. The main alternative sources of supply are currently Saudi Arabia and the United Arab Emirates (UAE). In part, the supply shortfall can be covered by increasing oil and gas production by over a million barrels per day in the UAE, Iraq, Kuwait and Venezuela. The lack of supply of oil and gas at the global level caused a jump in the prices of these energy products (Khudaykulova, Yuanqiong, and Khudaykulov 2022; Korosteleva 2022). In addition to the impact on the European market, disruptions in supply are also felt beyond the borders of this continent. For example, due to sanctions

imposed on Russia, China suspended investment in the Russian natural gas sector. The Ukraine-Russia war not only caused disruptions in international logistics and supply, but also changed the global supply and demand relationship for natural gas and oil. Under the influence of the Ukraine-Russia war conflict, over 1000 international companies have limited their business activities in Russia. International sanctions have changed the structure of the supply chain and many companies have to change suppliers and suspend cooperation with Russian partners (Khudaykulova, Yuanqiong, and Khudaykulov 2022).

Because the USA, the EU, Japan and South Korea imposed sanctions on Russia's oil and gas exports, the Russian national economy is experiencing a severe blow. This not only has a negative impact on the Russian economy, but also has the effect of creating an imbalance in the supply and demand for oil and gas globally (Cui et al. 2023). Due to the imposed sanctions and the reduced possibility of exporting oil and gas to the European market, Russia had to turn to other markets and redirect its supply chains to other countries. Consequently, Russia has redirected its energy flows to developing countries such as China and India. Most of the oil and gas is exported to these countries, but at lower prices. This is not an ideal solution for Russia, especially from a long-term perspective, because the Asian market is only a fraction of the EU market, which was the main export market before the conflict. Another obstacle that arises when it comes to redirecting the supply of Russian oil to Asia is the limited logistics capacity and infrastructure. This change in the structure of the supply chain requires the construction of new pipelines and terminals (Korosteleva 2022).

1.2.2. Food industry

Food is one of the most traded commodities, and the war conflict in Ukraine has caused disruption to global food supply chains. The availability and supply of a wide range of raw foods and ready-made food products is at risk, and global markets have recently seen a rise in food prices. Furthermore, this conflict has negatively affected food supply chains and it caused significant shifts in demand between nations that rely on imports from Ukraine (Jagtap et al. 2022). The consequences of the military actions affect the ability to transport agricultural products within and outside the borders of Ukraine, especially due to the fact that the ports and railways have been destroyed or not operating. The initial impact of the war conflict on the food industry was reflected in the reduction of the grain transport from Ukraine. This is due to the fact that as much as 95% of grain is exported by sea via ports (Ben Hassen and El Bilali 2022). Jagtap et al. (2022) point out that Ukrainian agricultural industry is highly dependent on fuel imports, with about 70% of gasoline and diesel imports coming from the Russian Federation and Belarus. This represents another limitation for the efficient functioning of the agriculture and the food industry.

Then, in the war events there is a danger of increased fraud in the market (Jagtap et al. 2022). For example, evidence shows that there is a replacing of expensive species of fish with species of lower quality and value, mislabeling the geographical origin, labeling cheaper farmed fish as more expensive fish caught in the wild, or labeling fish that is traditionally farmed as more valuable ecological or organic varieties. Since seafood (including white fish such as Atlantic cod and haddock seafood) is among Russia's largest agricultural exports, restrictions on Russian exports of these products are likely to affect supply and increase fraud.

Another problem that arises as a result of current geopolitical events is the difficulty in supplying organic fertilizers. For the global economy to remain resilient to the shocks in the supply of organic fertilizers and agricultural products, countries, especially those heavily dependent on exports from Ukraine and Russia, should begin diversifying food production alternatives and supply sources. The war between Russia and Ukraine and especially the sanctions imposed on Russia led to the disconnection of these countries from the global market, thus limiting the production and export of essential organic fertilizers (Shahini et al. 2022). Ukrainian farmers and food producers are struggling to maintain food supplies.

However, it is not only about the needs of Ukraine citizens. Ukraine is a major exporter of food, especially in certain countries of Africa and Asia (Rabbi et al. 2023). According to the United Nations, the number of people on the brink of starvation will increase by 47 million in 2022.

War events in Ukraine affected the quality and prices of food products on the local and global markets. Food prices were rising even before Ukraine-Russia war conflict, which was caused by pandemic COVID-19, bad weather conditions and a poor harvest that reduced the supply of these products. In the current political and economic conditions, their unavailability and deficit on the supply side are the main factors of the increase in prices of agricultural products (Alexander et al. 2022; Shams Esfandabadi, Ranjbari, and Scagnelli 2022). Faced with numerous obstacles, farmers, food producers and exporters are trying in various ways to revive foreign trade. For example, in July 2022, Ukrainian economy managed to export three million tons of agricultural products via the Black Sea despite the Russian port blockade. From the beginning of August of the same year, the sea route was reopened and Ukrainian agricultural trade revived (Alexander et al. 2022; Jagtap et al. 2022). On the other hand, no grain is exported from Russia. Moscow claims that Western sanctions on its banking and shipping industries are making it impossible to export food and fertilizer. As for food quality, it can be compromised because food companies are often required to omit or replace certain ingredients or change the production process and find alternatives in the short term, which can reduce product quality (Jagtap et al. 2022).

To summarize, the main effect of Ukraine-Russia conflict in the food industry refers to reductions on the supply side of the market (both, the raw materials and finished goods). This is caused by disrupted or interrupted physical (transport) and financial flows (due to sanctions) and results in inflation, reduced or suspended production of related products in countries that are import dependent on Ukraine/Russia, and, the most severe consequence: famine in African countries.

1.2.3. Pharmaceutical industry

In addition to the consequences imposed by the global Covid-19 pandemic, pharmaceutical supply chains are facing another serious setback due to this Ukraine-Russia war conflict. Although the Russian pharmaceutical industry was not directly sanctioned, the negative impact of the political situation is felt in various sectors of the economy that are related to this industry. For example, there were huge difficulties in the production of various packages for medicines and their supply, that is, there were interruptions in the supply chains (Ismailov et al. 2022).

What is specific to Russia's pharmaceutical market is that over 70% of pharmaceutical products are imported. The war crisis has a stronger influence on the pharmaceutical industry in Russia, compared to Ukraine. Namely, the deterioration of foreign trade relations led to a serious shortage of certain imported drugs, which led to the need to strengthen Russia's pharmaceutical capacities. However, this practice is difficult to achieve due to the lack of modern technology in this sector and low investment activities (Zyukin et al. 2021). The sanctions imposed on Russia caused disruptions in the pharmaceutical supply chains. This situation has put pharmaceutical companies in a not so enviable situation (Mishra et al. 2022). One way for pharmaceutical companies to mitigate the risk of further supply chain disruptions is to move to a digital supply chain. Traditional supply chains lack the real-time data visibility and robust reporting necessary for the optimal functioning of a global pharmaceutical supply chain that must deal with new supply bottlenecks, regulatory changes and compliance needs. These factors hinder the exchange of information and cooperation that is critical to countering the impact of war and other disruptions in the pharmaceutical supply chains. Digital supply chains are more efficient than traditional ones for many reasons. For instance, digital supply chains have a built-in system that controls and monitors stock levels in real time,

synchronized scheduling, provides quick and accurate information on warehouse operations, assists in the process of planning and improving overall company performance and helps maintain customer relationships by flexible and dynamic order processing, smart delivery and digital platform of information exchange. Digital supply chains are more precise and efficient than traditional ones, giving company managers superior power over business maneuver (Lee et al. 2022; Mielcarek and Piekarczyk 2023).

It can be concluded that the main consequences of this conflict are visible on the market of the pharmaceutical industry in one of the conflict participating countries, in Russia. These consequences refer to the disruption in supply due to the interruption of import flows caused by sanctions and Russia's high import dependence, both in terms of final products, but also in terms of inputs for own production in this industry. Moreover, in conditions where there is no continuous inflow from the upstream part of the supply chain (limited imports) and due to inadequate insight into the state of flows and stocks in certain parts of the supply chain in the country itself, delays, lengthening of the lead-time and additional shortages occur.

1.3. General findings on Ukraine-Russia war effects on supply chains in different industries

The analyzed examples indicate a very important common characteristic of the impact of this war conflict on supply chains. Namely, the primary interruption that occurs in supply chains is the interruption of the supply of inputs, which causes interruptions in production and leads to disruptions on the whole supply side of the market. Unlike the impact of the Covid-19 pandemic, when the impulse for interruptions in a large number of cases came from the demand side, in the cases analyzed in this paper, the negative impulse in the supply chains come from the supply side. And this is what the supply chains in the analyzed industries have in common. On the other hand, the geographical scope of the negative impacts that this particular war conflict has on supply chains differs across industries. While in some cases the negative impact from directly affected countries spilled over to other countries (energy, food), in other cases the impact was less *exported* (pharmaceutical industry).

Due to the interruptions of the physical flows (transport) and restrictions on international trade (sanctions), this war conflict has caused interruptions in the supply and production of two key drivers of the economic and social flows – energy and food. Bearing in mind that the conflict involves countries that are globally significant exporters of raw materials and energy, disruptions and/or restrictions which affect them affect all related countries and supply chains. With the most immediate consequence that this situation has led to, which is related to shortages (restriction on the supply side), the conflict has started a spiral of negative effects that are manifested in the form of rising prices, consequent reduction in demand and possible larger-scale economic crisis. Although this war conflict is geographically limited, the fact that the major global energy and food exporters are involved affects global supply chains, to the extent that they are connected to the direct participants in the conflict.

The conflict between Russia and Ukraine has caused disruption in various industries' supply chains. Although the future is unpredictable, businesses need to be proactive and consider how the situation may evolve over time and what scenarios might arise. Conducting risk assessments of the strategic suppliers to minimize supply chain disruption is essential, as is a full assessment of labor and inventory levels for short- and long-term planning to prevent potential future disruption (Orhan 2022). Potential solutions to mitigate disruptions in the supply chains may be (Paché 2022; Shteynberg et al. 2022):

- adopting policies that increase the resilience of critical supply chain's elements – this includes testing supply chains and investing in infrastructure and business ecosystems

that support geographical diversification or local development and production of key materials and components;

- manufacturers should adopt risk mitigation tactics – this may include identifying multiple suppliers for key components, increasing safety stocks and bringing critical suppliers closer together;
- taking advantage of new opportunities – there is an opportunity for companies to fill the gaps created by instability, creating new business models. Companies should start collaborating to increase capacity and to develop the best-in-class agile competencies.

CONCLUSIONS

Supply chains have become increasingly complex, both in terms of geographic scope and in terms of scope of their activities. Being a part of an efficient and effective supply chain has become a key factor of growth and competitiveness for many companies and national economies (Grzybowska and Stachowiak 2022). At the same time, supply chains are sensitive to changes in the environment, especially when the changes are sudden.

The world economy, which has not yet managed to fully recover from the consequences of the Covid-19 pandemic, is faced with new challenges caused by the war conflict between Russia and Ukraine. These countries have major impact on the global economy, given their share in the global supply and exchange of oil, gas, food and pharmaceutical products. Observing the changes in the supply chains that this war conflict has caused, common to the analyzed industries are the interruptions in the supply and the appearance of bottlenecks. This is a consequence of the sanctions imposed on Russia and the closure of the main export routes on the Ukrainian territory. One way to overcome supply bottlenecks within the oil and food industry is to develop new partnerships and identify alternative international trade sources and routes. Digitalization of the pharmaceutical industry is seen as a possible solution which will ensure more efficient and faster data flows within this industry's supply chains.

Thus, this war conflict has caused and is still causing major changes in the structure and functioning of the supply chains in various industries. Limitations imposed on the international trade have negative consequences for the global economy. The global market is still in the process of finding the most effective solutions to overcome emerging problems. There is no single solution, but turning to new sources of supply, increased independent production, investment in new infrastructure and more rational use of the existing capacities stand out as the best ways now available.

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