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# Global supply chains' disruptions as a result of the COVID-19 pandemic crisis and the dynamic world container shipping market recovery

## *Zakłócenia globalnych łańcuchów dostaw wskutek kryzysu wywołanego pandemią COVID-19 oraz dynamicznego ożywienia rynku żeglugi kontenerowej*

***Abstract***

The world crisis caused by the pandemic exerted significant impact on the global supply chain operations. They were subjected to numerous unprecedented disturbances which then significantly intensified as a result of the unexpected, dynamic recovery of the global container transport market. The aim of the article is to attempt a multifaceted initial assessment of the scale and widespread results of the destabilization of markets and global logistics supply chains, as well as to determine its impact on the global economy, along with an indication of the possible short- and medium-term consequences of this state for selected entities operating in global supply chains. The main hypotheses which were verified during the study were as followed: (1) the COVID-19 crisis impacted the global commodity and shipping markets with unprecedented and unknown so far force, (2) the global container shipping sector experienced historical boom during the period from October 2020 to March 2022 and was in fact a real financial beneficiary of the last crisis. The methods of economic and statistical analysis and among them the factors analysis (FA) have been used as the main analytical tool to carry out the set research goals and to verify the hypotheses. The results of this study indicate the need for greater control of the global container shipping alliances by antitrust authorities as well as for deeper structural reconstruction of the existed global logistics supply chains.

***Keywords:***
supply chains disruptions management, container shipping market, freight and charter indices, resilient digitalized supply chain

***Streszczenie***

Światowy kryzys spowodowany pandemią wywarł znaczny wpływ na globalne łańcuchy dostaw. Zostały one poddane licznym, niespotykanym dotychczas zakłóceniom, które następnie nieoczekiwanie nasiliły się w wyniku niespodziewanego, dynamicznego ożywienia globalnego rynku przewozów kontenerowych. Celem artykułu jest podjęcie próby dokonania wstępnej, wieloaspektowej oceny skali i skutków nieznanej dotychczas w historii rozwoju handlu i żeglugi światowej destabilizacji rynków oraz globalnych logistycznych łańcuchów dostaw. Sformułowano dwie hipotezy badawcze, które następnie poddano weryfikacji: (1) kryzys COVID-19 wpłynął na światowe rynki towarowe i żeglugowe z nieznaną i niespotykaną dotychczas siłą, oraz (2) globalny sektor żeglugi kontenerowej doświadczył w trakcie jego trwania w okresie październik 2020–marzec 2022 historycznego boomu i był realnie beneficjentem finansowym ostatniego kryzysu. Metody analizy ekonomiczno-statystycznej, a wśród nich analiza czynnikowa (FA), zostały wykorzystane jako główne narzędzie analityczne do realizacji założonych celów badawczych i weryfikacji postawionych hipotez. Uzyskane wyniki wskazują na potrzebę większej kontroli globalnych kontenerowych aliansów żeglugowych przez organy antymonopolowe, a także głębszej, strukturalnej przebudowy istniejących globalnych logistycznych łańcuchów dostaw.

***Słowa kluczowe:***
zarządzanie łańcuchem dostaw, rynek żeglugi kontenerowej, indeksy frachtowe i czarterowe, odporny cyfrowy łańcuch dostaw

JEL: E32, I13, L43, L91, R41

## Introduction

The global economic crisis caused by the COVID-19 pandemic appears to be the black swan, and not as before, a huge financial crisis or a sudden economic collapse in a particular region in the world (Taleb, 2008). Hence, there are different than the previously known and brought, and also different in their form and nature, types of reactions to the crisis from countries and global supply chains operators to eradicate the negative economic phenomena (JLL, 2020; Roland Berger, 2020). Furthermore, these events occur in different than previously known circumstances for the global economy which has entered further into the development of 4.0. industry based on digitization, while gradually implementing the development model typical of the sharing economy (Greenspan, 2008). The real and regulatory sphere of global economy has significantly changed, including its ability to respond to crises (Gay & Morgan, 2013).

It resulted from the progress made in the area of economic deregulation and market liberalization as well as the expansion of outsourcing and offshoring, and the implementation of digital solutions. These processes were accompanied by closer relations between transnational corporations and companies, and thus increasing inter-relations between them. These were reflected by the development of supply chains, including global value chains, through which approx. 79 per cent of the world trade value, amounting to 18.1 billion USD, was transferred in 2019 (WTO, 2021). The processes of economy integration and individual rather fragmented types of markets have also intensified, with, to the greatest extent, the freight and transport markets.

However, these processes and phenomena have generated new risks, not always vivid and clear in the era of prosperity (Greenspan, 2008; WEF, 2021). They were often underestimated; entities often failed to take appropriate actions to effectively manage the risks and changes that occurred in the real-world economy and global supply chains (WTO, 2021). The global crisis caused by the coronavirus pandemic has had a profound impact on most global economy sectors, including the transport and logistics sector. They are most visible in the area of global supply chains operations and management since these supply chains were subject to numerous, multifaceted disruptions (Mangan *et al.*, 2009). These disruptions caused by the pandemic in the first half of 2020 were intensified, which is a paradox in the current crisis, by rapid and increasing since September 2020 revival of the global container shipping market which constitutes one of the key links in the global supply chain. The scale of the effects arising from this recovery caused by the increase in demand, and the response from the carriers revealed not only the strength of this sector, resulting from the degree of its concentration (the strength of shipping alliances operating in the oligopolistic market), clearly focused on the implementation of corporate goals, but also many of its weaknesses (Grzelakowski, 2022b).

Such a rapid recovery in one link of the global supply chain, which was not fully prepared for such situation, not only failed to create an impulse to improve the movement of goods — an increase in flexibility and the expected resilience of the global supply chains to the crisis phenomena but caused their deeper destabilization. The scale of its financial, economic and social effects that were revealed, seriously threatened stabilization of not only selected sectors but also the entire system of the world economy.

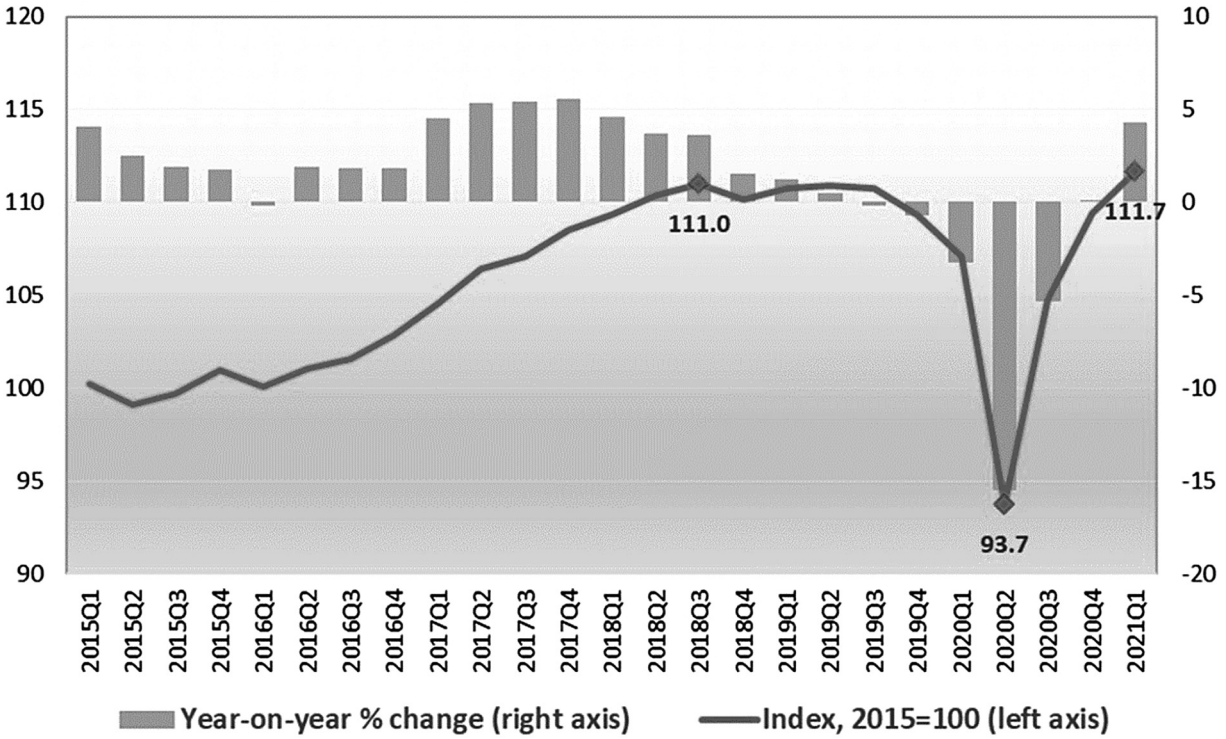
## Global economy in the era of pandemic — disruptions in global trade and global supply chains

The effects of preventive measures taken by particular countries, aiming to limit the spread of COVID-19 have been revealed not only on a micro and macro, but also on the mega scale. In the macroeconomic context, the aggregated effects of fighting the pandemic were revealed mainly as a significant decrease in GDP and employment. Numerous countries recorded a negative GDP growth rate, mainly in the first but also second quarter of 2020 (Roland Berger, 2020). As a result, on a yearly basis, global GDP fell below 4 per cent compared to 2019 yet leading to grave economic consequences in most countries (UNCTAD, 2021).

The dynamics of the decline in the volume of world trade was not as dramatic as it could be expected The volume of merchandise trade dropped by 5.3 per cent in 2020 while real GDP at market exchange rates declined by 3.6 per cent. However, the value of merchandise exports fell by 8 per cent in 2020 to 17.58 trillion USD while commercial services exports dropped by 20 per cent to 4.91 trillion USD (WTO, 2021; UNCTAD, 2020b). This type of relationship between the global trade and world GDP is presented in Figures 1 and 2.

Figure 1

World merchandise trade volume, 2015(Q1)–2021(Q1)

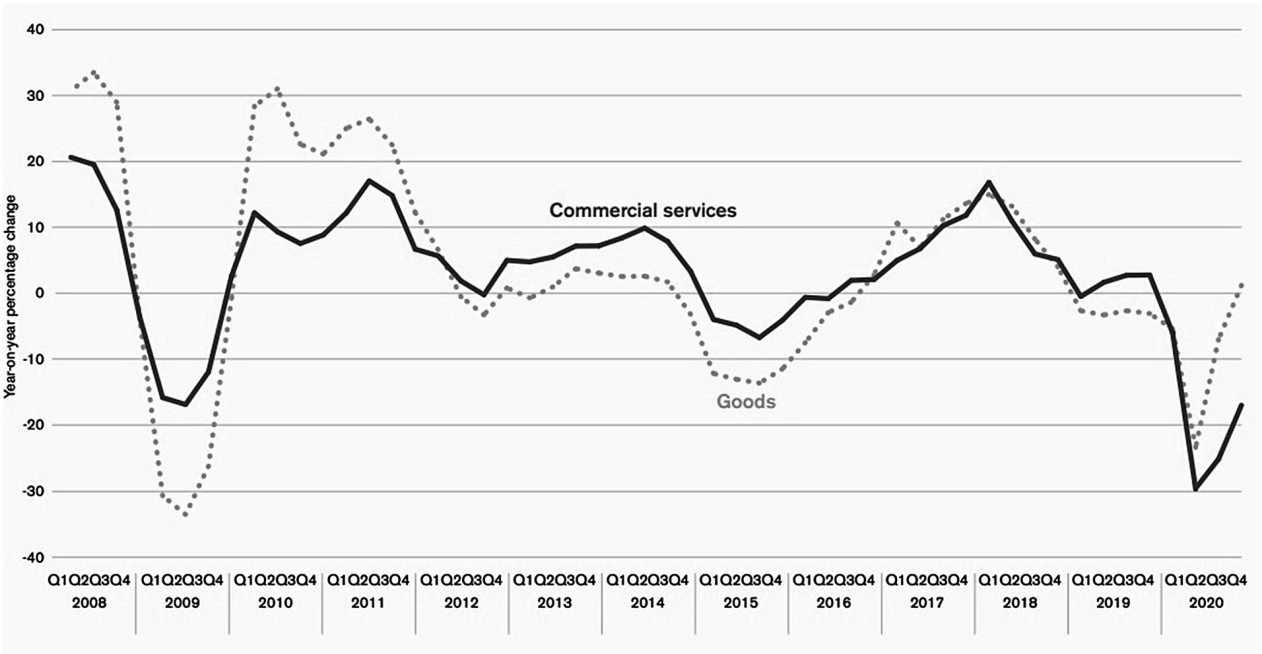



Volume index 2015 = 100 and year-on-year percentage change.

Source: UNCTAD, 2021.

Figure 2

Trade in goods and services experienced a deep slump in 2020 due to COVID-19 pandemic




Source: WTO, 2021.

Global merchandise trade volume jumped 11.4 per cent in the third quarter of 2020 compared with the previous quarter and another 4.4 per cent in the final quarter, bringing the volume of trade back to its level of the fourth quarter of 2019 (UNCTAD, 2021). This resulted in a strong increase in the demand for container transport in the global scale.

The most severe impact of the pandemic on the world merchandise exports in value terms was felt in the second quarter of the year 2020, when services trade dropped by a record 30 per cent as travel and global transport as well as logistics sector were severely affected, while goods trade fell by 23 per cent, both in value terms. This trend is depicted in Figure 2.

Significant asymmetry in time and in the spatial aspect of occurrence, i.e., the appearance and intensification as well as phasing out of crisis phenomena on a global scale in the conditions of far advanced globalization and integration of production and consumption centres and internationalization of the trade and logistics sector, have had a significant, destructive impact on the supply chains operations (WTO, 2021), In fact the following supply chains have been hit the hardest by the pandemic: (1) fuels and mining products — 23.9 per cent, (2) products of automotive industry — 16.4 per cent (WEF, 2021). Similar to the strong declines in turnover, the effects resulted from unexpected and rapid increases in demand for certain goods. In this aspect, it mainly concerned the following supply chains: (1) medical products and personal protective equipment — 47.2 per cent, (2) textiles — 16 per cent (WTO, 2021).

With the ongoing pandemic, a large number of SCM operators and professionals experienced disruptions that forced them to change their strategies (FinancesOnline, 2021; RetailNext, 2021). Based on the survey research conducted at the end of 2020, it can be concluded that (RetailNext, 2021):

1) 56 per cent of SCM professionals experienced moderate disruptions,
2) 32 per cent of SCM professionals experienced little disruptions,
3) 12 per cent of SCM professionals experienced heavy disruptions.

Interos' Annual Global Supply Chain Report based on the survey conducted among 900 senior SCM decision makers interviewed in April and May 2021 reveals that the global supply chain disruptions are costing large organizations about 184 million USD in lost revenue annually (Interos, 2021). It has been discovered that 83 per cent of those companies suffered at least some reputational damage because of the supply chain issues and 66 per cent are not currently assessing their global supply chain on a continuous basis. Finally, 74 per cent of these companies still rely on manual methods of assessing their supply chains and the related risks (Interos, 2021).

The financial impact of supply chain disruptions varied depending on the region of the world, with the average cost being 228 million USD in the U.S., compared to 145 million USD in DACH[1]. The U.S. companies give higher priority to the supply chain risk management given the potential negative financial burden (RetailNext, 2021). However, the damage to organizations due to the supply chain disruption goes beyond the purely financial aspects. It can also lead to "reputational damage," In the report conducted by Interos it was pointed out that four-fifths of companies suffered some damage to their reputation directly due to the supply chain related issues. For this can lead to a greater financial cost to organizations through the loss of confidence and trust from existing customers, lack of new business opportunities and other aspects, This, combined with the existing financial burden of supply chain disruption, further emphasizes the pressure exerted on organizations to effectively monitor and ensure the robustness of their supply chains (Baker McKenzie, 2020).

The list of disruptions and weaknesses identified and specified in the reports, links in the area of supply chains revealed during the crisis caused by the pandemic in 2020 and 2021 is much longer than the issues mentioned above. In most cases, these include periodic suspension of production and limited possibilities to change the production potential, disruption in the maritime, air, rail and road transport operations, as well as the supply of logistics services, access to raw materials and other materials (components, semiconductors, trade restrictions, etc.) (Citi, 2021). However, one of the most severe type of disruptions, noticeable in the economic and financial aspect, was the increasing freight in maritime transport, mainly the container transport, observed since September 2020 (Grzelakowski, 2022a). The scale of this growth was so significant that it led to serious deformations in the global supply chains operations in the era of the increasing recovery of global economies, threatening, at the same time, the generally evident processes of economic recovery and continuous economic growth (WEF, 2021; Baraniuk, 2021).

## The global market of container and freight maritime transport as a link in the supply chain

Maritime transport plays a vital role in the modern global economy and the development of

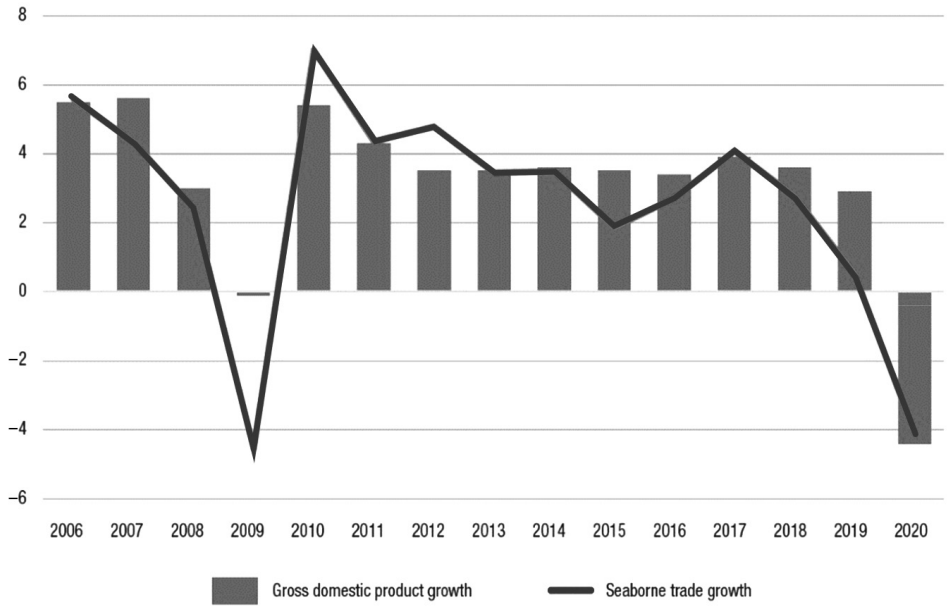
global supply chains, co-defining to a considerable extent the efficiency of the smooth flow of goods traded internationally. More than 82 per cent of the world trade volume is transported by sea (11.01 billion tons in 2021). With an average distance of one ton of cargo transported over a distance of more than 5,230 nautical miles, it means that by ton-miles, global maritime transport is responsible for 92 per cent of the world trade (UNCTAD, 2021). Compared to 2010, the transport volume increased by 40.5 per cent and was almost 3.9 times higher than in 1990. Since 1970, maritime trade (2.6 billion tonnes) has increased on average by more than two per cent a year, and the rate of growth has outdistanced the rate of growth of the world GDP and the industrial production of OECD countries but was lower than the rate of growth of the world trade (between 2000 and 2020 it amounted to more than 7.0 per cent). Figure 3 indicates strong correlation between the global maritime transport market and the world economic situation.

The highest rate of growth can be observed in the high-value cargo transported in containers. Between 1990 and 2014, this increase totalled on average 8.1 per cent. However, between 1985 and 2010, the share of this technology in the global volume of maritime trade increased as much as threefold, and between 2000 and 2020, it more than doubled (in 2000 it totalled only 8.5 per cent, and in 2020 already 17 per cent, i.e., 1.9 billion tons).

In 2019, compared to 1990, the maritime trade freight weight transported in containers increased by 770 per cent, while the increase in dry bulk transport amounted only to 360 per cent and liquid fuels 166 per cent. In 2020, 145 million TEU (in 2019 — 152 million TEU) was transported by sea, which means that in 2019, seaborne transport carried 3.4 times more containers than in 1996 (45 million TEU). Whereas in 2019, seaports handled in total 811.2 million TEU, i.e., 16 million TEU more than in 2018, and in the critical 2020 there was a drop to 145 million TEU.

In terms of value, the global maritime freight container transport accounts for approx. 60 per cent of the total value of maritime transport estimated in 2019 at 14 billion USD (Statista, 2021). Importantly, in terms of value, their share in handling the global trade indicates a constant, high rate of growth. As a result, the value of global maritime container transport market has systematically been increasing. As per the estimates of 2021, in 2027 it should reach the value of 12 billion USD (UNCTAD, 2021; WTO, 2021; Grzelakowski, 2022b).

Figure 3
The rate of growth of global maritime transport and world GDP between 2006 and 2020 (changes year to year in percentages)




Source: UNCTAD, 2021.

## Disruptions in the sector of global maritime container transport and their effects on the global supply chains

The course of crisis caused by COVID-19 pandemic, asymmetrical in the spatial and time--related context, as well as various economic effects it caused in particular economic sectors of crisis-ridden countries, which were consequently more significantly reflected in global economy, also affected, to a substantial extent, the maritime transport sector, and particularly the container transport during the first wave of the pandemic. However, the reasons for this situation refer to other non-transport links in the supply chain (Grzelakowski, 2022b).

Since in the first months of the COVID-19 pandemic, the production was closed or significantly limited in numerous production plants, which considerably contributed to the decrease in commodity supply. Furthermore, lockdowns led to rapid slump in retail trade. Then, as the restrictions were gradually lifted, we could observe rather rapid, unexpected recovery in trade and production. However, other links in the global supply chain, including maritime transport sector, were not prepared for these new challenges (Koerber, 2020).

For the first wave of the pandemic led to limiting the activities of numerous ports and excluding a considerable number of containers from operation. Numerous seaports and container hubs were closed due to sanitary restrictions. In this situation, to reduce the operating costs the container operators slowed down the transportation and at the same time withdrew many vessels from operation. In these conditions, hundreds of thousands of full containers were kept on ships that served at that time as warehouses, or on storage yards in port terminals (e.g., the Chinese ports of Ningbo and other). Whereas empty containers remained in those ports where their transfer cycle was suspended due to the pandemic. The inability to continue transportation to the ports of the exporting countries, in particular to China, due to the collapse of the container ships schedule (blank sailings), and the increasing port congestion, which prevented the unloading of full containers in various parts of the world, caused the collapse of the existing and efficiently operating container turnover system (CEVA Logistics, 2020).

This phenomenon has significantly deepened the already existing chaos in the global container transport sector, leading to an (artificially) created shortage of containers and serious disruptions to the supply chains (DHL, 2021). And so, at the beginning of the fourth quarter in 2021 in the Californian ports of Los Angeles and Long Beach, handling 40 per cent of the containers transported by sea in the US export and import, dozens of ships with 500,000 containers await unloading (Source Today, 2021b). To relieve the congestion, the working time was extended to 24/7. In the British port of Felixstowe, handling approx. one-third of containers imported to Great Britain by sea, at present at least 50,000 containers await unloading and receipt. At Felixstowe, with the chronic shortage of drivers, the average time between unloading the containers from ships and collecting them by trucks extended to 10 days, although by standard it takes 3 to 5 days, and the container ships have to wait up to seven days to enter the port and unload the containers at the terminal. The said situation is only slightly mitigated by the carriers who redirect their ships (e.g., Maersk) as much as possible from Felixstowe to other, less congested ports in Europe. However, these operations generate additional costs for all the participants within the supply chain (JLL, 2020; Habert & Braun, 2020).

Therefore, after one and a half years since the outbreak of the COVID-19 pandemic, the capacity of seaports and container terminals has significantly decreased, which led to the accumulation of previously observed, on a relatively large scale, backlog and delays of supplies and, consequently the unprecedented collapse in the supply chain system on a global scale. This situation affects to a larger and larger extent all entities in the supply chain. It is difficult to restore smooth supply operations quickly in this area because never before has there been such a paradoxical situation where the fully operational ports block the supply chains and these in turn block the ports. This deadlock significantly delays the possibilities to restore balance in the supply and container turnover sector in the global supply chain system (Sea-Intelligence, 2020).

It is estimated that worldwide there are more than 170 million shipping containers, used to transport about 90 per cent of high-value cargo in the global trade. Hundreds of thousands of them — both empty and full — are still, as it has been emphasized, stuck in the ports of the US, Europe and China, hindering trade and disrupting the supply chain operations. To take advantage of the current boom, the container carriers order new containers. The world's largest container manufacturers, China International Marine Containers (CIMC), Dongfang International Container and CXIC Group, are struggling to

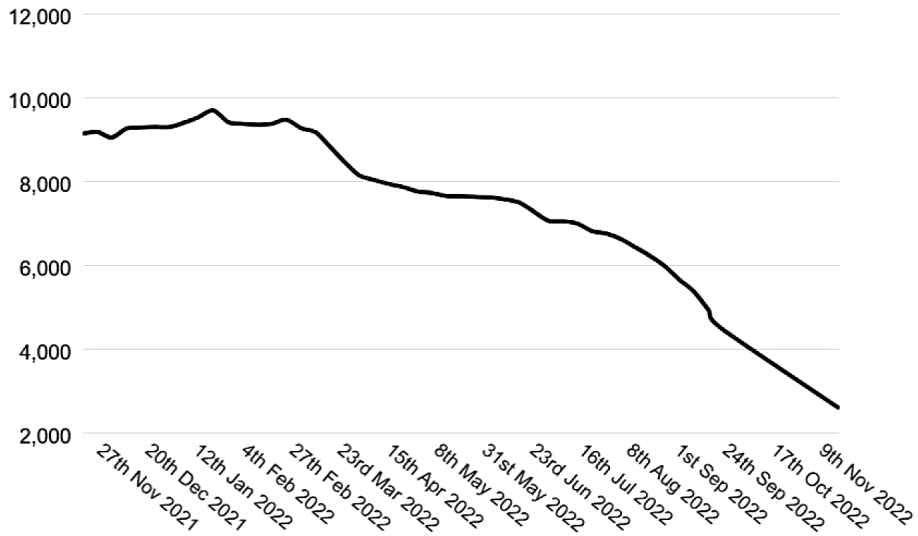
meet this increasing demand. The Chinese triad of manufacturers, producing more than 90 per cent of the world's containers, will produce a record 5.2 million TEUs in 2021, i.e., two-thirds more than in 2020. However, despite their growing overall number, the rates of container rental by carriers and forwarders are increasing exponentially, which consequently contributes to a further increase in freight and charter rates. Already in mid-2021, the costs of transporting 1 TEU from China to Europe increased by 600 per cent compared to their average level in 2019 (Logan, 2021; Leggen, 2021). This rate of growth in longer period is presented in Figure 4.

The Drewry's WCI composite index of 2,879 USD per 40-foot container of November 9th, 2022, is 74% below the peak of 10,377 USD reached in September 2021. It is 18% lower than the 5-year average of 3,747 USD, indicating a return to more normal prices, but remains 119% higher than average 2019 (pre-pandemic) rates of 1,420 USD (Grzelakowski, 2022a).

The data from container shipping markets which reflects charter and freight indices shows that since October 2020 the container shipping industry has been booming under the strain of high demand. The carriage of 40-feet container from Asia to Europe costs 17,500 USD, more than ten times the price of the previous year (Logan, 2021; S&P Global Platts, 2021). Additionally, some shipping companies are charging premium rates to guarantee delivery within a few weeks. Many importers are also attempting to outbid one another, offering extra cash to snap up containers over their rivals (Source Today, 2021a).

Consequently, global container operators are the short-term financial beneficiaries of the ongoing shipping boom. By obtaining unprecedented revenues (in 2021, Maersk Line estimates them at 16.2 billion USD), they are investing on a huge scale in new tonnage which in the next two years will significantly increase the potential supply of services in the global freight market, restoring its currently distorted balance. The tonnage investments by container shipowners are boosting the economic situation in the global shipbuilding industry which was earlier also significantly affected by the crisis, mainly in China and South Korea. The operators also undertake large-scale pro-ecological investments, while supporting the digitization processes in the global supply chains by implementing blockchain technologies and AI and developing digital platforms such as ShipLane. Consequently, their actions lead to the recovery in sectors closely related to the operators' activity. These actions may bring the desirable effects in the medium term. Whereas within a short time, they will not mitigate the severe effects observed among other entities in the global supply chains, caused by the scale of disruptions this entity generated facing serious market, logistics and operational challenges — mainly for the trade, but also for the production and supply sectors.

Figure 4
The rate of growth of Drewry's composite World Container Index in the period November 27th, 2021 to November 9th, 2022 (USD/40ft)




Source: https://www.drewry.co.uk/supply-chain-advisors/supply-chain-expertise

## Discussion and the recommended direction towards global supply chains restructuring

The pandemic crisis has significantly affected the global supply chains and caused serious disruptions, leading to their far-reaching destabilisation and disorganization. As a result, currently it is absolutely necessary to rebuilt them, because most of them lost their agility and flexibility, and consequently the ability to respond to rapid changes in the global environment. Loss of their resilience and visibility had a significant impact on the global transport, mainly maritime transport handling over three fourths of the world trade freight volume.

In this situation, actions were taken to redevelop and improve them in terms of increasing their resilience and visibility. Since it turned out that many configurations of the global supply chains are very sensitive and are characterised by poor response to the emerging threats and require replacing them with different structures other than the typical ones from the beginning of 2020 (Grzelakowski, 2022a).

In addition to the obvious needs for change in this area to effectively respond to crisis related challenges, at the heart of the currently undertaken large-scale actions aimed to reconstruct the supply chains, there is a conviction that the current crisis, like any such meltdown, always creates new impetus and opportunities for innovative solutions. The principle "Never waste a good crisis" also refers to the supply chains in the era of COVID-19, stimulating the need to rebuild them, often in a difficult and time-consuming way. It is commonly believed and accepted that their structural reconstruction is indispensable. The key thereto involves meeting not only the requirement of different approach to reconstructing the formula and the supply strategy and often the distribution channels, but also the requirement of reshoring, namely stronger orientation to the closest environment (regionalization). There is also the need to develop a new cost-related model of the supply chain and the formula of its effective operation (Grzelakowski, 2022b).

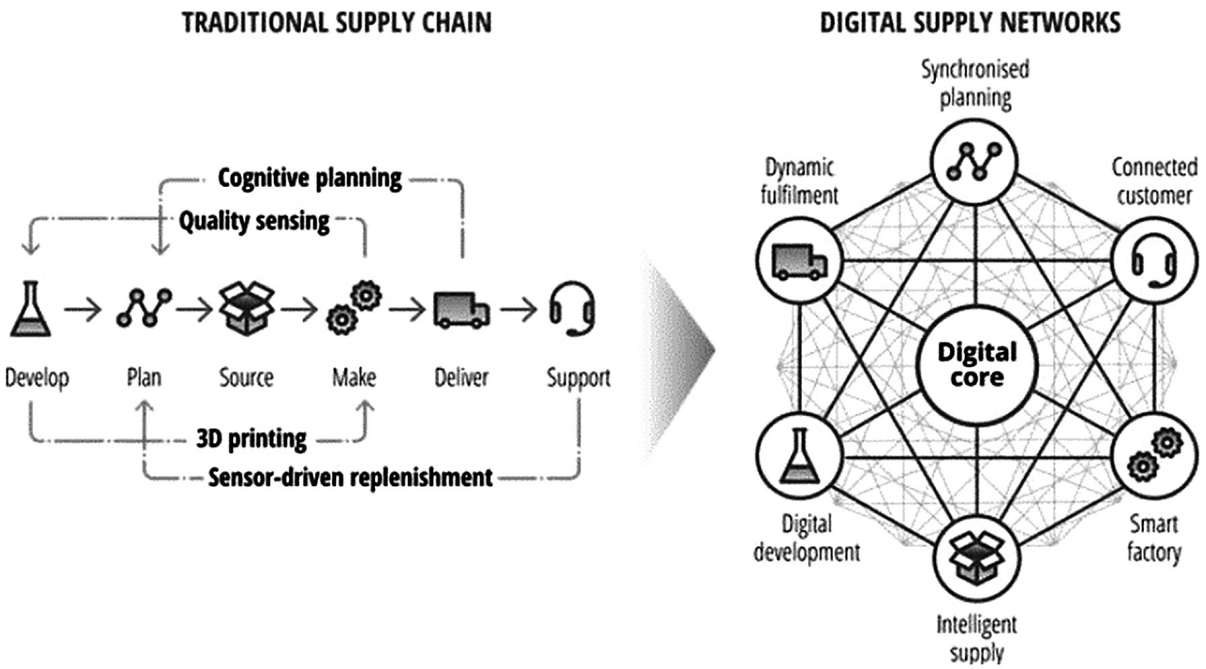
At present, in the era of industry 4.0 and widespread digitalisation, the digital solutions within the newly constructed supply chains are crucial. However, the digital supply network must be adjusted to the company business strategy, constituting its integral part at the same time. Moreover, risk management must be a coherent component of such project since risk management and business continuity also constitute an integral element of the overall business strategy. From the perspective of adopted risk management model, the key to success also involves developing a resilient supply chain. This chain not only seeks to reduce the risk on its own, but also has the ability to quickly adapt to unpredictable disturbances and restore the state of balance within the global supply chain. In this context, the newly created supply chains should be strongly oriented toward the contemporary challenges generated by globally accepted strategy of sustainable development as well as supported by the promoted concept of circular economy. Taking into account the above, it should be noted that the new trend in the reconstruction of global supply chains should be directed towards their reconstruction corresponding to the digital and circular supply chain model (JLL, 2020; FinancesOnline, 2021). Figure 5 presents the structure of linear and digital supply chain which dominates nowadays in the global logistics scale. However, it turned out that there is a need for its further reconstruction.

The implementation of a sustainable development strategy in the global economy requires the construction of a circular economy. It forces the transformation of traditional linear, partially digital global logistics supply chains into circular and fully digital supply chains. Figure 6 presents the simple structure of such a supply chain that could cope with the contemporary requirements and challenges of the global trade and container shipping development, supporting at the same time the further growth of the global economy as well as improving the quality of life of the global society.

These days, the supply chain digitalization and including the supply chain into the circular economy is perceived as an effective and rationale way to develop the strategy aimed to achieve the required resilience, visibility and operational effectiveness as well as efficiency of global supply chain. This is currently the only strategy leading to the development of smart supply chains that meet the standards of the global logistics area.

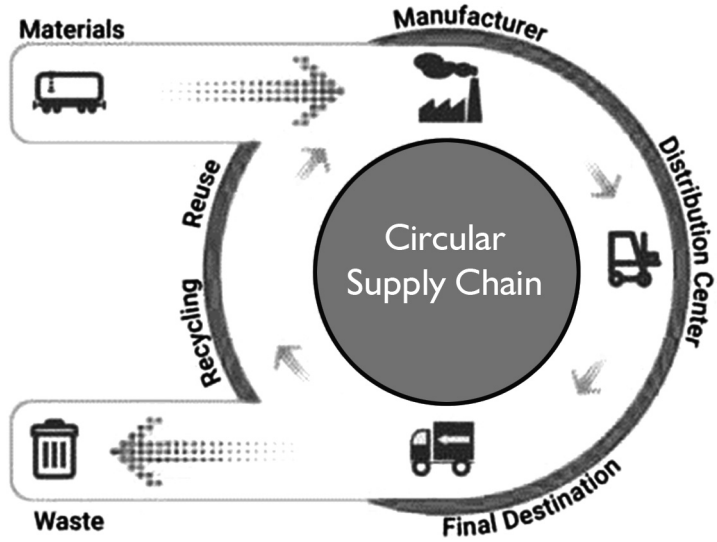
In such circumstances the analysis of large sets of data may help trading and maritime transport companies to facilitate the process of selecting suppliers and processing in a cloud which is more frequently used to help build relations with the suppliers and manage these entities. As a result, thanks to the automation, AI, Internet of Things as well as adopting blockchain technology they can significantly facilitate the logistics and transport processes, not only overcoming smoothly major obstacles resulting from current supply chains disruptions but also creating global logistics system adequate to the requirements of the industry 4.0.

Figure 5
Linear versus digital supply chain




Source : JLL, 2020; Koerber, 2020.

Figure 6
Green and circular supply chain




Source: JLL, 2020.

It is worth pointing out that to overcome the still serious barriers in the global supply chains' smooth operations, the leading container shipping operators, being nowadays global transport and logistics operators, are already implementing the new generation of mobile telecommunication networks. It promotes numerous activities within the development of 5G services in the global logistics sector. Moreover, numerous actions have been already taken to develop digital technologies to establish a new market organization in the container shipping industry. It is best exemplified

by TradeLens — digital blockchain platform developed by companies Maersk and IBM. It was joined not only by the leading container operators, but also during the pandemic by many forwarders and container terminal operators. The TradeLens platform has the potential to encourage the global logistics sector to digitalize the supply chains and cooperate within common standards. With more than 200 members today, the key platform initiated by leading container shipping operators, based on the digital collaboration, has already processed more than ten million separate shipping events and thousands of documents each week, providing freight forwarders, carriers, customs officials, port authorities, inland waterway suppliers and other entities common access to information on transactions. Such formula of data integration allows to introduce digital transportation into the container supply chains much quicker. As a result, this will stimulate innovation, leading to the evolution of the container transport sector towards not only its full digitisation, but also its integration into the digital global ocean logistics area.

Several actions taken by global container shipping operators also lead to the transformation of traditional supply chains, not only in the digital ones, in form of created in 2021 Digital Container Shipping Association and Future International Trade Alliance, but also via the decarbonizing the shipping sector, into green and fully based on circularity. These actions indicate their leading role in creation smart and secular global supply chains.

## Conclusions

The analysis and assessment of the impact of crisis caused by the COVID-19 pandemic, perceived through the disruptions in the global supply chains, fragile and not very resilient to disturbances as it was revealed, clearly indicates the need for their deep restructuring. The path for this restructuring, based to a large extent on reshoring, can be expressed mainly by meeting the following conditions:

1) depart from the formula of one source of supply in favour of multiple sources (multi-sourcing),
2) cooperate, i.e., build cooperation-based relations between entities,
3) ensure flexibility and resistance of the supply chain to random events,
4) optimize the area of production, network location and risks,
5) accept the fact that the markets and supply chains were, will be and must be different,
6) include, in a flexible way, the supply chain into the existing ecosystem,
7) develop scenarios for various groups of products and continuously map their impact on the costs of customer service.

Furthermore, in the era of 4.0 industry, the only possible solution leading to gradual elimination of the existing disruptions in the global supply chains and their truly effective restructuring to ensure smart, digital and green, circular supply chains.

The global leading container operators perfectly fit this concept of global supply chains since today they have already taken serious efforts to implement such strategy of the supply chain development meeting the global economy contemporary challenges. However, their very strong oligopolistic market position which was aggressively used during the crisis period, should to be significantly reduced by antitrust bodies responsible for building fully competitive global shipping market.

## Notes/Przypisy

[1] DACH is an acronym from the first letters of European German-speaking countries: Deutschland, Austria, Cofederation Helvetica (Switzerland).

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