Risk management in supply chains under COVID-19 conditions

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Abstract: Coronavirus pandemic in 2020 posed new challenges for supply chains, requiring a rethinking of risk assessment approaches, with a focus on post-pandemic recovery and SC's ability to adapt to new business conditions. This study is aimed at performing a descriptive and comparative analysis of the potential risks of supply chains in a number of countries, as well as at assessing the processes of their integration into global supply chains based on the Global

Resilience Index FM 2020 as a parameter of resilience of an entity to disruptive events, which fully meets the requirements for a comprehensive assessment of supply chain risks. According to the findings, when formulating a supply chain risk management strategy, the focus should be on an analysis of the external environment and the sustainability of the supply chain. The results and methods of this study can be applied by top managers of supply chain risk management, while government officials can use the results and methods of this article to determine policy for supply chain management.

Keywords: risk management; COVID-19 conditions; supply chain; resilience index; risk factors.

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1 Introduction

Today, risk management and the development of mitigation mechanisms are becoming one of the main functions of the day-to-day activities of a procurement manager. This applies to both new purchases and existing contracts. Current trends in supply chain management (SCM) are characterised by the fact that supply chain resilience (SC) complements supply chain risk management traditional approaches to risk management

and business continuity. Best practices focus on what actions can be taken to improve resilience at all stages of a typical SC – from demand to end of product or lifecycle (Annosi et al., 2021).

Supply risk management (SCRM) is a wide range of strategies for identifying, assessing, mitigating, and monitoring unforeseen events or conditions, both macro and micro events that may adversely affect part of the SC (Baryannis et al., 2019). SCRM techniques are often based on making quick and adaptable decisions based on potentially large multidimensional data sources.

Risk factors are any combination of people, actions and circumstances that could endanger the supply chain or pose a danger itself. When looking at risk areas, it is important to understand the potential risk areas in order to develop appropriate solutions and support the general resilience strategy. Business risks are usually classified as internal (to the organisation) or external (to the environment of the organisation). Internal risk factors include, for example, the size of the organisational and management priorities, while external ones relate to suppliers, location, political stability, climate and epidemiological situation (Revilla and Saenz, 2017; Abdyusheva and Stepanov, 2019).

Risk management remains an integral part of SC sustainability challenges. The culture of risk management should be higher than the scope of the organisation, because for proper understanding and distribution among partners, risks should be identified not only at the company level, but in relation to the entire SC. For example, by tracking inventory levels, a company can reduce inventory risks and costs, while monitoring the execution of an order can be seen as an element of customer service review. In this case, the reliability of suppliers can be considered as an indicator of the performance of risk monitoring (Choudhury et al., 2021).

Typically, SCRM considers three elements: the type of risk, the environment in which it occurs, and its overall impact on the SC. The first element considers situations that are potentially dangerous. The goal is to determine the type and degree of risk. The second element relates to SS vulnerabilities and considers organisational, technical, operational, control and monitoring aspects. The third element relates to the impact of risks on SC operations: customer response, customer experience, service quality, and system costs (Habidin et al., 2019).

Modern companies have no choice but to manage risks, deal with unforeseen disruptions and increase productivity in an ever-changing business environment. As companies adopt global and SCM practices, they discover new opportunities and challenges. On the one hand, global resources are lowering purchasing prices and expanding market access. On the other hand, the management of the global distribution channel increases the risk level of shopping malls, the probability of interruption in the flow of products and services, and their scale (Tse et al., 2021).

The COVID-19 pandemic affects the entire process, from the field to the consumer, and has thus tested the resilience of entrepreneurs in all areas. Thus, the stability of the country's business environment is a key indicator and a measure of the credibility of companies seeking to recover from a coronavirus outbreak. Thus, it can be said that the assessment of the external environment of the SC is important for effective SCRM and remains a necessary condition for successful business (Aday and Aday, 2020).

2 Literature review

A SC breach often takes a direct financial hit to a business and can cause serious damage to the company's reputation. In this respect, researchers' interest in SCRM is steadily increasing. The scientific community and practitioners widely recognise the importance of SCRM in the context of the increasing complexity of SC and the resulting uncertainty. SCRM includes a comprehensive analysis of the various stages of SCRM delivery. However, researchers often disagree about the number and content of these steps. Baryannis et al. (2019) that the vast majority of studies (84%) focus on responding to risks primarily using SC models, allowing for uncertain and preventable consequences. Only a few authors have adapted response methods and the form of risk assessment or incorporated identification and risk assessment (Baryannis et al., 2019). Scientists say that a holistic approach to SCRM is only possible when strategies based on artificial intelligence, machine learning, and big data analysis are used (Baryannis et al., 2019).

Vishnu et al. (2019), El Baz and Ruel (2021) collects the results of various research in the field of SCRM. The researchers suggest methods that can be used to manage SC risks and modelling to aid in relevant decision making. Their review identifies gaps in SCRM research and provides some promising directions for future research, such as hybrid models, field specificity, reliability, resilience and resilience in SCR (Vishnu et al., 2019; Cunha et al., 2019).

Behzadi et al. (2018), Dome and Prusty (2020), Shekarian et al. (2020) have made an in-depth review of the literature related to quantitative risk management models for agricultural SC. Behzadi et al. (2018) noted that risk management is particularly important to UK agricultural issues due to seasonal problems, oversupply, long supply periods and disruptions. Hence, researchers suggest flexibility and resilience as the two main ways to manage risk. Ho et al. (2015) analyse recent developments in the definition of SC risks, types of risks, risk factors, and risk management strategies. Based on an analysis of the relevant scientific literature, the researchers examined the potential drawbacks of SCRM. In particular, Meqdadi, et al. (2020) notes that more research is needed to examine and quantify the relationship between risk factors that can lead to SC disorders and the types of risks associated with them. To develop ways to eliminate these risks through mitigation strategies.

Collier et al. (2019) reviewed various strategies to evaluate and mitigate cyber hardware at the component level, supply chain, and within the system, and explored how it arrived at the principle of system engineering and risk management, from purely risky approaches to strategies that accept flexibility as an organisation. According to the results of the study, beyond the classical understanding of risk, developing standards and guidelines for risk management and ensuring sustainability at all levels of the circular supply chain and embedded equipment of critical infrastructure systems are beneficial (Collier et al., 2019).

De Oliveira et al (2017) investigated the applicability of ISO 31000 in the context of SCRM. After systematically reviewing the publications on this topic, they suggested prioritising risk assessment methods and identifying ISO 31000: 2009 risk assessment tools and methods that could help build a comprehensive methodology for SCRM. Based on the study results, the researchers concluded that ISO 31000 can be used as a standard method for performing SCRM when considering company needs and business characteristics.

Much research has been devoted to exploring the benefits of modern information and communication technologies for solving SCM problems. Thus, Salamai et al. (2019), Samizadeh et al. (2019) consider SCRM for information science problems and suggest the use of large-scale data acquisition methods to gain a deeper understanding of real-world risk management data. The study by Munir et al. (2020) Depends on the concept of manufacturing to be exposed to risks. The relationships between SCRM integration and SCRM are explored to improve functionality (Shahbaz et al., 2020). Studies by DuHadway et al., (2019), Kara et al. (2020) focused on developing data-driven methods to identify, assess and mitigate different types of risks in SCs. The results presented in (Kara et al., 2020) are supported by a baseline study based on a series of interviews, discussions, and group research. This study demonstrates how data analysis supports the concealment and usefulness of information from unexpected problems for informed risk management decisions.

Several authors explore SC risk assessment and management approaches based on source science review (eg, Ho et al., 2015; Baryannis et al., 2019; Pournader et al., 2020). Using a literature review, Manhart et al. (2020) found that channel integrations and networks contribute to SCRM. Their research studies confirmed that SCRM is an important contributor to the overall stability of work, and they indicated that the effectiveness of risk management depends on culture. Bier et al. (2020) A comprehensive overview of the current methods used to relieve SC stress. The results of their analysis indicate that research in this area is differentiated and a common form language has not emerged recently.

Mari et al. (2019) suggested a potentially hazy environment for flexible supplier selection and order allocation, taking into account the new flexibility criteria (supply intensity, transition time and flexibility index score) for supplier selection. For this purpose, a multi-purpose interactive ambiguous programming approach has been developed that allows to reduce the uncertainties inherent in the supplier selection decision (Mari et al., 2019).

According to Tripathi and Gupta (2020), the benefits of change are due to easy technology to integrate with business objectives. Saving 60% of time decision making through appropriate efforts in product handling. Min (2019) stated that blockchain technology (IT) can improve fixed-line supply in times of high risk and uncertainty, as it reduces risks associated with network communications, including IT and network breaches, vulnerability to political unrest, and high compliance. With federal laws and regulations, financial instability in enterprises and contractual disputes.

With a wide range of applications to SCRM, special emphasis should be placed on the tasks assigned in studying the properties of SCRM for specific types of products. For example, work (van den Brink et al., 2020) examined the extent to which cobalt production and supply could be rooted in SC hazards and potential risk values. The issue of risk in SC fabrics attracted the attention of Adhikari et al. (2020) – They note that the potential impact of all store traders and brokers may lead to buying stockbrokers.

As per Zhang et al. (2019), the supply disruption problem can be successfully addressed by the emergency model, and the sustainable emergency strategy also limits the changes that occur as a result of operational changes between emergency subsystems and uncertain customer requirements. Thus, a strong and non-transparent emergency strategy can ensure that the supply chain system is stable in the event of an accidental supply interruption and that the overall cost of the emergency supply chain system is maintained at the best level (Shareef, et al., 2020).

Zhukov et al. (2019) examined the relationship between barriers and speed SCM in travel companies. As part of the study, they identified and constructed the main characteristics of the barriers in the SCM. In terms of the main barriers, Prajogo et al. (2020), González-Zapatero et al. (2020) describe the difficulty in measuring and monitoring the quality of work with service providers as well as the barriers to obtaining information about the potential for improving the SCM.

Looking at the information above, one can suggest that the number of publications regarding risk factors for hepatitis C disease has increased in recent years. The analysis of the scientific literature in this chapter allows the identification of two research centres:

1 classifying the types of risks and making efforts to cover the topic as broadly as possible

2 narrowing down on a specific type of risk.

The literature review highlighted the lack of integrated research on the complexity of the external environment in the emergence of risk in SCM. It should also be noted that SC risk assessment is often based on a widely defined risk rating. However, the Coronavirus outbreak in 2020 poses new challenges for the wider world. Reassessment of problem-solving models and consideration of reward in disease rehabilitation techniques was required and the ability of SCs to adapt to new working conditions (Yang et al., 2021).

Presently, there is great significance in scholars' interest in resilience in SC among scholars around the world (Behzadi et al., 2018; Luthra et al., 2018; Pournader et al., 2020). Many situations can be identified when the risk becomes real. At the same time, the fact that some organisations were able to eliminate these negative actions easily could not be ignored, while other companies did not recover their results. It was clear that some companies were well prepared for the risks, while others were affected by unforeseen circumstances. With the increase in exports and the development of multi-level global supply chains (GSCs), many companies faced increased risks of disruption or harassment (such as low-quality products), corrupt behaviour, and youth employment) in their own communities. Long-term, outcome-oriented supply chains are beginning to explore important aspects that are highly valued by the organisation and most consumers to reduce the negative impact of risk and increase the resilience of SCs (Raut et al., 2017; Manhart et al., 2020; Gupta et al., 2020). Tsai et al. (2021), Prakash et al. (2021) focuses on minimising supply chain risks with a view to sustainable development. However, the issue of assessing the external environment in which the Supreme Committee operates is still under discussion.

In light of this, the present study aims to conduct a detailed comparative analysis of potential railways using the example of Austria, Russia and Kazakhstan and to assess their integration into global supply chains. To achieve this goal, the study authors collected relevant data sets and only time analysed the indicators to assess risks and uncertainties in SCM activities. The paper also dealt with the characteristics of the economic environment in which the Supreme Committee operates, described the characteristics of large objects, and compared them with environmental impact studies. All this helped discover the risks of reducing uncertainty and increasing the resilience of the Supreme Committee, and contributed to defining the country's comparative position on a global scale.

3 Materials and methods

To assess the risk of SC, one must rely on statistics and practical experience. This study uses available statistics provided by the World Bank Group (2020), the Organisation for Economic Cooperation and Development (OECD, 2020), the International Monetary Fund (2020), and the FM Global Resilience Index (2020). The annual Resilience Year, published by FM Global, is a detailed presentation providing links of countries' resilience to disaster events, which fully meet the SC's risk analysis requirements. The index combines the 12 main drivers of climate change into three categories - economy (production, political energy, fuel economy, and urbanisation rate) and the quality of life risks (exposure to natural hazards and natural hazards), Fire risks, and electronic risks), and product supply (corruption management, infrastructure efficiency, organisational management, Supreme Committee vision). Their ratings provide points for 130 countries and territories around the world. Selected to cover the largest countries (by major local products) with the most complete data in the past five years (FM Global Resilience Index, 2020).

Therefore, the FM Global Resilience Index (2020) is a comprehensive tool to help companies assess the ability of different countries to take risks and recover with confidence in the event of a crisis. With its help, management firms around the world can make better informed decisions when managing the risks that their companies face.

This study focused on studying and evaluating the state of the logistics environment in Austria, Russia and Kazakhstan based on the status of their resilience index and on comparing the risk assessment of the SC for these countries with those of world leaders. The Summary of Comparative Studies included different countries included in the FM Global Resilience Index. However, for example, more flexible economies and a few countries close to the case of Russia and Kazakhstan are compared in this paper. In general, the resilience index was surveyed in eight countries: Russia, Kazakhstan, Austria, USA, Qatar, China, Singapore and the Czech Republic.

The selection of these countries was determined to be scored differently in the FM 2020 Global Sustainability Index, different geographical locations and different levels of developed and organised economies. The Russian Federation and Kazakhstan were selected as the two main countries of study, taking into account the common economic structure and the common economic and political system, all of which are members of the Soviet Union.

4 Results

As reported by FM Global (FM Global Resilience Index, 2020), when the 2020 Sustainability Index was compiled, countries' responses to infectious diseases were also permitted, allowing market analysis to maintain stability and address the problem. Thus, according to the end of 2020, Norway, Switzerland and Denmark are above the general level of stability. The top ten also includes Sweden, Finland, Luxembourg, Austria, the United States, and the United Kingdom. Haiti, 130th, is still at its lowest level (Global Sustainability Index, 2020). For more controversy, the paper discusses the impact of tax tolerance in detail.

Norway tops the FM Global Sustainability Index 2020 (FM Global Sustainability Index, 2020). The country's economic stability, stable political environment, low

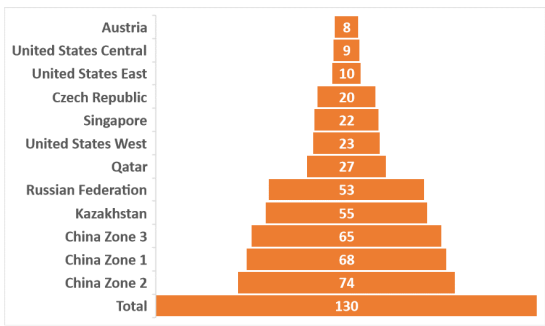
corruption, good risk standards and excellent governance play a major role. Despite its oil-dependent economy, Norway spends a lot of money to reduce carbon emissions and has the highest level of electric motor construction sites in Europe. Among the top five countries in terms of early payment machines, Switzerland and Denmark, which ranks second and third. Switzerland advanced one level this year as it remains one of the most politically stable countries in the world, with high-quality infrastructure and a positive outlook on the Global Labour Index. Meanwhile, Denmark continues to improve due to corruption management and Supreme Committee identification (FM Global Sustainability Index, 2020). Austria ranks eighth, lagging behind economically. Russia ranks well overall, ranking 53 out of 130 countries and regions. Kazakhstan ranks equally (55) (FM Global Sustainability Index, 2020). China and the United States are divided into three occupied regions due to different climatic conditions and natural hazards (China ranks 68, 74 and 65 in Zones 1, 2 and 3, respectively, while the United States ranks 10th, respectively. 23 and 9, series) (FM Index Global Sustainability, 2020).

On the other side of the index are Haiti (130th), Venezuela (129th) and Ethiopia (128th) (FM Global Sustainability Index, 2020). Haiti is most at risk from natural disasters. In 2019, the country experienced many hurricanes and floods. Venezuela is highly dependent on oil production and remains at high levels of corruption and high risks. Ethiopia, despite the lower scores, improved its political situation and organised corruption (FM Global Sustainability Index, 2020).

Natural hazards have a big impact on the final outcome of the situation. These days, floods are a serious threat. In addition, global warming threatens with frequent winds and turbulence, leading to torrential rains and hurricanes. The need for prevention and risk reduction efforts is becoming increasingly important. Using flood contingency planning, combined with efficient flood maps and global flood maps, can increase businesses' resilience to flood risks.

The next step in the study is to select some countries with different resilience conditions for detailed analysis. Their position according to the elasticity index is shown in Figure 1.

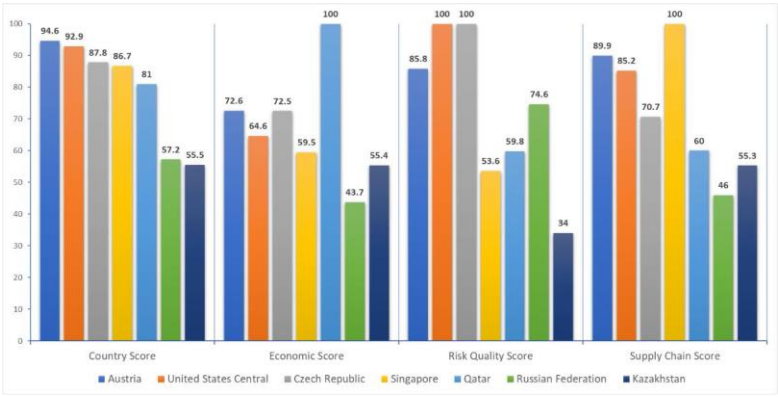
Figure 1 country ranking by resilience (see online version for colours)



Source: Based on data retrieved from (Fm Global Resilience Index, 2020)

Figure 1 shows that Austria and the United States maintain high levels. They are followed by the Czech Republic, Singapore and Qatar in the 20th, 22nd and 27th places, respectively. The total distribution of scores is shown in the figure (Figure 2).

Figure 2 Resilience index scores: country scores and by factor (see online version for colours)



Source: based on data retrieved from Fm Global Resilience Index (2020)

The design must also take into account the fact that the score is not only a set of characteristics that determine a country's position in the rating. It also represents the average of the important factors affecting economic resilience. Thus, Figure 1 and Figure 3 illustrate the differences in studies in the same key areas – economic analysis, risk assessment, and provision of chains for key factors in the countries' wars of Austria, Russia and Kazakhstan.

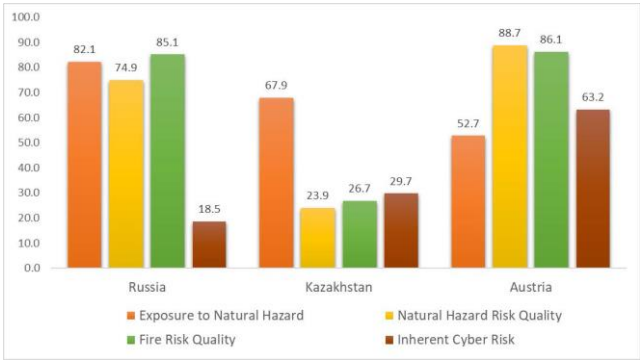
Figure 3 Resilience index scores: overall and by factor (see online version for colours)

Source: Based on data retrieved from Fm Global Resilience Index (2020)

One of the unique aspects of the Resilience Index is the flow of expertise and data gathered by FM Global Property Risk Engineers (FM Global Resilience Index, 2020), which annually visits and evaluates many sites throughout the world. The risk profile includes three basic conditions: exposure to natural hazards, natural hazards and fire

hazards. In addition, a fourth engine is included to reflect the country at risk of the Internet (FM Global Resilience Index, 2020). Figure 4 shows the scores for the main drivers of quality risk in Austria, Russia and Kazakhstan.

Figure 4 Risk quality factor scores by country (see online version for colours)

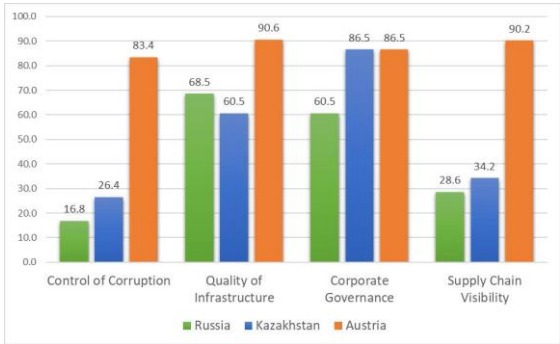


Source: Based on data retrieved from Fm Global Resilience Index (2020)

As can be seen in Figure 4, Russia has the highest level of natural disasters and fire hazards, which gives it a high level of quality and a high overall rating (74.6 and 25 points, respectively). As far as Austria and Kazakhstan are concerned, they are ranked 15th and 85th respectively.

According to the resilience index developed, the Supreme Committee can be evaluated against four main criteria that determine its impact and reliability: corruption management, infrastructure quality, business management, and oversight. (FM Global Resilience Index, 2020). Figure 5 shows the rates for these engines for Austria, Russia and Kazakhstan.

Figure 5 Supply chain factor scores by GRI pillar (see online version for colours)



Source: Based on data retrieved from Fm Global Resilience Index (2020)

Interesting is the fact that Austria ranks first on metrics for all drivers, while Russia is showing good scores for infrastructure well-being and Kazakhstan – for commercial governance. However, Russia and Kazakhstan do not see the Supreme Committee well and are a bit corrupt. In such cases, SCM risks increase, resulting in a breakdown in confidence in global standards and hindering its economic growth.

With all this, one could argue that when developing a SCRM plan, one should think very carefully about the details of the external environment. The effectiveness of the procedures performed can be greatly reduced due to the conditions in which the SCM is managed. There is still a global trend that needs to think about SC Global Resilience. Therefore, the Global Risk Management Resilience Index is a suitable tool for rapid SC risk assessment to allow priority setting when developing risk management.

5 Discussion

An in-depth analysis of the published science reveals that the authors often discuss both internal and external risks during their SC risk assessment. Internal content typically includes a wide range of institutions, internal partners and support from officials, while external content includes issues related to applicants, locations, government requirements, legislation, institutions, economy, and price. The foregoing indicates that, first of all, it is necessary to consider the potential risks to the external environment in which the Supreme Committee is working in order to develop an effective risk management strategy in the sector within the home. Despite this apparent fact, most of the authors focus on the company itself without referring to external factors (Habidin et al., 2019).

SCM is gaining increasing importance today due to globalisation, numerical change and shift to new technologies (Collier et al., 2019). At the same time, today, resilience of the topic often appears as the focus of research on SCM – there is a large body of literature examining resilience under six scans. Participate in SCM. The combination of model-based and data-driven approaches enables a network of data risks, interference models and performance evaluations (FM Global Resilience Index, 2020). Increasing access to information in companies helps increase the transparency of operations and reduce risks (Ivanov and Dolgui, 2020). In addition, the combination of the use of traditional and data-based methods could enhance the competency model and improve the SC's ability to adapt to the lagging course of COVID-19 disease (Ivanov and Dolgui, 2020).

Although the fact that the impact of disease is not measured by the 2020 FM Global Resilience Index is evident, the resilience of the business environment provides reliable data for companies trying to deal with the impact of disease. The FM Global Resilience Index analyses the data to provide a rating of resilience for three main factors: economics, supply chain, and risk (FM Global Resilience Index, 2020). This data supports important business options - such as where to create a business on the website, contracts with suppliers, and specific customers - all of which are options. Knowledge can be replenished (Tripathi and Gupta, 2020). It helps companies assess the resilience of all different countries to withstand disasters and recover in the event of a disaster. Resilience to climate change, floods and online risks was highlighted in the 2019 events, but by 2020, the problems associated with COVID-19 are on the rise. As risks advance, the need for flexible business becomes apparent (Aday and Aday, 2020).

For this reason, effective resilience activities in an organised higher committee can help avoid or manage negative impacts. The mainstay of any effort to develop an approach to SCRM should be an understanding of the potential risks, those most at risk, and the overall costs of these adverse effects (Revilla and Saenz, 2017). The flexibility of the Supreme Committee is the ability to effectively plan and plan the Supreme Committee network to plan unplanned events, understand financial resources, and respond positively to crises while maintaining crisis control and actions and achieving desired results. Risk assessment remains an important step that cannot be achieved without a thorough study of the external environment in which the SC is managed (Mari et al., 2019).

Conducting risk factors in SC processes is essential to obtain the desired result. Although this is a group research activity aimed at improving the progress of the company in its activities, the disadvantage of the current methods is that they only study the conditions of local events in the Supreme Committee. Salamai et al. (2019) says that it is also important for companies on the Supreme Committee to consider external factors because they will be directly involved internally, which underscores the importance of the external analysis performed in this article.

SCRM is critical to a company's success. Due to the increasing complexity of SC, avoiding and minimising the effects of complications is very difficult (Bier et al., 2020). Early contributions addressed risks with their greatly diverse structure, and only a few projects focused on their intersection (Bier et al., 2020). Munir et al (2020) showed that internal integration and customer and customer integration have a positive effect on SCRM. They simulated and modelled comprehensively to demonstrate the effects of integrated SCRM on SCRM. Kara et al. (2020) data that increased risk levels, technology development, and increased large-scale data on SCRM sites, convinced societies to adopt a data-driven approach to SCRM. This realisation of the impact of the increasing number of changes, and the use of information and communication technology, has increased the visibility of the Supreme Committee. On the other hand, this requires that electronic risks be evaluated at the same level as other types of risks. However, given the fact that the FM 2020 Global Resilience Index also takes into account online risks, the overall approach to this issue is emphatic (Min, 2019).

6 Conclusions

Digitalisation has revolutionised nearly every business. Empirical research has shown that the widespread use of digital and big data technologies is an effective way to develop resilient global supply chains, reduce dependence on natural disasters, and develop a larger economy. The use of new technologies and communication technologies can expand trade barriers, increase the reliability and visibility of SCs, and positively influence the stability of SCs and the global market. On the other hand, in the face of many uncertainties, risk management is critical to the SCM School.

The study of the causes of crises in the SCs and their drivers for recovery revealed some general trends. Numerous conflicts, political upheavals, the emergence of terrorism and other atrocities have taken place in the world. Many countries are plagued by corruption. Some countries rely on oil shortages. Disasters and climate emergencies, COVID-19 disease and schedule of natural disasters in 2020, natural disasters, extreme

weather, communication problems, SC visibility and other factors affect the resilience of the country and it is important to assess problems.

The study highlighted the importance of external risk assessment for SCM schools. Corruption, cybersecurity, the emergence of the Supreme Committee, and political insecurity are important in the resilience index analysis. For Russia and Kazakhstan, environmental policy, anti-corruption and the special agreement are seen as major areas that need improvement. In addition, Russia has a high level of risk quality, with the only exception being the personal cyber risk drivers. This fact indicates the need to improve the quality of the country's security records. In general, it can be said that financial management is one of the ways to reduce the effects of corruption, as well as increasing the visibility of SCS, is the widespread introduction of modern technologies into the operations of companies involved in international trade.

This study is limited to analysing 8 of the 12 GRI sub-indicators from 8 countries (out of 130). There is the possibility of some studies using a large number of sub-indexes including other groups or wide groups of countries.

Data and research methods can be used by senior executives to manage selection risk, and officials can apply the findings and research methods to interpret management guidelines.

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