
SUPPLY CHAIN RISK MANAGEMENT IN COVID – 19 PANDEMIC

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Abstract: *Uncertainties, vulnerabilities, breaks, supply and delivery problems, etc., are some of the characteristics of today's supply chains. Appropriate management, with special emphasis on risk, is required for the success of the supply chain. Risk management is a particular segment of supply chain management that aims to reduce vulnerability and increase the resilience of all its entities. The COVID-19 pandemic has significantly contributed to an increase in the number, types, and volume of risks in supply chains. To ensure the sustainable functioning of the supply chain, it is necessary to formulate appropriate risk management strategies in the current pandemic. This paper aims to identify and recapitulate some of the key risks in the pandemic and to suggest ways to manage them to increase the resilience of all entities in the supply chain. Special attention is paid to the analysis of these risks to mitigate the consequences of their outbreak.*

Keywords: COVID-19 pandemic, SCRM, breaks, vulnerable, risks.

1. INTRODUCTION

Stochastic requirements of users and markets, the establishment of strategic partnerships between providers of logistics and other activities, economic, energy, and information transactions, and shorter product life are just some of the causes of the company's exposure to supply chain risks (SCR). These risks can be the result of man-made disruptions or natural disasters and can have major consequences for the company. Lately, within the SCR literature, supply chain risk management (SCRM) has become a key area of interest. SCRM aims to develop a strategy for identifying, assessing, treating, and monitoring SCR. Risk management can be defined as a complex function that aims to identify, assess, and manage them in such a way that the risks related to their realization are minimal. As time goes on, SCRM practice is based on reducing the vulnerability of SC and mitigating the impact of the disorder (Wijaya, 2021; Ivanov, 2018).

The emergence of risks due to the COVID-19 pandemic affects companies and government institutions that are equally responsible for resolving disruptions. It is undeniable that strict societal constraints in dealing with the transmission of COVID-19 significantly affect

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consumer behavior and purchasing power. As a result, a significant number of companies have difficulty due to reduced traffic, which is associated with lower customer demand. Similarly, COVID-19 has caused significant uncertainty in the realization of financial activities in tourism, travel, catering, supply chains, consumption, production, etc. Furthermore, the COVID-19 crisis has had an impact on all product prices, including fossil fuels and renewable energy sources.

Many companies have temporarily stopped functioning due to bankruptcy and a lack of capital flexibility to face uncertainty during the pandemic. During the COVID-19 crisis, consumers behaved in a similar way as during historical crises, such as the 2002–04 SARS outbreak, the 2011 Christchurch earthquake, and Hurricane Irma 2017. COVID-19 significantly affects changes in user behavior, affecting global economic conditions too. This results in significant economic downturns, company and industry failures, as well as increased unemployment and flooding, especially in undeveloped economies (Wijaya, 2021).

In a competitive market environment, effective SCRM is a critical issue for a company's growth and survival. Therefore, the primary goal is to consider the possibilities for SCRM recovery in context, defining necessary measures and recommendations for overcoming the negative effects caused by the pandemic. After identifying the risk, it is desirable to consider and define a strategy that will best manage the disturbances and build greater resilience for the entire SC. Various SCRM methods and strategies can be used to increase SC resilience, as can modern tools, methods, and modern technologies (e.g., Blockchain, Big Data, Digital Twin) (Wijaya, 2021; Ivanov, 2018).

The concept of SCRM and the impact of the COVID-19 pandemic will be explained at the start of the paper. The importance of risks for SCs, their classification, and some common issues within SCRM will also be discussed. The risks to which SCs were vulnerable during the pandemic are detailed below, with a focus on risks related to supply and demand and coordination of activities in customer service. The processes of implementing these procedures and techniques, including future research directions in the context of risk management strategies, will be analyzed due to the complexity of SCRM.

2. SUPPLY CHAIN RISK MANAGEMENT

An SCR is an activity that can disturb the flow of information, materials, or finished products from producers to consumers. In essence, there are several dimensions to risk. According to some researchers, risks in SC can be categorized as operational risks and risks of disruption (Ivanov, 2018). Operational risks relate to common disruptions in SC activities, such as delivery times and fluctuations in demand. Risks of disruption mainly relate to road phenomena that have a major impact on companies (Hosseini et al., 2019). Pandemics are a special type of risk in SC since they are long-term, unpredictable, and have a wide distribution (Ivanov, 2020). Disturbances caused by pandemics can endanger the resilience of the SC and affect its recovery. SC recovery is essential for SCRM and the sustainability of SC (Son et al., 2013). Sustainability refers to "the ability of an SC to sustain and survive in a changing environment for the company."

Some of the current studies indicate that SCRM is becoming an increasingly important topic in research. Also, SCRM is a concept that encompasses all strategies, benchmarks, knowledge, processes, and technologies that can be used at both operational and strategic

levels to minimize SCR. A review of the literature on this topic concludes that the authors most often apply proactive and reactive measurements for effective SCRM. Proactive measurements are used to reduce the likelihood of risky events occurring (Chen et al., 2015; Chowdhury et al., 2019). Reactive are established to reduce the impact of risks and ensure a rapid recovery of SC. Reactive measurements can be used to respond to disturbances caused by disease outbreaks, earthquakes, and terrorist attacks because their occurrence is unpredictable and beyond the control of business entities (Ali et al., 2019).

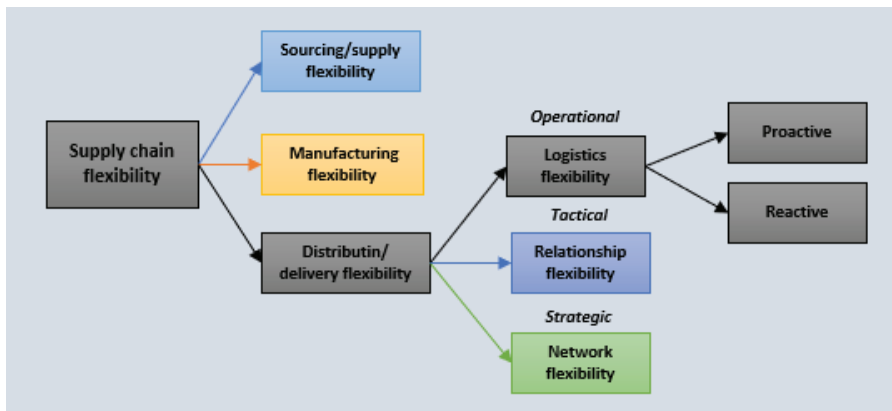


Figure 1. Implementation of proactive and reactive policies (Chen et al., 2015)

As indicated in figure 1, the implementation of proactive and reactive measurements has a direct impact on the flexibility of the entire SC. Their application is inextricably linked to operational flexibility. Through the operational level, further connection extends to the flexibility of the distribution process, i.e., product delivery. Flexibility at this level was critical in the SC during the pandemic. As significant limits were imposed by the crisis, distribution had a significant effect on meeting customer demands (Chowdhury et al., 2019; Ali et al., 2019).

The results of some previous research indicate that 80% of companies within two years of the interruption failed to formulate and implement recovery strategies due to SC disruptions during the pandemic. Based on analyzed statistics, the incidence of such major disorders in SC has increased in recent years. The development of strategies for the recovery from major pandemics has become a key factor for the long-term survival of SC. The available literature on major epidemics mainly addresses SC issues of providing humanitarian assistance in the event of outbreaks of such disturbances or other natural disasters. There is a lack of studies on how traditional SCs can recover from natural disasters. Most studies to date have focused on the development of a recovery model after an SC break. These recovery models focus on supply, production, demand, and transportation disruptions. Although the development of a recovery model is necessary, identifying potential challenges in recovering from a breakup is vital to properly planning to overcome the pandemic challenges (Huber et al., 2019; Li & Zobel, 2020).

Companies face many challenges in formulating SC recovery strategies. Resource limits are one of the challenges, especially for small and medium-sized companies. Efficient allocation of scarce resources is essential as companies struggle to decide on investment priorities for rapid recovery. Major disturbances in SC also affect broader socio-economic

factors and the purchasing power of consumers (Huber et al., 2019). As a result of SC disruptions, companies have challenges at various levels of their operations, pointing to the prominence of the bullwhip effect. The bullwhip effect further reduces SC resilience and the ability to design and implement a recovery strategy (Li & Zobel, 2020). Recovery from disruption requires the formulation of flexible recovery strategies that take into account different scenarios and challenges (Wang & Yu, 2020). Flexibility is necessary because the effects of the pandemic-induced disorders on SC will vary. Therefore, different combinations of recovery strategies need to be considered, which is a common challenge for many companies. Recovery strategies to return to normal or better operational conditions after catastrophic events are vital for the rapid recovery and survival of SC. The conclusion is that the goal of the SCRM process is to limit the effects of SC disturbances that interfere with the continuity of material and information flows within the SC.

3. RISKS IN SC DURING THE COVID-19 CRISIS

Natural disasters, such as the COVID-19 pandemic, represent a special case of SCR in terms of duration (long-term), high uncertainty of consequences, and effects of spread. Disorders of SC caused by pandemics can threaten the resilience and reliability of SC, as shown in several studies (research by Kumar & Chandra (2010) on the impact of bird flu on US companies). The outbreak of the COVID-19 pandemic has affected the operations of global SCs by causing disruptions. The effects of the COVID-19 disruption have affected the global economy and temporarily stopped many industries. Statistics show that more than 94% of the largest companies have been negatively affected by this pandemic. Additionally, COVID-19 directly causes supply and demand disruptions at the global and local levels (Ivanov, 2020; Chowdhury et al., 2019). The field of SCRM is very broad and the need to control the negative impacts that inevitably occur is great. Therefore, the authors gave several definitions and categorizations of disorders that lead to adverse events. According to some studies, there are three main types of SCRs (Ivanov, 2020; Chen et al., 2015; Kumar & Chandra, 2010):

1. Internal company risks: control risk and process risk
2. Company external risks or internal SCR: supply risk and demand risk
3. External SCR: risk to the environment

The following is a brief description of control, supply, and demand risks (Figure 2). Special attention is paid to these risks because the pandemic has drastically affected their nature.

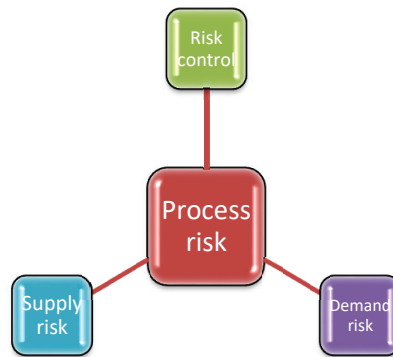


Figure 2. Types of SCR (Ivanov, 2020)

In the context of the pandemic business, the following is a short summary of control, supply, and demand risks. COVID-19 conditions have had a significant impact on the nature of these disturbances, so increased attention is being paid to them.

3.1 Supply risk

Supply risk includes all disturbances that occur between producers and suppliers. More precisely, this is related to the risk of delivery of raw materials of poor quality, at the wrong time, in the wrong quantity, etc. The consequences, such as delays in the production or delivery of finished products of poor quality, can lead to huge costs for the company during a pandemic. One of them was goods delivery stopped at the border due to the closure of countries in order to prevent the spread of the pandemic (Ali et al., 2019; Remko, 2020; El Baz & Ruel, 2021).

SC entities reported several different forms of supply disruptions and extended delivery times. Due to the stopped production in factories, the delivery time for certain products has been extended from day to week and from week to month. The company could have lasted during that period if there had been inventory, but there were major disruptions after that, resulting in the companies' inability to meet demand. Supply disruptions have occurred primarily due to the closure of some countries due to the pandemic. This prevented the uninterrupted supply of raw materials, semi-finished products, and finished products (Wijaya, 2021; Hosseini et al., 2019; Remko, 2020; Ivanov, 2021).

The effects of supply disruptions have led to delays in delivery when delivery requests increase again, i.e., return to the old level before the pandemic. This will have long-term consequences for the SC because the companies will need some time to return to "normal", i.e., to recover from the impact of the pandemic. The following discussion supports this. The factories resumed operations in China in 2020, but it took some time for them to reach full productivity again. The reason for this was partly because their supply sources were also exposed to disturbances, and they had to start working before the production volume increased. The implication of this is that, without changes in the design of the SC, supply disruptions due to COVID-19 will have long-term consequences after closure and quarantine if deals are done as they were before the pandemic (Remko, 2020).

In the period of the pandemic, there was a certain bottleneck in the implementation of logistics activities. Some deliveries can be transported by air, but this generates high costs. Reopening the plant will result in a high demand for transport capacity. The conclusion is that SC was not able to respond to supply disruptions. The insufficient applicability of the existing SC strategies for responding to emergencies caused by the COVID-19 pandemic must also be mentioned (Li & Zobel, 2020; Remko, 2020).

3.2 Demand risk

Demand risks are related to any type of disturbance in the flow of goods, information, or money. This risk often causes a discrepancy between the production plan and actual demand and occurs when demand significantly exceeds supply, or the other way around (Diabat, 2012).

According to SC management involved in reporting on the demand situation, there is an increase in demand for certain products, while others are facing a rapid decline. While demand for food, beverages, and necessities increased by 50% in 2020, demand for clothing decreased by 20%. Also, demand in the automotive industry has decreased significantly. The reason for that is the closure of factories at the beginning of the pandemic and the loss of jobs of many employees (Wang & Yu, 2020; Remko, 2020).

For example, in March 2020, there was a significant increase in demand for transportation services. Fear of people due to the outbreak of the pandemic relates to the need to order all the necessities on time. Some changes in demand are causing changes in ways and delivery methods, and they are stimulating a greater focus on digitization and visibility. The pandemic has led to a huge shift towards digital delivery, e-commerce, and online shopping services. Because they have invested a lot of money and energy in building e-businesses to survive during the epidemic, many corporations expect to keep their online enterprises even after the pandemic is over (Son et al., 2013; Wang & Yu, 2020; Remko, 2020).

3.3 Control risk

This risk category consists of the external risks to SC, which refers to all disturbances in the environment. These negative events can be the cause of economic, socio-political, or market changes and can both directly and indirectly affect the company. This type of event is very difficult to predict and control because it takes place in the very environment of the company, over which it has no influence. It is very important to emphasize that all these disorders are interconnected, and most often the occurrence of one risk causes another, which complicates the problem of SCRM even more (Son et al., 2013; Chowdhury et al., 2019, Lai et al., 2009).

The COVID-19 pandemic had a special impact on this segment, primarily during the introduction of various measures to prevent the spread of the infection. The measures that have contributed to the development of these risks are the ban on crossing borders, i.e., the locking of countries. This led to delays and non-realization of deliveries, which generated large costs for companies. It has also caused a large drop in good demand and declining revenues (Ali et al., 2019; Remko, 2020).

4. SUPPLY CHAIN RISK MANAGEMENT – SIGNIFICANCE IN COVID 19

Different industry trends, such as pronounced outsourcing, supply base reduction, just-in-time delivery, and shorter product life cycles, increased SCR exposure. The causes of risk in SC are different, and some of the key ones are related to human factors, information technology, natural disasters, etc. Within the available SC literature, SCRM has become a key area of interest (Fan & Stevenson, 2018). SCRM is a relatively complex process, as it involves understanding the risks and applying appropriate methods to reduce the consequences of their realization. In addition, it should be borne in mind that the consequences of risk can be intangible (reputation, credibility, authority). The risks in one part of the SC affect all its entities, which further complicates the SCRM process. Although much analysis has been done on SCRM, there are still areas that need further study (Fan & Stevenson, 2018; Remko, 2020).

Risk management in the SC has become particularly significant in the COVID-19 pandemic era. Due to the global disruption, SC has become significantly more vulnerable and sensitive at all levels. SCRM has never appeared more important than it is today when global SC has been heavily punched by the COVID-19 pandemic. One of the key questions is (Yang et al., 2021)?

According to El-Baz & Ruel (2021) and Ivanov (2021), the resource-based view and organizational information processing theory have a high impact on mitigating the role of SCRM practices during and after the COVID-19 pandemic. SCRM aims to reduce SC vulnerabilities. Previous SCRM studies have discussed various risk management strategies. Some of them include strategies for risk management within the company (investing in inventories, increasing flexibility, risk management culture), supplier management (supplier sustainability, flexible sources, alternative suppliers), and demand management (dynamic pricing, multiple modes of transport), etc. (Yang et al., 2021; El Baz & Ruel, 2021).

There are generally three steps in SCRM: identification, analysis, and treatment, i.e., risk response. Risk identification is the result of forming a list of all risks or only key ones. In this step, various qualitative and/or quantitative methods are used, and some of them are the checklist, interviews and group meetings, the Delphi method, what-if analysis, the Ishikawa diagram, etc. Risk analysis is performed from the aspect of impact on SC project management, i.e., analysis of the magnitude of consequences if the risk event is realized. Since the risk response is directly related to the type and magnitude of risk consequences, different risk treatments are present in SCRM. Five basic risk treatments stand out in the literature: acceptance, sharing, risk avoidance, transfer, and mitigation (Ivanov, 2020; Diabat et al., 2012).

4.1 Risk acceptance

Many companies agree to do business with risks. This does not mean that risks should be ignored. There are also clear principles on which risks a company should accept. A company should continue to monitor risks to ensure that accepted consequences do not escalate. If the consequences of a risk exceed a certain threshold, companies should consider how to avoid, transfer, share, or mitigate the risk. In the context of the post-COVID-19 pandemic, risk acceptance cannot be avoided. Each entity in the SC is faced with

the fact that it is exposed to certain risks, so it undertakes certain activities in advance to limit the consequences (Son et al., 2013; Chen et al., 2015; Diabat et al., 2012).

4.2 Risk sharing

Risk sharing involves entities sharing some or all of the risks. It is known that the risk of one entity in the SC affects all others. Therefore, risk-sharing means sharing the consequences. Risk-sharing seems appropriate for dealing with risks that have a low probability and high impact to reduce the associated costs and increase customer service levels. In the context of a post-COVID-19 pandemic, the risks are shared to ensure fast and efficient customer service, but also to ensure continuous functioning in the SC (Diabat et al., 2012; Lai et al., 2009).

4.3 Risk avoidance

Risk avoidance is the attempt to eliminate the types of events that could result in a risk. If supply is unreliable, the company could discontinue flows of specific products, suppliers' activities, or the functioning of a geographic market if supply is unreliable, thus eliminating the root cause of the risk. In post-COVID-19 conditions, risk avoidance can mean removing a company from volatile markets. However, as the new conditions indicate that all entities in the SC are exposed to risk, avoiding the risk may also mean a break in the SC, which may result in the temporary closure of some companies (Diabat et al., 2012; Lai et al., 2009).

4.4 Risk transfer

Risk transfer implies that all responsibility is on "the other side". The risk is transferred to the more resilient entity so that the consequences are fewer, which has a positive impact on the entire SC. In the context of the current pandemic, there are no clear guidelines for transferring risk. In this case, if the risk cannot be avoided, then it is transferred to the strongest link in the SC, i.e., to the entity that is currently most resistant to risk (Ivanov, 2020; Son et al., 2013; Lai et al., 2009).

4.5 Risk mitigation

Risk mitigation means taking all measures and actions to limit and/or possibly eliminate the consequences. It applies both to the reduction of the probability of a risk event and its consequences. Companies in the SC should consider sharing, accepting risk avoidance, and selecting appropriate risk mitigation strategies. The choice of a risk reduction strategy also depends on the type of risk and the company's budget. As risks are often interrelated, mitigating one risk can worsen or mitigate the others. In post-COVID-19 conditions, any risk-mitigating response is acceptable, provided that it does not endanger other entities and activities in the SC, especially not customer service (Chowdhury et al., 2019; Ali et al., 2019; Lai et al., 2009).

5. CONCLUSION

Supply chain risk management is a complex process because SCs generally function globally. Production may be in one nation, but product consumption may be in another,

including reverse logistical flows that come from developed economies. In the SCRM, the pandemic has prompted new methods. Some initiatives to inhibit the virus's transmission have resulted in the identification of disasters or disturbances connected with the placement and use of specific goods. Changes in user behavior have been strongly influenced by current circumstances. Consumer behavior and purchasing power have been significantly influenced by measures adopted to curb COVID-19 transmission. As a result, businesses have struggled due to lower turnover as a result of lower customer demand. Furthermore, the COVID-19 challenges have an impact on all product prices, with a focus on fossil fuels as a promising future propulsion (Hosseini et al., 2019; Li & Zobel, 2020).

Due to the increasing importance of outbreak risks to the entire SC in COVID-19 conditions, this paper discussed commonly utilized proactive and reactive strategies that are utilized in practice that aim to limit the consequences of their realization. These techniques have a direct impact on increasing SC flexibility, which was a significant trump card for SC during the pandemic. It is important to note that there is still a scarcity of research on SCR. Previous research on SCR has been focused on the study of SC food, medication, and consumer items. It was concluded that there is a paucity of risk analysis and the design of treatment strategies in SC related to the COVID-19 impact on customer satisfaction. Only a small portion of the SCRM issues in pandemic situations were examined in this paper. The paper highlights some of the SCRM techniques, such as risk acceptance, sharing, risk avoidance, and mitigation, due to the complexity and longevity of SCRM. The study analyzes important risks faced by companies during the pandemic, such as supply and demand and control concerns. The above-mentioned pandemic risks can negatively impact the SC's resilience and hinder its recovery. SC recovery is necessary for SCRM and SC's long-term viability, so future research in this area will only become more attractive.

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