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LONG-TERM COMPARATIVE EFFECTS OF THE COVID-19 PANDEMIC ON SUPPLY CHAINS IN POLAND, GEORGIA AND TURKEY

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Purpose: This paper explores the enduring repercussions of the COVID-19 pandemic on global supply chains by investigating the experiences and adaptations of organizations in Poland, Georgia, and Turkey. It seeks to provide valuable insights into the long-term implications of the pandemic on supply chain management, with a focus on strategies and challenges faced by businesses in different regions.
Design/Methodology/Approach: We conducted an extensive study utilizing an online questionnaire to gather primary data from a diverse sample of organizations in Poland, Georgia, and Turkey. This research approach is quantitative and comprehensively assess the pandemic's impact on supply chains. We analysed responses from a range of industries, enabling a holistic understanding of the topic. In addition to descriptive analysis, we conducted a comparative examination of the three countries using ANOVA (Analysis of Variance) to assess any significant differences among them. Furthermore, we employed Cramér's V, a robust statistical measure, to investigate associations between categorical variables within the dataset
Findings: The research reveals that the outcomes in three distinct countries are surprisingly similar, contrary to initial expectations. The majority of the proposed COVID-19 factors exhibit no statistically significant distinctions among Poland, Georgia, and Turkey. Consequently, we can infer that the COVID-19 pandemic exerted a considerable and widespread impact on the entities under consideration.
Research Limitations: Despite our efforts to gather a representative sample, the study may not encompass all industries and organizations equally. Additionally, the research is subject to the limitations of self-reported data and potential bias in responses. The focus on specific regions may not capture the entirety of global supply chain dynamics.

Practical Implications: This research provides practical insights for organizations navigating supply chain challenges in a post-pandemic world. It offers guidance on building resilient and adaptable supply chains and managing risks effectively. Businesses can use these insights to make informed decisions and enhance their supply chain strategies.
Originality/Value: Drawing from our own research conducted in three countries after the official conclusion of the pandemic, this study adds a distinctive contribution to the current body of literature. It takes a long-term perspective on the repercussions of the COVID-19 pandemic on supply chains, specifically emphasizing diverse regions. The employed methodology and regional comparisons offer a nuanced insight into the dynamic evolution of the supply chain landscape, underscoring the importance of adaptability and resilience. In contrast to various studies conducted at the onset and during the pandemic, this paper uniquely seeks to discern the enduring effects.
Keywords: Supply chain, COVID-19 pandemic, long-term effects, risk management, regional variations.
Category of the paper: Research paper.

1. Introduction

A supply chain is a collaborative network of manufacturers and service providers working together to facilitate the processing and transportation of commodities, from the raw material stage to the end-user level, with interconnectedness maintained through the exchange of physical products, information, and monetary transactions (Bozarth, Handfield, 2007). Supply chains, in order to better adapt to the market, should align with the type of demand for the goods flowing through them. Supply chains can be classified into two basic groups: efficient (dealing with flows of standard products, and demand that is stable) and reactive (dealing with flows of innovative products and variable demand) (Webster, 2002).

In the context of different types of supply chains, it is important to understand that risk management plays a crucial role for both efficient, stable supply chains and reactive ones that respond to innovations and demand. Optimal risk management can help align supply chains with different types of demand and minimize potential threats and irregularities in the functioning of the entire logistics system. Effective identification, assessment, and control of risk are therefore key elements of effective supply chain management.

Risk is a very complex concept, making precise definition challenging. Risk is defined as "the possibility of realizing something undesirable, a negative consequence of a certain event" (Rowe, 1997), and also "the degree of probability of events occurring that are independent of the acting entity, which it cannot predict precisely and cannot fully prevent..." (Pszczołowski, 1978). However, according to Knight, in economic activity, unique events dominate, for which it is impossible to apply any measure of probability (Knight, 1971). The vulnerability of the supply chain to risk is its sensitivity to threats occurring both within the organizations forming it and outside of them. Zsidisin defines this risk as "the probability of an incident related to

supplies occurring due to a market or individual supplier failure, resulting in the company losing its ability to meet customer demand or posing a threat to the life and safety of customers" (Zsidisin, 2003).

The emergence of the COVID-19 pandemic in November 2019 in Wuhan, China, serves as a prime example of a "black swan event". This global-scale occurrence, characterized by unexpected and unforeseen developments, carried severe consequences. An example of such an event is the COVID-19 pandemic, which began in November 2019 in the Chinese city of Wuhan. There is no doubt that the coronavirus pandemic was an unexpected and unforeseen event on a global scale, with extremely severe consequences. According to many analysts, it can be classified as a "black swan event". This metaphor was introduced in 2007 by Professor Nassim Nicholas Taleb. "Black swans" are events that have three attributes (Taleb, 2008):

- they are unexpected, unpredictable, unusual, and highly improbable, lying outside the realm of regular expectations, because nothing in the past indicated the possibility of such events occurring,
- when they do occur, they have a huge impact on society and the economy,
- after their occurrence, many people believe that such events could have been predicted.

The COVID-19 epidemic was undoubtedly an unexpected and unforeseen event on a global scale, with extremely severe consequences. No financial analyst in January 2020 predicted the crash in the global stock markets that occurred two months later in March due to the outbreak of the pandemic.

2. Literature review

2.1. Impact of the pandemic on logistics

The outbreak of the pandemic has had an unimaginable impact on people, the economy, entrepreneurs, government authorities, and others. The coronavirus has caused significant disruptions in the global supply chain. At the onset, the pandemic caused chaos and disruptions in the functioning of companies. This situation significantly disrupted supply chains and limited in-person consumption. Production halts, suspensions, or bankruptcies of suppliers can disrupt the supply of key components and materials (Dubey et al., 2016).

Most companies collaborate with international suppliers, making supply chain logistics face numerous challenges. After the outbreak of the pandemic, it was difficult to maintain the fluidity of goods flow across borders, partly due to modifications in regulations and shipping restrictions imposed by various governments (Nartey et al., 2022). In the initial phase of the pandemic, there were disruptions in road transport due to mandatory driver checks at border crossings, resulting in extended waiting times at borders and thus delays in delivery times,

reducing transport throughput, and disrupting the flow of goods and materials (Ivanov, Dolgui, 2020). Air transport was also severely limited, primarily in the passenger sector, as air traffic was suspended. This sector, however, impacts cargo traffic because some cargo shipments are carried out using passenger aircraft. Medical equipment cargoes became a priority, which was also evident in the urban transport sector.

A comparative study for Turkey and the EU-27 (European Union – 27 countries) and EA19 (Euro area – 19 countries) concerning logistics turnover taking into account the impact of COVID-19 reveals a huge long-term impact of the COVID-19 virus on turnover in various logistics modes and a radical shift experienced by Turkey from land transport to air transport. The significant difference between Turkey's growth rate (535.84%) and the EU27 (18.58%) and EA19 (13.62%) countries is evidence of Turkey's rapid development in logistics, especially in warehousing and air transport (Balkan, Akyuz, 2023).

While COVID-19 caused a global shock in passenger flights due to travel restrictions and passengers' reluctance to travel, there was an increased demand for cargo flights for the rapid transport of medical equipment, vaccines, and PCR tests (Deveci et al., 2022). The authors believe that cargo transportation will continue to be a very important source of revenue for airlines after the COVID-19 pandemic.

Since international transport plays a leading role in trade and relies on travel and human interactions, the outbreak of the COVID-19 epidemic had a direct and indirect impact on the maritime industry. According to a report by the European Maritime Safety Agency (2021), analysing the impact of the COVID-19 pandemic on EU ships in the years 2019-2021, maritime traffic between Europe, China, and the USA decreased in 2020, but in 2021, traffic from the USA returned to pre-pandemic levels. As the COVID-19 pandemic intensified, ports faced an unprecedented number of ships at anchor, with vessels queuing up waiting for a place to unload cargo. The EMSA report demonstrated that the cruise and passenger transport sectors were the most affected by the COVID-19 pandemic. This also impacted other sectors, but despite the challenges, commercial ships, ports, and other maritime transport sectors continued to operate, ensuring the flow of goods, and highlighting the strategic importance of maritime transport for supply chain continuity.

An assessment of the sectoral impact of COVID-19 on global supply chains using the example of Turkey and China (Kazancoglu et al., 2023) showed an imbalance between import and export activities caused by maritime logistics due to a lack of available containers and equipment, drastically increasing transportation costs. This indicated a need for an alternative means of transport that could provide cost-effective transportation, such as the "One Belt, One Road" initiative, which constitutes a new transportation network between Asia and Europe.

The world had never experienced disruptions in supply chain management on the scale caused by the pandemic. Prior to the COVID-19 pandemic, supply chains were planned using a just-in-time production approach, where inventories worldwide were minimal or even zero. The aim of such an approach was to minimize inventory costs throughout the supply chain.

However, in the face of the pandemic, this approach significantly reduced the flexibility of companies. As a result, implementing management approaches in companies requiring working with minimal inventories, such as Lean Supply Chain and just-in-time production systems (Brakman, Garretsen, Witteloostuijn, 2020) seems almost impossible, and the importance of shorter and more flexible supply chains will increase in the future. The coronavirus exposed all the drawbacks of just-in-time/just-in-sequence production methods and gaps in the transportation industry. The sectors that heavily rely on JIT/JIS models suffered the most, for example, the automotive industry, because any disruptions in tightly managed production in these industries will immediately have serious consequences, and large distances between suppliers and customers increase the risk of many problems (Strom, 2021).

Disruptions in the supply chain caused by the COVID-19 pandemic drastically transformed the automotive industry, adversely affecting and seriously disrupting its global networks in terms of severity and complexity, scale, and duration of the impact. Supply chains designed for efficiency often did not ensure operational continuity in prolonged pandemic conditions (Chervenkova, Ivanov, 2023).

During the COVID-19 pandemic, logistics was one of the most frequently discussed topics. The sudden increase in demand for hygiene products and essential items such as food products, antibacterial gels, masks, and toilet paper posed a significant challenge to the entire logistics sector.

Panic buying, stockpiling, and disruptions in the supply chain can lead to challenges in inventory management, including stock depletion and excessive stock (Chopra, Sodhi, 2004).

Supply chains of companies offering essential items and other products necessary for daily life had to operate continuously despite travel restrictions in many countries. However, many businesses had to suspend their operations, resulting in disruptions in the supply of raw materials and production breaks in various industries. In the face of a disrupted supply chain, new suppliers, both local and foreign, had to be found to ensure the delivery of essential materials. These changes resulted in fluctuations in delivery prices and order delays, among other challenges.

Food supply is a key element in ensuring social stability and public health during a pandemic, and effective management of this aspect is crucial for societal well-being. The COVID-19 pandemic caused global disruptions in agri-food supply chains, increasing uncertainty regarding the availability and stability of food supplies.

Agri-food supply chains (AFSC) encompass a sequence of activities from "farm to table", including land cultivation, plant production, processing, testing, packaging, storage, transportation, marketing, and distribution of food products (Vafadarnikjoo et al., 2023). Food supply chains connect closely dependent producers and consumers worldwide, often providing just-in-time deliveries. Agricultural products have higher logistics service requirements, making them more vulnerable to disruptions. As Gray points out (2020), the intermodal container flow of grains and food products was disrupted due to a lack of empty

containers in North America. The widespread use of physical distancing measures by consumers significantly increased the demand for food delivery and pickup services in retail to the extent that these services were rationed due to long waiting times.

An analysis of data from 367 SMEs in the agri-food industry across 17 countries collected in May 2020 allowed for capturing the early impact of the pandemic on their operations. Approximately 94.3% of respondents reported that the pandemic affected their business operations, primarily through a decrease in sales, as well as limited access to production resources and financing with limited financial reserves. Difficulties in staffing were also commonly reported. 82% of companies reported a reduction in production volume due to the pandemic, with 13% ceasing production entirely. About 54% of companies changed product prices due to the pandemic. Over 80% of companies took actions to mitigate the pandemic's impact on their business and/or employees, and approximately 44% considered exploring new business areas (Nordhagen et al., 2021).

One of the proposed solutions to such problems (Zeng, 2021) is to enhance the application and innovation of big data in agricultural product supply chains, such as precise demand forecasting for agricultural products, sustainable planning of agricultural product supplies, collaboration in agricultural product logistics, traceability of agricultural product quality, innovation in agricultural financing, early warning of risks in the agricultural product market, monitoring agricultural product-related disasters, and early warnings.

The analysis of IT system vulnerability and the use of CRM with big data support were also highlighted as significant risk reduction strategies in supply chains for the food processing sector in Bangladesh (Ali et al., 2019).

Another proposed solution for mitigating risks in supply chains is suggested by Janssen et al. (Janssen et al., 2018), who developed a stochastic model for perishable goods, considering a policy of micro-periodic inventory replenishment.

One of the links in the food supply chain most affected by the pandemic was home delivery. The pandemic situation compelled most stores and some restaurants, pharmacies, and bakeries to create home delivery options, allowing them to stay in the market. The adapted infrastructure of the last link in the supply chain resulted in the continuation of many of these changes after the COVID-19 pandemic (Gray, 2020).

According to Chenarides, Manfredo, and Richards (2021), the COVID-19 pandemic exposed critical weaknesses in the American food supply chain. Faced with the almost complete loss of the foodservice distribution channel, there were frequent stories of food waste, collapsing suppliers, and food shortages. The authors argue that the pandemic revealed a fundamental lack of resilience in the food supply chain, which, although it caused short-term welfare losses, did not necessarily have to occur, and resulted from a lack of vision rather than market unreliability in the traditional sense. For example, in the American fresh produce industry (onions), they show that the ability to change suppliers and maintain supply chain flexibility has significant value. The authors state, referring to Copeland and Antikarov (2003),

that "if the costs of changing suppliers are low and uncertainty is high, then it is quite clear that highly flexible strategies dominate over inflexible strategies".

The lack of continuity in the supply of essential raw materials for food production can pose a serious risk to food safety, especially for perishable food and vegetables. Moreover, the pandemic raised other concerns regarding improper handwashing, packaging, and other practices related to handling food (Rejeb, A., Rejeb, K., Keogh, 2020). Quarantines, employee illnesses, and disruptions in the labour market can lead to labour shortages in production and logistics (Pettit, Croxton, Fiksel, 2013).

The crisis caused by the pandemic had both demand and supply-side characteristics. Due to the COVID-19 pandemic, many governments imposed radical restrictions on social and economic activities and travel barriers. Restrictions affected about half of the world's population and had a negative impact on the global economy. The result of Global Value Chains (GVC) is the dispersion of the production process in many places around the world, both within a single company and among many subcontractors. The absence of workers in factories disrupted these global value chains, making it difficult to maintain production even where restrictions were not yet in place.

2.2. Long-term effects and supply chain resilience strategies

The new rules and restrictions had a significant impact on the logistics industry. To comply with safety protocols and the fluctuating pace of activity, many companies were forced to implement changes in staffing and automate warehouse processes, including facility management using warehouse software. Drivers were relieved of the duty to participate in the loading and unloading process, and paper documentation was either limited or completely replaced by electronic documentation. Office workers, customer service representatives, freight forwarders, dispatchers, accountants, and salespeople were delegated to remote work, which proved to be a beneficial solution that many companies chose to maintain permanently.

As a result of many of the factors mentioned above, technological adaptation and broader implementation of digital technologies such as the Internet of Things (IoT) and artificial intelligence, allowing real-time monitoring and decision-making in supply chain management, occurred (Monczka et al., 2020). The shift of many companies to remote work also demonstrated the importance of digital transformation in the supply chain and logistics. It is expected that more data-driven decision-making processes and logistics operations based on data will emerge. Investments in automation and artificial intelligence in supply chains are expected to increase post-pandemic, with a greater utilization of more intensive information and communication technologies and technological capabilities in this context (Choi, 2020). New technologies enabling digital transformation provide increased efficiency and flexibility in the supply chain.

Due to the significant disruptions in global supply chains and the weakening of connections between buyers and suppliers caused by the COVID-19 pandemic, many authors emphasize the need for digital transformation in the supply chain, (Sharma et al., 2020; Villena, Gioia, 2020). This transformation will reduce the suppliers' response time by reducing the time needed to convey necessary information or access it (Ngo et al., 2023).

It is evident that the demand for certain products may exhibit high variability during a pandemic, leading to difficulties in forecasting and demand planning (Ivanov, 2020). The crisis caused by the pandemic altered consumption habits, with a significant increase observed in online sales. The logistics of many companies were not prepared for such a rapid demand, making it difficult for them to guarantee a fast and efficient service.

During the pandemic, interest in e-commerce increased even among consumers in middle and older age groups. The growth in e-commerce trade volumes, apart from certain sectors such as ready-made clothing, electronic items, personal hygiene, and cosmetics, led to a surge in the food sector in the e-commerce market.

Delivery on-demand of groceries gained immense popularity among buyers, combining mobile technology and urban logistics as a substitute for self-service grocery shopping. The pandemic compelled a larger number of consumers to favour e-commerce to meet their grocery needs. In July 2020, about a quarter of Turkey's population shopped for groceries online (Altay, Okumuş, Adıgüzel Mercangöz, 2022), and this upward trend is expected to continue even after the pandemic.

The significant increase in online sales prompted companies to reorganize warehouse operations to ensure that more efficient e-commerce logistics would yield greater profits. Special emphasis was placed on the health and safety of operators at every stage of the supply chain. Faced with such strong demand, the supply chain of some companies collapsed, making them unable to fulfil part of the orders. Circumstances required many e-commerce companies to employ tens, hundreds, or even thousands of workers to handle the rapidly growing number of orders.

Sułkowski et al., (2022) analysed the links between innovations introduced by Polish logistics companies (especially courier-express-parcel shipments) in response to the COVID-19 pandemic to enhance the level of services provided to customers. During the pandemic, sales and purchases through the e-commerce channel increased. It was also suggested that digital technologies can serve as a lever to increase the resilience of companies in the logistics and transportation sector.

E-commerce significantly helped boost the economies of many countries facing a serious public health pandemic. The COVID-19 pandemic created significant demand for online sales, but it also posed many threats to supply chains that often cross multiple national borders. Disrupting such a chain seriously affects a company's business performance, making crisis management in the supply chain crucial for e-commerce businesses, and effective detection and response to these crises have become very important (Ma, Chang, Lin, 2021).

E-commerce significantly aided in stimulating the economies of many countries facing a serious public health pandemic. The COVID-19 pandemic has generated substantial demand for online sales, but it has also posed numerous threats to the supply chain, often crossing many national borders. Disruption of such a chain has a profound impact on the business efficiency of a company, making crisis management in the supply chain crucial for e-commerce enterprises, and effective detection and response to these crises have become very important (Ma, Chang, Lin, 2021).

COVID-19 has exerted a significant long-term impact on passenger mobility in cities and rural areas in India. The fear of infection from social interactions prompted individuals with vehicles to refrain from using public transport. The authors suggest that this influenced the growing attractiveness of private vehicles as daily means of transportation (Aaditya, Rahul, 2023).

Goodland and Potoglou (2023) point out another challenge associated with increased use of private vehicles, which is the heightened greenhouse gas (GHG) emissions. If the number of private vehicles on the roads continues to rise, it will have adverse effects on human health, especially among those living near busy roads.

A study conducted by Downey et al., (2022) among 994 residents of Scotland indicates a potential shift in the type of transportation from public transport. Over one-third of the respondents expect to use buses (36%) and trains (34%) less frequently, with a significant potential for increased use of cars by drivers in the post-pandemic era (25%).

The COVID-19 pandemic triggered a national-level response regarding rail ownership and services in Wales and Scotland. In 2021, the Welsh government, through Transport for Wales, took ownership of the rail network and assumed direct responsibility for the Wales and Border rail network to safeguard services, protect jobs, and enhance infrastructure considering the ongoing challenges posed by the coronavirus. Similarly, the Scottish government took over control and ownership of rail services in 2022. Some rail services in England also became publicly owned. Another long-term effect of the pandemic in the UK was a shortage of bus drivers, as many bus drivers opted for a career change (Goodland, Potoglou, 2023).

In Turkey, due to rising freight prices and transit times in air and sea transportation, rail freight transportation gained competitiveness due to the COVID-19 pandemic. This was also facilitated by the lifting of pandemic restrictions imposed on all other forms of international freight transport (Ozkanlısoy, 2021).

As reported by Senir and Büyükkeklik (2020), there was also a decision to increase rail transport capacity on the Baku-Tbilisi-Kars route from 2500 tons to 6000 tons per day.

N. Taleb emphasizes the futility of historical data when attempting to predict events referred to as black swans (Taleb, 2008). This does not mean that we should not draw conclusions from them. However, creating highly detailed crisis management plans based on previous black swan events is not sensible. Instead, it is crucial to accept that we must live in times of uncertainty and be prepared for new challenges. However, companies implementing resilience strategies,

such as dual sourcing, supplier diversification, and risk mitigation plans, seem to better withstand disruptions (Sheffi, 2007).

Unpredictability and instability have become commonplace in logistics and supply chain management. The pandemic forced organizations to prioritize supply chain resilience. Supply chain resilience is the organization's ability to recover after disruptions in the supply chain and quickly adapt to adversities or disruptions (Kumar, Singh, 2019). Companies faced challenges in the logistics sector. COVID-19 showed that supply chains must be efficient and flexible to respond quickly to any changes and adapt to potential disruptions. Time and speed of reaction are crucial.

According to a study by the Capgemini Research Institute titled "Fast forward: Rethinking Chain Resilience for an After-COVID-19 World", over 80% of businesses felt a negative impact on their supply chains due to the pandemic (Capgemini Research Institute, 2020). Two-thirds (66%) of the managers who participated in Capgemini's survey believe that the pandemic compelled organizations to prioritize supply chain resilience. Therefore, they declare that their supply chain strategy will need significant changes. Only 14% of those surveyed did not expect any changes and plan to return to pre-pandemic conditions. Hence, for 62% of respondents, enhancing supply chain resilience after COVID-19 is a priority. The most common problems include shortages of necessary components (74%), delayed deliveries and extended lead times (74%), difficulties in adapting production capacities (69%), and planning processes amidst demand fluctuations (68%). Capgemini's research proves that to cope with a similar crisis in the future, companies must focus on areas that build resilience.

The study also shows that an effective response to numerous disruptions in the supply chain can be achieved by shortening it and increasing interest in collaborating with local and regional suppliers and manufacturers. Furthermore, 65% of respondents state that they are actively developing a local or regional network of partners among both suppliers and the production base. 68% of companies invest in diversifying their supplier base, and 62% in diversifying their production base.

Three-quarters of organizations (77%) recognize the need for changes and are accelerating their investments. Nearly half (47%) of respondents are accelerating investments in automation, and 39% in robotics.

In another study conducted by Rinaldi and Bottani in Italy, (2023) companies associated with plant and machinery manufacturing identified multiple sourcing as the most frequently adopted strategy in response to the extraordinary situation of COVID-19. This strategy enables the purchase of components from a greater number of suppliers, thereby increasing the robustness of the supply chain. These companies are fully convinced of the importance of global sourcing and do not plan to abandon this strategy despite transportation challenges caused by COVID-19. Some of them started implementing new modes of transport during the pandemic, shifting from road to rail transport to improve delivery timeliness and avoid travel restrictions between countries.

In a survey regarding the impact of COVID-19 on Business Continuity Planning conducted in March 2020 by Beroe, a U.S.-based market analysis firm specializing in procurement and logistics, over 450 professionals related to purchasing and logistics participated. Almost 50% of the respondents stated that their organization had implemented a Business Continuity Plan (BCP). At the same time, 26% had not yet identified key raw materials or components necessary to prepare risk management plans, a task accomplished, however, by 57% of the respondents. Nearly 60% of the respondents admitted not being familiar with the Business Continuity Plan of their critical suppliers. The analyses carried out highlight that companies are not truly concerned with the entire supply chain. They only pay attention to their direct supplier, without analysing how decentralized the supply sources used by their direct business partner are. Lack of this knowledge hampers effective risk management in extended supply chains (Prasad, 2020).

The pandemic has permanently altered the global economy, resulting in a partial retreat from globalization. The operation of the existing GVC model allowed for minimizing production costs. However, both the trade war between the USA and China and the ongoing economic crisis revealed the risks associated with it. Concentrating production in China turned out to be risky, prompting companies to diversify their geographic investments in manufacturing plants. Production was also moved closer to consumer markets to reduce risk. Companies began stockpiling parts to continue production despite supply disruptions. Avoiding the need for warehousing had previously helped reduce costs.

Many authors include changes in procurement location, easy accessibility for suppliers and customers, a flexible approach to product and inventory diversity, dynamism and digitization, as well as identifying alternative suppliers, logistics service providers, and distribution channels among the long-term effects on supply chains and logistics (Ozkanlısoy, 2021).

Regionalizing supplies is not only a means of securing business in the event of such a threat but also contributes to minimizing transportation, logistics, and warehouse rental costs. Furthermore, regionalization enables attracting new foreign investments in production and logistics to the country.

Global supply chains will distribute supply, production, storage, and sales to different regions and even continents to protect their SCs from unexpected events such as disasters and epidemics that may occur in the future. Companies will start implementing new SC strategies. One of them will be co-opetition, also known as collaboration with competitors (Sanders, 2020).

It is anticipated that changes in supply chains, particularly a new approach to manufacturers' inventory policy, will lead to an increased demand for warehouse space and overall logistics services. It is likely that some sectors will increase raw material or finished product inventories, while others will start maintaining safety stocks. The growth in inventories will necessitate an increase in warehouse capacity and the creation of new warehouse space. Additionally, to be close to customers and reduce risks during extraordinary periods, companies may need to maintain stocks in different cities or countries (Senir, Büyükkeklik, 2020).

When supply chains face the risk of a natural disaster, such as a pandemic, they must proactively make efforts in risk management to mitigate this risk with minimal damage. Resilience of the supply chain must be enhanced. Furthermore, enterprises must increase investments in digital transformation and transform their supply chains into connected and autonomous ecosystems. These supply chains will be the winning supply chains of tomorrow (Ozkanlısoy, 2021).

Every crisis is an opportunity for radical positive changes. Undoubtedly, the global COVID-19 pandemic has contributed to the development of a knowledge-based economy, online trade, remote access to public services, and the advancement of e-learning (Szczepański, 2020).

3. Methodology

Considering the aforementioned information, to ascertain the potential disparities among countries concerning the impact on organizations during the COVID-19 pandemic, we posited the following hypotheses for examination:

H_{a0}: There is no difference between countries in terms of share of affected organizations during the COVID-19 pandemic.

H_{b0}: There is no significant difference in affected organization extent by countries.

H_{c0}: There is no significant difference having supply chain disruption plan by countries.

H_{d0}: There is no difference between having supply chain disruption plan and enterprise size by country.

H_{e0}: There is no difference between affection and enterprise size by country.

The present study, primarily of an exploratory nature, includes 13 questions that encompass both explanatory and descriptive inquiries. This survey aimed to gather information from entities that are currently operating and have an active status, specifically focusing on the effects of the COVID-19 pandemic on their supply chains. Participants were asked to provide information regarding the nature and causes of supply chain disruptions inside their firms. In addition, participants were also prompted to elucidate whether contingency plans were in place to address such disruptions. Complementing these inquiries were descriptive questions pertaining to factors such as the size of the companies, the role of the respondents, and the sectors in which they operate. In our study, the essence of survey participation lies in voluntarism. As a result, a total of 358 questionnaires were received, with 106 responses from Poland, 140 from Georgia, and 112 from Turkey.

In conducting a cross-cultural study spanning three diverse countries—Georgia, Poland, and Turkey—the process of sample collection was meticulously orchestrated to ensure representative and reliable data. Employing a unified approach, we utilized online

questionnaires as the primary instrument for data gathering. The utilization of online or web-based surveys is seeing a growing trend, and when administered appropriately, they have demonstrated considerable efficacy (Rowley, 2014). Given the digital nature of our survey instrument, configured as an online questionnaire, a discerning approach was employed in selecting communication channels aligned with prevalent practices among industry professionals in each respective country. In the context of Georgia, a concerted effort was made to engage with the entire spectrum of active organizations operating within the country. This was achieved through the dissemination of the survey via targeted email invitations extended to organizations considered integral to the landscape under investigation. In Poland, a deliberate choice was made to leverage the expansive reach of industry communities on the Facebook platform as the conduit for data collection. The survey, strategically positioned within relevant professional groups, served as a focal point for soliciting responses from the discerning pool of industry practitioners. Similarly, in Turkey, the survey link was disseminated within the confines of professional groups on the LinkedIn platform, with an expectation that stakeholders within the supply chain domain would actively participate in the survey process. The tailoring of distribution channels to the idiosyncratic characteristics of each country's supply chain networks was deliberate, underscoring our commitment to securing data that is not only comprehensive but also imbued with substantive content, thereby contributing to a nuanced understanding of the distinct regional contexts under examination. Recognizing the significance of linguistic nuances, each survey was meticulously translated into the respective national languages of the participating countries. Careful attention was devoted to preserving the integrity and meaning of the questions, ensuring that cultural and linguistic disparities did not compromise the validity of the collected data. This comprehensive approach to sample collection reflects a commitment to inclusivity, cultural sensitivity, and methodological rigor in our pursuit of a nuanced understanding of the diverse perspectives across these distinct geographical regions.

Confronted with categorical data, researchers often rely on Cramér's V as a statistical measure that extends the chi-squared (χ^2) test for independence. Cramér's V provides significant information regarding the level of relationship between two categorical variables. The importance of Cramér's V values becomes prominent when the Chi-Squared Test achieves statistical significance. The values, which span from 0 to 1, provide a quantitative basis for assessing the degree of association, where higher values signify a more prominent relationship between the variables. Due to the categorical structure of the data, Cramér's V was opted into our analytical framework as a methodological approach to identify the relationships within the dataset.

There is insufficient statistical evidence to reject the null hypothesis at the 5% level of significance based on the H test statistic. Cramér's V coefficient to determine the association between variables was used (1).

$$V = \sqrt{\frac{\chi^2 / n}{\min(r-1),(c-1)}} \quad (1)$$

where:
n – total sample size,
r – number of rows,
c – number of columns.

The adjustment is such that V will range from 0 to 1. A large value of V merely indicates a high degree of association. It does not indicate how the variables are associated (Malhotra, 2017).

4. Results and Discussion

Upon amalgamating and cleaning the data procured from all three nations, a thorough analysis was executed employing the Statistical Package for the Social Sciences (SPSS). The underlying premise of our study posited that there exists a lack of disparity among countries in relation to the proportion of organizations affected. It was also postulated that there exists no substantial disparity in the proportion of countries that possess strategies for managing supply chain disruptions. It was also assumed that there is no statistically significant difference among the three countries in terms of whether organizations had a plan in place to address supply chain disruptions.

Figure 1. shows the share of the respondents in the Polish, Georgian and Turkish organizations which was affected by COVID-19 pandemic.

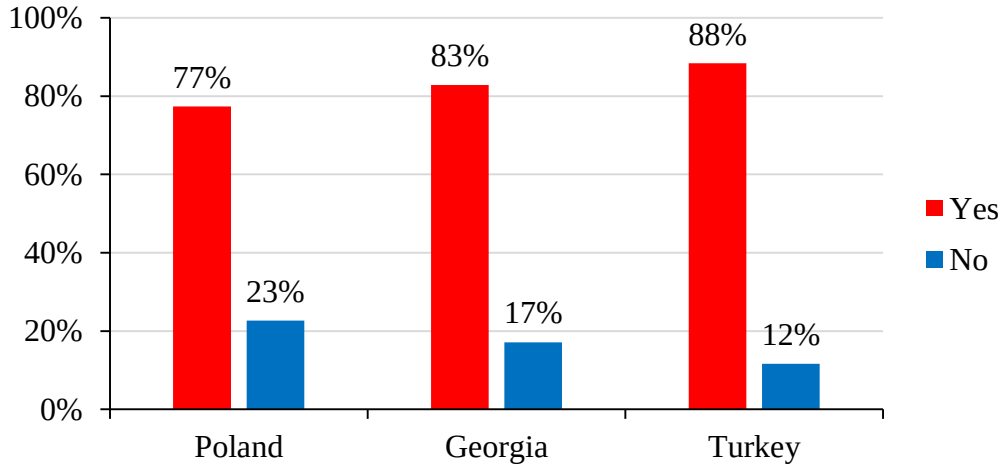

Figure 1. Share of affected organizations by countries.

Source: own study.

As can be seen from the diagram, the share of affected organizations is significantly higher in all three countries. In Turkey, 88% of the respondents answered yes, while in Georgia and Poland, this answer was 83% and 77%, respectively. Therefore, the cross-tabulation analysis shows that a yes answer cannot determine which country the issue concerns, as the COVID-19 pandemic has massively affected all three countries. This is confirmed by the low association index of Cramer's V and the level of significance, which is higher than 0.05. The calculations are presented and summarized in the Table 1.

Table 1.
Symmetric Measures

Symmetric measures			
		value	**approx. sig.**
Nominal by nominal	Phi	0.114	0.096
	Cramer's V	0.114	0.096
N of Valid Cases		358	

Source: own study.

Figure 2 shows the share of the respondents in the Polish, Georgian and Turkey organizations by affection extend of COVID-19 pandemic.

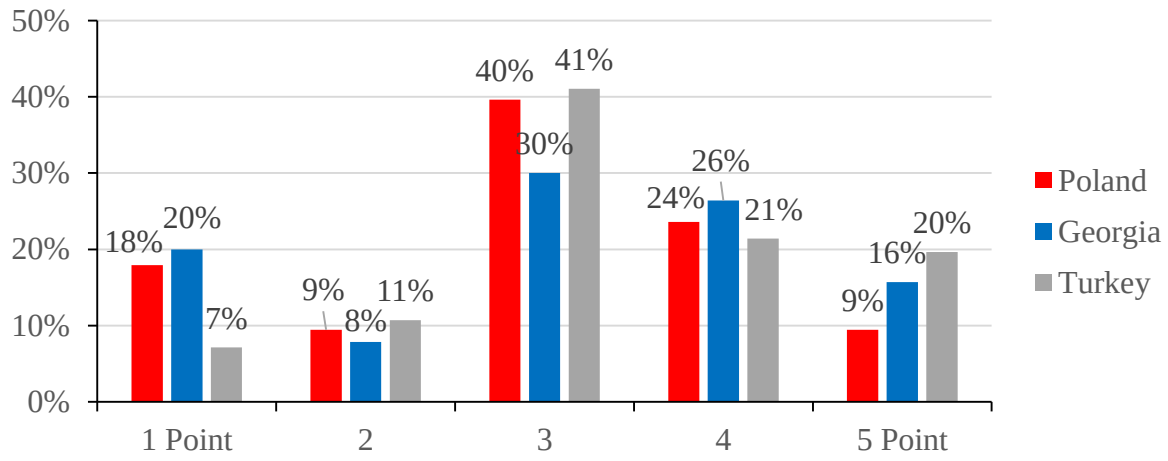

Figure 2. Distribution of firms affected by COVID-19 across the country in terms of degree of impact.
Source: own study.

The chart shows a more or less equal distribution in these three countries. As we can see, 3 points, which means an average rating, leads in all three countries.

As we can see from the table 2., mean points are close to each other, which is supported by the level of the significance (0.062) which is higher than 0.05. Therefore, our null hypothesis accepted. It means that perception of COVID-19 pandemic between countries was the same.

Table 2.
Descriptives

Descriptives						
Extent points						
	N	**mean**	**std. deviation**	**std. error**	**minimum**	**maximum**
Poland	106	2.972	1.1989	0.1164	1.0	5.0
Georgia	140	3.100	1.3320	0.1126	1.0	5.0
Turkey	112	3.357	1.1299	0.1068	1.0	5.0
Total	358	3.142	1.2387	0.0655	1.0	5.0

Source: own study.

We conducted analysis of variance (ANOVA) to determine if it was statistically important difference between means by counties as seen Table 3.

Table 3.
Analysis of Variance (ANOVA)

ANOVA					
Extent points					
	sum of squares	**df**	**mean square**	**f**	**sig.**
Between groups	8.505	2	4.253	2.800	0.062
Within groups	539.229	355	1.519		
Total	547.735	357			

Source: own study.

Figure 3 shows the share of the respondents in the Polish, Georgian, and Turkey organizations who have a plan for dealing with supply chain disruptions.

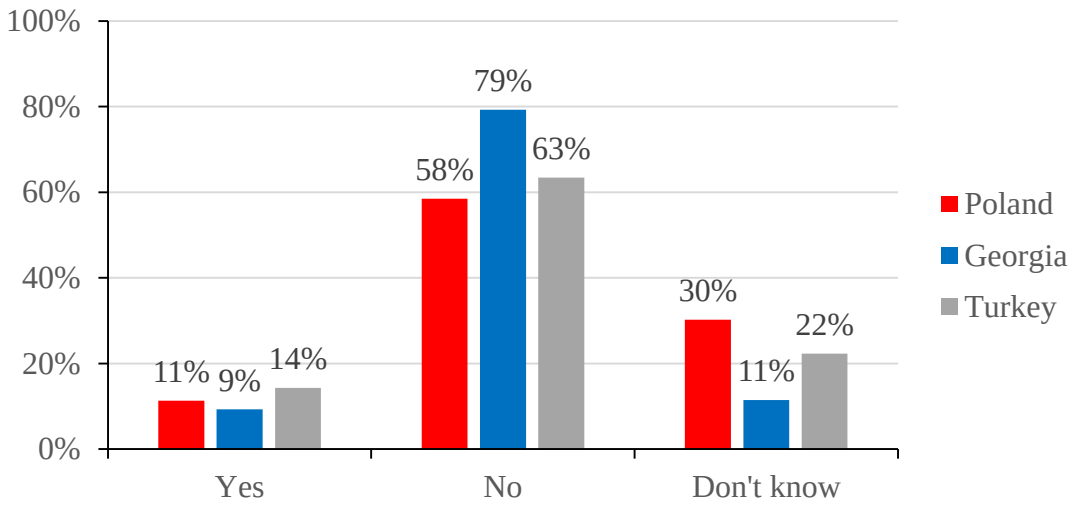

Figure 3. Having a plan for dealing with supply chain disruptions.

Source: own study.

Cross-tabulation analysis shows that the significance level is less than 0.05 and the null hypothesis should be rejected as seen Table 4. and Table 5. From the figure 3 we see that Georgia has the largest share of No answers than Poland and Turkey. Therefore, it needs further research what may be the results of this issue.

Table 4.
Chi-Square Tests

Chi-square tests			
	value	**df**	**asymp. sig. (2-sided)**
Pearson Chi-square	16.440[a]	4	0.002
Likelihood ratio	16.775	4	0.002
N of valid cases	358		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.14.			

Source: own study.

Table 5.
Symmetric Measures

Symmetric measures			
		value	**approx. sig.**
Nominal by nominal	Phi	.214	0.002
	Cramer's V	.152	0.002
N of valid cases		358	

Source: own study.

To go deep, we introduced an additional variable, enterprise size, which we grouped into 3 categories. Our goal was to show how organizations' readiness to have a plan for dealing with supply chain disruptions varies by enterprise size and country.

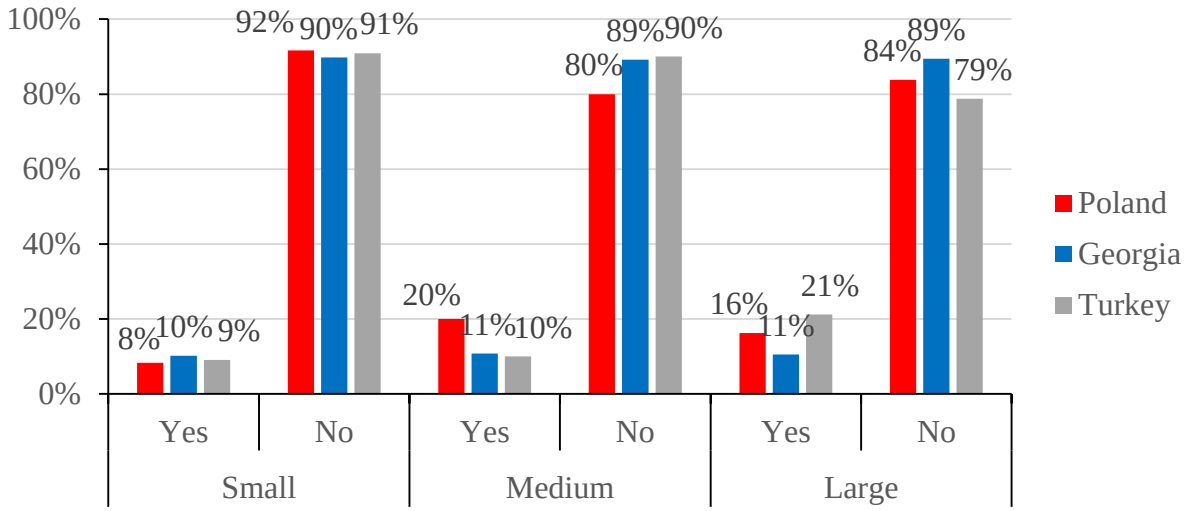

Figure 5. Distribution of dealing with supply chain disruption plan by organization size and country.
Source: own study.

Table 6.
Symmetric Measures

Symmetric measures				
size			**value**	**approx. sig.**
Small	Nominal by nominal	Phi	0.025	0.978
		Cramer's V	0.025	0.978
	N of valid cases		72	
Medium	Nominal by nominal	Phi	0.129	0.549
		Cramer's V	0.129	0.549
	N of valid cases		72	

Cont. table 6.

Large	Nominal by nominal	Phi	0.118	0.373
		Cramer's V	0.118	0.373
	N of valid cases		141	
Total	Nominal by nominal	Phi	0.100	0.238
		Cramer's V	0.100	0.238
	N of valid cases		285	

Source: own study.

As we can see, pandemic preparedness, as expressed by the supply chain disruption plan, does not differ by country. Cross-tabulation analysis shows that the significance level is more than 0.05 and the null hypothesis should be accepted as seen Table 6. That means that there is also no statistically significant difference depending on the size of the enterprises. This indicates that pandemic preparedness was roughly equal in relation to the criteria mentioned above. It is interesting how organizations will change their attitude towards crises by developing supply chain disruption plans. Depending on the size of the enterprise, they may adapt to the changed environment differently. This emphasizes conducting research in a similar direction in the future. Figure 6 shows if the firms based on their size affected by COVID-19 among countries.

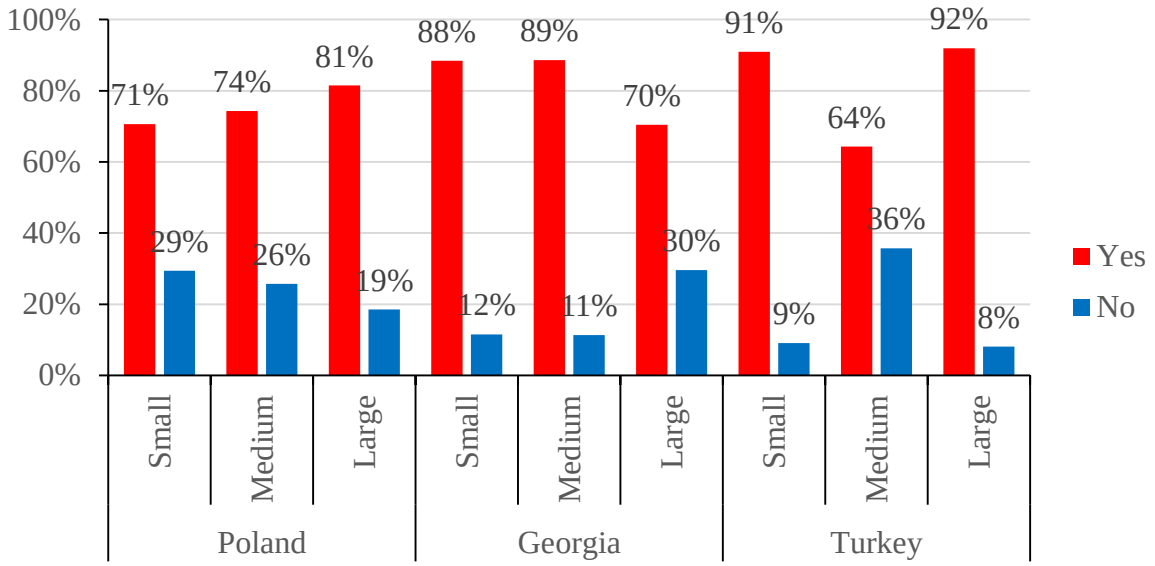

Figure 6. Affection by country and size.

Source: own study.

Table 7.
Symmetric Measures

Symmetric measures				
country			**value**	**approx. sig.**
Poland	Nominal by nominal	Phi	0.105	0.561
		Cramer's V	0.105	0.561
	N of valid cases		106	
Georgia	Nominal by nominal	Phi	0.223	0.031
		Cramer's V	0.223	0.031
	N of valid cases		140	

Cont. table 7.

Turkey	Nominal by Nominal	Phi	0.285	0.011
		Cramer's V	0.285	0.011
	N of valid cases		112	
Total	Nominal by nominal	Phi	0.055	0.583
		Cramer's V	0.055	0.583
	N of valid cases		358	

Source: own study.

Figure 6 shows the share of the respondents in the Polish, Georgian and Turkey organizations by affection extend of COVID-19 pandemic. Although the level of significance in the overall indicator is higher than 0.05, in the case of Georgia and Turkey it is lower than 0.05, which means that the differences are statistically significant as seen Table 7. However, this may be due to the fact that the share of affection in the large and medium organizations included in the study in Georgia and Turkey was significantly different from each other. It follows from the above that there is a difference within the country on the examples of Georgia and Turkey, although the difference between all three countries is not statistically significant and the null hypothesis has been confirmed. This means that overall, there is no difference in enterprise size and affection extent in the three countries.

Summarily, Table 8. provides a concise overview of the level of support for our research hypotheses.

Table 8.
The results of the analysis of the association between the variables

Hypothesis	Null hypothesis	Cramér's V	Sig.
H_{a0}	Supported	0.114	0.096
H_{b0}	Supported	-	0.062
H_{c0}	Not Supported	0.152	0.002
H_{d0}	Supported	0.100	0.238
H_{e0}	Supported	0.055	0.583

Source: own study.

The H_{a0} hypothesis indicated that there is no difference between countries in terms of share of affected organizations during the COVID-19 pandemic. We accepted H_{a0} hypothesis that means that that countries can't be determined by yes answers. So, we conclude that because share of the positive answers was high, the COVID-19 pandemic has massively affected Polish, Georgian, and Turkish entities.

The H_{b0} shows that there is no significant difference in affected organization extent by countries. Analysis of variance (ANOVA) introduced to determine if it was statistically important difference between mean points by counties. The result shows that means are close to each other. Level of the significance (0.062) which is higher than 0.05 also support this idea. Null hypothesis was accepted. Therefore, we can conclude that perception of COVID-19 pandemic affect to active entities between countries was the same.

The H_{c0} says that there is no significant difference having supply chain disruption plan by countries. It was rejected by assumption that statistically significant difference was between having a plan for dealing with supply chain disruptions. Georgia has the relatively large share of No answers. From our point of view, it needs further research to be understood the reasons of it and potential benefits of having plans for dealing with supply chain disruptions from Georgia perspective.

Meanwhile the H_{d0} concludes that there is no difference between having supply chain disruption plan and enterprise size by countries. As expressed by having the supply chain disruption plan, pandemic preparedness does not differ by country. Through cross-tabulation analysis, it is evident that the significance level exceeds 0.05, leading to the acceptance of the null hypothesis. Consequently, there is no statistically significant variance based on enterprise size. This indicates that pandemic preparedness was roughly equal in relation to the criteria mentioned above. The adaptation to the altered environment may vary depending on the enterprise's size, underscoring the importance of future research exploring this aspect.

Finally, the H_{e0} says that there is no difference between affection and enterprise size by countries. While the overall indicator's significance level exceeds 0.05, it is noteworthy that for Georgia and Turkey, the level drops below 0.05, indicating statistically significant differences. Consequently, even though the distinctions among all three countries lack statistical significance, confirming the null hypothesis, there exists a disparity within large and medium organizations results in Georgia and Turkey. In summary, there is no discernible difference in enterprise size and the extent of affection across the three countries.

Upon testing all five hypotheses, the findings revealed the acceptance of four and the rejection of one. This indicates that most of the proposed COVID-19 factors exhibit no statistically significant differences among Poland, Georgia, and Turkey. Consequently, we may infer that the COVID-19 pandemic was an overwhelmingly influential event for the entities under consideration.

5. Conclusions

The COVID-19 pandemic exhibited a global scope, as seen by its widespread impact across various industries and enterprises, as supported by scholarly literature. This research investigated the implications of the COVID-19 pandemic on global supply chains, analysing the strategies and adaptations implemented by firms in Poland, Georgia, and Turkey. The objective was to provide insightful viewpoints on the long-lasting impacts of the pandemic on supply chain management, with a focus on the solutions implemented and obstacles faced by firms in various nations. The obstacles consist of disruptions in transportation, changes in demand patterns, and the susceptibilities that are intrinsic to various industries. The results

indicate that, among the organizations included in the sample, there were no statistically significant variations seen among nations in terms of the presence and extent of the impact experienced by organizations due to the COVID-19 pandemic.

The practical implications of this study provide useful insights for businesses and organizations as they navigate the complicated challenges of supply chain management in a world that has been shaped by the effects of the epidemic. The results, obtained from an extensive empirical inquiry conducted in Poland, Georgia, and Turkey, shed light on similarities in the effects of the COVID-19 pandemic on supply chains in several geographical areas. Organizations can leverage this research to inform strategic decision-making, enhance resilience, and develop adaptation within their supply chains. The prioritization of the implementation of good risk management strategies provides firms with practical guidance. Furthermore, the supply chain environment experienced by these three countries during the COVID-19 period may serve as a valuable foresight for companies embarking on new international market pursuits.

The research presented in this study, while contributing valuable insights into the lasting repercussions of the COVID-19 pandemic on global supply chains, is not without its limitations. Initially, despite our efforts to ensure that the sample is diverse and representative, it is acknowledged that the study may not cover all sectors and organizations equally, limiting the generalizability of the findings. Secondly, it is essential to acknowledge that participation in the online survey was voluntary, thus potentially introducing a selection bias as only companies willing to engage voluntarily contributed to the data pool. Moreover, the reliance on self-reported data introduces inherent limitations, as responses are subject to individual perceptions and biases, posing a challenge to the objectivity of the results.

For further research, expanding the study to include additional nations would provide a more expansive and diversified perspective on the enduring impacts of the COVID-19 pandemic on global supply chains. Furthermore, conducting sector-specific investigations within the existing or expanded geographical scope could offer nuanced insights into the unique challenges and adaptations prevalent in different industries. Alternatively, collaboration with governmental bodies could enhance the depth of research by accessing additional datasets and insights, thereby enabling a more comprehensive analysis of the long-term implications of the pandemic on supply chain management. These potential avenues underscore the adaptability of the study framework and its capacity for further refinement through broader geographic representation, sector-specific analyses, or leveraging governmental support for enriched datasets.

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