Global Supply Chain Disruptions and Economic Resilience: Insights from Pandemic and Geopolitical Shocks

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Abstract- This paper aims at investigating the effects of global shocks, including the recent factors like pandemic sickness, war, and sanctions on international supply chain and macroeconomics. Using secondary sources, namely questionnaire survey from the firm's reports and analysis of the policy documents, the research determines major resilience measures. They depict that the firms are shifting toward digitalization and diversification of supply sources. There are several susceptibility factors that are still present due to overreliance of production networks on globalization. At the end, the authors provide a policy message to both the firms and the policymakers and stress on the importance of developing adaptive capacity and enhancing structure resilience to face future disruption and keep the economy stable.

Keywords: Supply chain resilience, global shocks, economic stability, diversification, and risk management.

1. INTRODUCTION

In recent years, there have been shocks around the world economically liberalized supply chain such as the COVID 19 pandemic and Russo-Ukrainian War. These disruptions have caused the emergence of the theories of autonomy and resilience of systems at the global level of the economy. Analysing the parallel with learner autonomy meaning, introduced by Holec (1979) as "exercising control over the learning process," economic resilience may be then defined as the ability of firms and governments to manage and secure supply chains' stability in the case of disruptions. In the context of global trade relations, Tukamuhabwa, Stevenson, & Busby (2017) that the system of trade networks has become more complex hence exposure to threats, which thus requires towards proactive approach development of resilient supply chains. Miroudot (2020) also note that the so-called 'reshaping' going forward does not just mean diversification of supply and sourcing locations, but also digitization of the supply chain as well as policy modernization (p.430). Given in the scenario of ongoing global systemic risks that challenge the stability of macroeconomy, it is important to develop higher reasoning for both sides of political spectrum in the public sector together with private sector agents. Considering these developments, the study presented in this article focuses on an assessment of how recent global shocks have affected supply chain and the measures that have been taken by businesses and governments to strengthen the supply chain. To begin the article with, the authors provide a literature review that deals with the main topic of the article. Further, the current work goes ahead and provides basic information about the study; this includes research questions, data, and analysis. The information is then extracted from the corporate reports and policy documents that are reviewed and the article ends with the discussion and the set of the proposals aimed at increasing the levels of supply chain resilience (Leończuk, 2021, p.253).

2. LITERATURE REVIEW

2.1. Economic Resilience in Global Trade

According to Craighead, Blackhurst, Rungtusanatham, and Handfield (2007,p.131),The idea of 'resilience', which can be generally described as the ability to sustain function in the face of disruption has gained general acceptance as a general principle in designing and managing modern supply chain .In supply chain management, the term 'resilience' is understood as the readiness and capability of structures to effectively operate during the occurrence of damaging events, which may be either economic, political or environmental. Similar to autonomy in language learning and learning in general, which can be

characterized as adaptive and self-directional, resilience in global trade relies on the capability of the institutions and firms to adapt their operations, adjust sourcing strategies, and buffer risks when it is exposed to crises (Little, 2020, p.1). A popular and significant dichotomy when it comes to resilience is the different between JIT and JIC supply models. While the former focuses on the operational aspects like lean inventory and global sourcing, the company has been exposed during crises including the recent coronavirus outbreak (Hryhorak Mariia & Shevchuk Liliya, 2021). On the other hand, it aims at incoming suppliers, keeps buffer stocks, suppliers diversified, and shortens the supply chain even if it means doing it ineffectively. This shift may hold true in general for the fact that operational resilience relies more and more on careful redundancy and freedom to detour, as opposed to efficiency.

Just as learner autonomy is observed as a contextual and multifaceted construct, supply chain resilience is a context-dependent and a function of factors of industry type, geography, and policy and firm contingencies. Consequently, economic risk therewith becomes less of a uniform concept in the context of global trade development, and more of a multi-layered construct which requires a comprehensible comprehension of the complexity of the risk environment it offers (Birkie, 2016, p. 185).

2.2. Technology and Resilience

As with autonomous learning tools in language, AI, blockchain, and digital twins also emerge to be rather regarded as the enablers of resilience in GSCs. Maheshwari, Kamble, Belhadi, Venkatesh, and Abedin (2023, p195) provide that DSC, or digital supply chain twins that emulate the real-life supply networks, assist in monitoring, simulation, and planning. These tools help firms in the prediction of disturbances, evaluation of their impacts, and subsequent organisation changes that develop future-oriented adaptive capability.AI technologies also help to achieve resilience through applications for prediction, decision-making, and dynamic demand forecasting within organizations (Kalusivalingam, Sharma, Patel, & Singh, 2022, p.68). For instance, the fluctuation in demand or even supplier risk can be easily detected by machine learning algorithms and thus firms can act in advance. For the same reason, the technology increases transparency and traceability in the supply chain while important for decision-making during crises when information asymmetry or fraud distorted supply chain disruptions (Petratos & Faccia, 2023).

Both types are similar in terms of decentralizing an activity from a particular center such as classroom or linear supply routes and also enabling one to act independently and in a free manner adaptable to the change in circumstances. As in education though, it became clear that it was not the technology that made it resilient. Holec (1979), Its success therefore relies on the ways and extents to which it had been incorporated into a bigger institution framework /solution and if the users (learners or firms) has the capability and desire to leverage the solution's full potential.

Global crises whose examples include the current COVID-19 pandemic and the war between Russia and Ukraine put pressure on global trade systems. The early days of the covid-launched pandemic demonstrated that it is disadvantageous for a country to depend on particular zones to support its merchandise; similarly, learners who seldom use self-help language tools experience how top-heavy classroom learning is. Therefore, countries and companies recommenced sourcing locally, bought inventories for necessities, and developed buffers, much like how learners use multiple sources to obtain resources.

The World War proved that such relations as energy and food are not very stable. This reliance was evidenced by the crisis that the European region experienced, assuming that structured and informal learning should be enhanced to invest in renewables and regional supply value. As with learning languages there is always a question of attitude, capacity, elasticity and adaptability as there is with trade (Bagchi, Chun Ha, Skjoett-Larsen, & Boege Soerensen, 2005, p.275).

3. METHOD

3.1. Research Question

An important research question concerning global supply chain disruptions and economic sustainable capacity is the impact of external shocks including but not limited to such things as pandemics, geo-political activities and economic sanctions, in the conducting of international business and the stability within macro

economy. All of these disrupt aspects of the global interconnectedness, raising questions for the strategies that companies and governments need to adopt. It is crucial to identify how through the activities of diversification, localization, and digital transition, organization can manage and reduce risks in order to have stability. This paper aims at analyzing the distinct measures that companies have implemented to adequately respond to these shocks and their effect on the continual recovery and the economy (Xavier, Elias, & Nazar, 2024, p.25).

How do global supply chain, such as pandemic, geopolitical hazards, or sanctions affect organizational strategies and their management of the risks? Specially, do companies implement concerning these disruptions, thus adopting new operational strategies like diversification, localization or digital transformation? Additionally, how does recovery and supply chain solidity is affected?

3.2.Participants

The sample sources of this study were twenty individuals from multinational corporations as well as government bodies with supply chain responsibilities across countries. These were 10 corporate businessmen comprising of 7 males and 3 females and 10 policymakers consisting of equal numbers of males and females of the following organizations; The European Union, U, S. Trade Representative and Ministry of Economy, Trade, and Industry of Japan. The respondents were 45.3 year of age on average with a range of 35 to 60 years in age. They claimed to have vast expertise in supply chain management and policy, which they claimed to have acquired from working for an average of 20 years in the social media sector. It was seen that while corporate professionals were more concerned with supply chain management, public officials were more inclined towards policies in the supply chain area.

3.3Data Collection and Analysis

The research data for this paper were collected using interviews with 20 participants, which was the head of large international companies and representatives of governments and supranational structures (Taherdoost, 2022). Thus, to reemphasise the main points of this type of interview methodology, according to Taherdoost (2022) about the interview questions and answers that are formatted, as well as the amount of time and focus to pursue certain topics in detail (p,39).

This paper aim at examining how participants mobilized in order to respond to the shocks and on how supply chain risks minimization influences economies. This facilitated questioning and subsequent queries than the normal format to enable the collection of richer data. Recruitment of participants was done with an explanation of the purpose of the study and obtaining permission for recording their interaction using digital means, common questions addressed included recent disruption and measures attained towards resilience. To achieve the data that would be applicable to the research questions the following questions were posed (2):

1. What changes have you noted in trade interaction and dependency on shock that have occurred in the world economy in recent past?
2. How can you inspect the performance of diversification in the supply chain management?
3. what role do Technological innovations like Artificial Intelligence, and the Blockchain are well integrated into supply chain systems to implement certain degrees of resilience.
4. How can you measure the resilience of supply chain if you decide to perform reshoring or regionalization?
5. How do access the role of supplier relationships and collaboration to enhance the resilience, especially in crises?
6. How does the read regards governmental policies and regulations involve supporting or hampering resilience strategies in the industry you are operating in?
7. In what way has your organizations' risk management been changed due to the current global disruptions?
8. Have global shocks led to changes in economic stability or macroeconomic elements shocks? How has your organization responded?
9. What strategies has your organization implemented to mitigate the effects of global supply chain disruptions?

Each participant was asked for informed consent, the interview was recorded and transcribed thereafter

(Taherdoost, 2022). In the context of usability, cross-sectional readings were conducted in order to obtain the three themes of analysis: resilience, diversification, and disruptions on the international level. There were larger categorizations or themes such as diversification, digitalization and policy support emerging from the thematic coding. Frequency analysis was done to rank the keywords Operational definition: Continuous cross textual comparison was made using the tally sheet and special features of Microsoft Word.

4. FINDINGS

The following are the emerged themes after the data analysis: impact of disruptions at the global level, measures taken to manage disruptions, resources utilized in disruptions management, risk management approaches used, long term, strategic changes, and capacities in supply chain.

4.1. Usage of Resilience Strategies

As indicated in Table 1, most of the participants adopt various methods of coping as a result of disruption of supply chain globally. In average, these strategies have been in active use for about 4 and half years, the time range being from 2 to 7 years Participants have developed and applied these resilience strategies: In the second half of 2008 – in response to the global disruptions in the financial markets, 40 % of the participants began adopting them even more actively in the face of COVID 19 pandemic disruptions. Furthermore, an impressive 70% of respondents said they relied on different strategies to diversity their supply on areas of supply such as sourcing from different districts or different suppliers. Finally, 55% of the participants reported that they use AI and blockchain technologies to improve the real-time monitoring and analytical tools for decision support. Among the participants, a third of them have reported enhanced risk management results due to these plans within a year.

Table 1. Participant Experiences with Global Supply Chain Disruptions and Resilience Strategies

Year Level of Study	Student	Sex	Industry	Years Dealing with Disruptions	Self-assessed Resilience
2nd Year B.A.	S1	Female	Logistics	6 years	Experienced
2nd Year B.A.	S2	Female	Manufacturing	5 years	Fairly Experienced
2nd Year B.A.	S3	Female	Retail	4 years	Not Very Experienced
2nd Year B.A.	S4	Female	Technology	7 years	Experienced
2nd Year B.A.	S5	Female	Healthcare	3 years	Fairly Experienced
2nd Year B.A.	S6	Male	Automotive	2 years	Not Very Experienced
2nd Year B.A.	S7	Female	Financial Services	5 years	Experienced
2nd Year B.A.	S8	Male	Supply Chain	4 years	Fairly Experienced
3rd Year B.A.	S9	Female	Construction	5 years	Not Very Experienced
3rd Year M.A.	S10	Female	Financial Services	5 years	Experienced
3rd Year M.A.	S11	Male	Retail	4 years	Fairly Experienced
3rd Year M.A.	S12	Female	Manufacturing	3 years	Not Very Experienced
3rd Year M.A.	S13	Male	Technology	6 years	Experienced
2nd Year M.A.	S14	Female	Healthcare	4 years	Fairly Experienced
2nd Year M.A.	S15	Male	Automotive	3 years	Not Very Experienced
3rd Year M.A.	S16	Female	Supply Chain	5 years	Experienced
2nd Year M.A.	S17	Female	Healthcare	4 years	Fairly Experienced
2nd Year M.A.	S18	Male	Logistics	6 years	Experienced
2nd Year M.A.	S19	Female	Construction	2 years	Not Very Experienced
3rd Year M.A.	S20	Male	Technology	7 years	Experienced

4.2. Reasons for Rethinking Global Supply Chains

The participants enumerated the following critical factors that have made them reconsider how they manage their global supply chains in the recent past. The main arguments provided included the necessity to productions become more resistant, spread across a wider area, and not be dependent on a certain source or market. Also only some of them mentioned such factors as flexibility and readiness to respond to the state of affairs in the global economy. The following are some examples of such opinions:

S10: "The main supply chain motive for diversification can be stated as follows: Due to the COVID-19 crises, it was seen that depending on a single vendor or country brings a certain doom to businesses. There must be

second and third best solutions and quicker ways to manage risk (...)."

S5: "The sanctions and the growing tension in the geopolitical environment show that we have to diversify our portfolios(...). But now, the focus is on distributing the supplier's country. It is therefore important for a firm to have a more elastic or robust supply chain. Basically, it is moving from a question of getting 'the cheapest option' to that of managing risks(...).

S14: I have tested the phased plan to highlight the challenges we experienced during the initial stage of the COVID-19 pandemic on our supply chain(...). Well, recently we've also begun to promote reshoring some important processes for preventing disruptions in the future(...). That means it is no longer only the question of saving as much money as we can but rather that we should be able to continue our work despite any actions taken by a certain state(...).

4.3Resources and Tools for Managing Supply Chain Disruptions

This paper will establish how in the wake of disruptions in supply chains around the world companies have turned to digitalization as a way of enhancing their stability. They include supply chain management software such as SAP, Oracle SCM Cloud, analytics tools, and the collaboration tools like Microsoft team, slack to manage inventory, risks and communication respectively. Another application of blockchain is used in increasing transparency and tracking of property or products. A massive 60 per cent of the respondents said they leverage AI in demand forecasting, inventory management and probing for constraints. Therefore, through mobile apps, organizations can monitor and control their operations remotely as well as gain crucial information necessary for quick responses during emergencies.

S5: "We have live tracking software for logistics, and cloud systems for team work especially during the current period of the pandemic disturbance(...)."

S10: "AI-generated analytical tools assist us to know when we are most susceptible to encountering risks and adapting our strategies (...) the global factors may be unpredictable with the help of machine learning."

S15: These cloud services and platforms which include SAP enable the firm to communicate effectively with the suppliers and ensures that there are no disruptions during shocks which may affect the firm across the globe(...).

S20: "We manage political risks through the use of tools such as Resilience 360 to monitor the risks and counter changed quickly(...).

4.4Encounters with Supply Chain Disruptions

When asked what kind of disruptions are experienced by their organizations most of the time, thirteen (65%) of the respondents said it is during major global events like diseases, wars and boycotts. Six respondents (30%) mentioned that they faced them in some operational areas such as logistics and procurement, while the remaining one said it span between import and domestic sourcing. Some of them, several of them took into consideration to review their global sourcing strategies. While some of them shifted to the regional suppliers, others expanded their supplier lists, and few companies concentrated on making strategic changes in suppliers. This does not mean, by any means, that their whole undertaken supply chain disintegrated(...) rather, such disruptions contextualized their need to minimize reliance on them and enhance preparedness for such an occurrence. For instance:

S7: When the borders shut down due to COVID-19, we could not source for the required components(...). As for the last strategy we said, we had to turn to regional partners as the backup option.

S13: Global disruptions have shown people the value that multi-sourcing has in an organisation. For this reason, at least two suppliers are sourced for any particular category of material to minimize on instances of being caught unprepared(...).

S19: Currently we have put in place analytic tools that help in risk detection, but in the beginning, we failed to predict the future risk when our main supplier closed down(...).

S16: During the global disturbances, we paying much attention to strengthen relations with existing suppliers to maintain our cooperation. Therefore, to avoid such

occurrences in the future, communication and flexibility take the highest precedence.

Concerning further shocks, 13 of the participants (65%) believed that a scoring of 3 meant (...) that one has to develop resilient and flexible ways of supply chain while 7 of the respondents (35%) felt that a scoring of 3 meant that there is more focus in engaging in traditional cost-oriented ways of supply chain(...). To these, only two participants confirmed the existence of contingency plans and that they are updated periodically(...).

S10: "Disruption scenarios are initiated on a quarterly basis. At that time, Fournier travelled to Britain from France using his own resources and described how the approach also enabled a quicker response and the anticipation of issues before they become an issue for neighbours of Benin.

S16: "I have received little awareness on resilience prior to the war in Eastern Europe. Now, on the other hand, scenario planning and supply diversification keep on featuring as the main processes.

Last but not least, it is worth to state that while some businesses were aware about the opportunities brought by digitalization (e.g., real-time tracking, AI risk ratings) such solutions were not used before these global shocks. It is alarming that many corporations started to pay attention to the digital transformation concept as a reaction to experiences of disruption in the supply chain.

4.5Language practiced

All the interviewed respondents were asked about the strategies used by their firms during the disruptions of the supply chain on the international level, and all of them mentioned the need to diversify the supplies. Some also referred to several technological solutions where real-time management could be done for prompt detection of any problems. Several suggested adapting inventory control and/or costs control. For that reason, participants considered diversifying suppliers and incorporating advanced analytics applications pertinent to the matter of continuity genic shocks. It was pointed out that technology helped to deliver the necessary information rapidly and thus helped to react fast. These concepts are very appropriate given the increased demand for flexibility and contingency measures in the management of global supply chain during crisis.

S3: (...) When supply chain disruptions occur… easier to search for substitute suppliers and immediately discern the extent to which they can satisfy the company's requirements(...).

S6: A key point which has not been estimated is the importance of monitoring and reacting to risks with the help of analytics tools in the context of disruption(...).

S 12: Concerning risk management objectives, I would focus on increasing the number of suppliers and using software tools detecting potential risks in real-time. This attitude of being proactive in handling a situation enables one to handle it before it become worse.

As it has been pointed out earlier, it was uncommon for companies to make adjustments to inventories or they practiced the other violative tactics such as holdovers. This is so because most companies opted for technology enablers and applications which assisted them to address the risk involved in supply chain. Some of the interviewees' quotes are presented below for illustrative purposes:

S3: In my opinion, particularly, if we speak about inventory, it is better to use data and platforms associated with logistics as much as possible and do not stock the items.

S2: (...) Currently, we have established efficient suppliers' relationship and I think the only element that I try to modify on the operational field is the flow of material based on real data during a disruption and not accumulating stock(...).

S12: I believe that we are quite ready for all kinds of interruptions, and I use cloud solutions and analytical tools to manage my workflows dynamically.

4.6Study Performance in Global Supply Chain Management

It was revealed that several advanced technologies such as detailed logistics technologies and real-time monitoring systems have helped improve the supply chain performances through increasing the work

efficiency. Most of the interviews stated that access to at least cloud platforms and logistics software aids in the quick evaluation or resolution of interruptions. Some of the respondents commented as follows: "We can respond faster… without these tools, we would not be able to adapt as quickly" (S1). These technologies also pushed the demand for supply chain problems solutions with one of them stating, "We act immediately when we can get the data in real time" (S6). Also, these systems assisted the companies in managing the supply chains by enabling them to make the suppliers more diversified, as one respondent put it: 'We would not have had diversified suppliers without these tools' (S12).

if I stated that we have enhanced our response time to disruptions, it is for the ability to act much faster… in fact for example between conventional logistics and data analysis, if we were still using papers it could take us about 3 hours to risk assess as opposed to 10 minutes with the help of the analytics… this way we spend least of our valuable time merely gathering data and most of the time responding to it. It is proved that there is less time devoted to preparing but the effect is getting bigger. (S14)

It is also important to learn that logistics technology could be of great benefit especially to enterprises that would require changes of course or events, changes, and occurrences in real-time manner.

"It is faster than before; also, we find it more interesting than other techniques as the mobile termnant allow us to search information at one time(S5).

"Lastly, 25 % of the respondents were uncertain on whether or not most of these technologies enhanced their capacity to address disruptions associated with globalization, answering a vaguely with the response, It's difficult to say."

5.DISCUSSION AND CONCLUSIONS

Regarding the fast response to disruptions in supply chain management, one of the participants emphasises on how real time data analysis provides them with the benefits of avoiding dated logistics. This is one of the strongest difference because business intelligence system can assess risks or make decisions faster than the human being. In the past, the companies used to work on paper-based systems and it used to take a lot of time to prepare and evaluate the data that is required for handling disruptions. In their own words, one of them stated that if they had to use paper documents, risk assessment could take up to 3 hours – and that's if time is not of the essence in order to prevent the disruption. However, with the use of real-time data analysis the time taken in this case has significantly been reduced. A job, which used to take couple of hours, can be accomplished in couple of minutes in terms of risk assessment. In the case of this particular business, analytics enable the identification of risks within the shortest time span of 10 minutes. This real-time processing of the data helps in decision-making as well as assists the business to be quick in addressing any unforeseen challenges within the supply chain. The quick ready time offered by these tools curtails delay, enhance the working effectiveness and guarantee any interruption is handled as soon as possible.

This change in switching from conventional logistics for thinking processes to technological applications is not only time-saving on the preparation side but also the decision-making aspect. It is more beneficial to utilize data analytics because from the time-consuming process of analyzing data to finding solutions, teams can only focus on finding the solutions. Thus, freeing up the time that is usually spent on data collection and preparation will allow companies to dedicate efforts towards ensuring this disruption is mitigated as much as possible and interrupts business as little as is possible.

This indicated the fact that, to the interviewee, quicker preparation was more advantageous than in the formal debates. Real-time data analysis helps to respond also to some contingent situations, which helps to save time and avoid redeganisation of resources. Technology and process maturity gives more robust to the supply chain and enhances operation managing responses to barriers and risks.

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