


Chapter 9

The Significant Impact of the COVID-19 Pandemic on Supply Chains

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EXECUTIVE SUMMARY

As the COVID-19 pandemic has spread across the world, the existence of disruptions in demand and supply have become more severe, conducted by containment measures taken by countries and affecting different sectors around the world. Although businesses and workplaces are restarting activities in some countries, with containment measures gradually being lifted, overall consumer demand is expected to remain low, also determined by the loss of jobs and income. Therefore, the scale of the impact on supply chains exceeded anything most companies had anticipated. This study aims to understand how companies were affected and identify some lessons learned about their vulnerabilities and the possible ways to address them in the long term. On the other hand, it is intended to reveal some of the impacts of COVID-19 and make some practical suggestions that can help in political and operational decisions to strengthen and build additional resilience in supply chains in the future.

INTRODUCTION

Coronavirus disease (COVID-19), is an infectious disease caused by a newly discovered coronavirus, emerged in Wuhan, China, at the end of 2019 (Hui et al.,

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2020). COVID-19 is an acute, sometimes severe, respiratory illness caused by a novel coronavirus SARS-CoV-2. The clinical spectrum of SARS-CoV-2 infection appears to be wide, encompassing asymptomatic infection, mild upper respiratory tract illness, and severe viral pneumonia with respiratory failure and even death, with many patients being hospitalised with pneumonia in Wuhan and it soon became clear that efficient person-to-person transmission was occurring (Huang et al., 2020; Wang et al., 2020). In a short period of months, the disease went beyond the boundaries of China and spread quickly to other countries worldwide. On March 11 of 2020, World Health organization (WHO) declared COVID 19 a global pandemic (World Health Organization, 2020). The COVID-19 pandemic has caused a collapse in consumer demand forcing governments to implement containment measures, including the closure of jobs. Supply chains play an important role in spreading economic impact across sectors and countries (OIT, 2020b). To limit the spread of COVID-19, governments were forced to implement measures of confinement, which severely affected companies and workers from all over the world. The international interconnectivity of production across global Supply Chains implies that measures of confinement adopted by a particular country can have a significant impact on production and employment in other countries. Supply Chains are particularly complex and extend across multiple countries and sectors, playing a very important role in propagating the economic impacts of containment measures not only in internal markets, but also across borders (Barakat, Ali, Abdelbary, & Haroun, 2020).

There are some main factors that impact production and jobs: on the one hand, the lack of consumer confidence, the decrease in purchasing power resulting from the loss of jobs and income, and the introduction of containment measures, such as the closure of stores or travel restrictions, contributed to a sharp decline in global demand for consumers. On the other hand, the local closure of activities has disrupted the supply of factors of production across borders, causing a lack of vital inputs for industrial production of at least some companies.

In general, when talking about Supply Chain management, there are two very important concepts to take into account, efficiency and resilience. While these concepts are often in conflict with each other, it is the right balance between them that makes supply chains effective.

THE RISK FOR SUPPLY CHAINS

According to (S. Y. Ponomarov, 2012), from the beginning of the 2000s onwards, “as a result of globalization of supply chains, the use of outsourcing, the use of lean methodologies, attacks terrorists committed and of various threats”, the theme of risk management in the supply chain wins relevance. However, according to the

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available literature, the concepts of management and management of risks are still under construction.

On the other hand, some authors have established indications that suggest that the term risk management “relates to coordination between members of a supply chain in order to reduce the

vulnerability throughout the chain” (Jüttner & Maklan, 2011; Jüttner, Peck, & Christopher, 2003). Thus, management would be how the chain is strategically organized to manage risks, referring to its architecture and action planning, in order to avoid unwanted situations, while management is intrinsically linked to the structure and processes within the chain. Also according to (Jüttner et al., 2003), a risk management model is based on four phases, namely the identification of risk sources, risk assessment, strategy proposition and risk mitigation. (Tummala & Schoenherr, 2011) propose in their study the “Supply Chain Risk Management Process (SCRMP)”, a model composed of three phases and the treatment of risks effectively and efficiently, as described below:

Phase 1 - Risk Identification

- **Identification** of affected areas and understanding of consequences, aiming to implement mitigation strategies. The identified threats (forces that can produce adverse results) can affect the chain’s resources (assets, people, earnings);
- **Risk classification** to determine its consequences and impact magnitude. They can be classified as catastrophic, critical, marginal or despicable. Consequences are the manner or extent to which a threat manifests its effects on resources and may include loss or damage to assets, cost overruns, schedule delays, disruption of service levels, etc.;
- **Risk assessment** refers to the assessment of uncertainties and relates to determining the probability of each risk factor. Each risk has a probability category, that is, the probability index proposed by the model will help to identify the risk. can be considered as very common (occurs 1 x per week), frequent (occurs 1 x per month), rare (occurs 1 x per year), and very rare (occurs 1 x every 10 years).

Phase 2 - Supply Chain Risk Management Process - (SCRMP)

- **Risk estimation** refers to the classification, or ranking, based on the “value assigned to risk exposure (VER)”. In this context, the risk is calculated based on the formula below, and the higher the calculated risk value, the greater the attention required in relation to it. The risk it may also be classified as tolerable, acceptable or unacceptable.
- **Risk mitigation and contingency** plans to contain or control risks. Plans are evaluated and the best course of action determined. This step

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also considers the analysis of the possible costs involved to mitigate the identified risks, which are classified as: substantial, medium, low and trivial.

- **Risk Totem Pole Analysis** refers to a diagram designed to combine dimensions of risk, allowing the determination of a probability of occurrence rating, severity of consequence and the cost of implementing an action plan in response to an identified risk in the supply chain.

Phase 3 - Supply Chain Risk Management Process - (SCRMP)

In this phase, of control and monitoring of risks, it is possible to check the progress made in relation to the implementation of action plans to respond to risks, determine preventive measures and suggest improvements. Deviations, abnormal cases and interruptions are reported. If the expected results are not achieved, the risk management process must return to Phase 1 for re-analysis.

According to Sheffi & Rice (2005) an interruption will inevitably have a negative effect on the company performance. The authors define the rupture profile and the response dynamics in eight phases, these being:

- Preparation - It refers to the first moment of disruption and, according to the authors, in some cases it can be predicted, giving the company time to prepare, thus minimizing its effects, such as, for example, when there is a strike movement, which aims to halt production. This phase lasts until the moment of rupture, in fact;
- Disruption event - It refers to the disruptive event itself, such as a weather event, a supplier closing the deal, the beginning of a strike. The existence of capabilities, such as redundancy, which presupposes the maintenance of some resources in reserve to be used in the event of an interruption, can serve to mitigate the event;
- Initial response - It refers to the attempt to control the disruptive event and the prevention of further damage;
- Initial impact - It may be noticed immediately or it may take time to affect the business, depending on the magnitude of the disruption. In this case, the available redundancy and the level of resilience inherent in your supply chain can mitigate the effects of the event;
- Total impact - It is noticed when the effects of the event reach their greatest level and the company's performance drops drastically. Objectively, the performance drop starts with the disturbing event. It is at this stage that actions to prepare for recovery begin to manifest themselves;
- Preparation for recovery - It occurs parallel to the first response or even before the response, if it was anticipated. According to the authors, this step

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considers the qualification of new suppliers or the redirection of suppliers' resources;

- Recovery - It can be done with the use of loss of production compensation. Companies make use of overtime, producing at a higher than normal level, seeking to recover losses;
- Long-term impact - It has extensive effects. The impact will be greater if it reaches the end of the chain, that is, the customers.

According to Scholten, Scott, & Fynes (2014) and Sheffi & Rice (2005), it is observed that the preparation phase occurs when the company is strategically directed towards prevention behaviours in relation to disruptive events, while the immediate response refers to actions taken immediately after the break. The recovery phase can start still in the response phase and consists of the implementation of actions. Mitigation is linked to risk management and continuous improvement processes. The details of the phases according to (Scholten et al., 2014):

Mitigation

- Establish planning team;
- Analyse supply chain resources and risks;
- Develop a communication plan for preparedness, response and recovery;
- Develop continuous improvement and supply chain risk mitigation plans.

Preparation

- Implement preparedness plan: translate strategic investments into issues operational with the creation of new forms of delivery;
- Evaluate, based on measurements and metrics, the impacts of the interruption;
- Establish routines through training and simulation in the main links in the chain.

Response

- Implement the response plan, measurements and metrics;
- Evaluate directions and controls;
- Evaluate communication throughout the supply chain;
- Assess the extent of supply chain disruption.

Recovery

- Review and implement a recovery plan;
- Ensure continued risk management and resilience;
- Maintain support for employees.

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The available literature shows that several risk management models have been developed. However, it is clear that the models have emphasis on a particular aspect and that they differ little from each other. However, the models show, in general, that companies must anticipate the threat of risks, through the prevention and construction of consistent and appropriate plans for the business profile, as well as selecting the best strategy for each type of risk, from in order to reduce the probability of the occurrence of an event and/or reduce its impact, if the rupture materializes.

The COVID-19 pandemic is not the first calamity that unexpectedly damaged supply chains. More than a few other natural catastrophes, such as the 2011 earthquake and tsunami in Fukushima-Japan and extensive flooding in Thailand, the 2003 SARS outbreak in China, the 2004 tsunami in Indonesia (Kraude, Narayanan, Talluri, Singh, & Kajiwara, 2018; Tan & Enderwick, 2006), the 2005 hurricane Katrina barreled ashore in New Orleans (Irwin, 2012), have led to absences of products. But, it can be pointed out here that the production is recovered from these events in a matter of weeks. However, based on range and dimension, the impacts caused by COVID-19 are different from all previous disasters. Most of the disasters, like earthquakes, tsunamis, nuclear accidents, diseases and wars, are frequently restricted to precise geographic areas over quite small periods.

With the virus spreading rapidly to the planet, sending billions of people into lockdown and total confinement, and contributing to the partial or total shutdown of several countries and economies, the disruption of supply chains has become serious (Inoue & Todo, 2020). Furthermore, it is not possible to predict when this pandemic will be contained; any infected area on the planet is undoubtedly a high risk area for a new outbreak, as well as the presence of new variants (Xu, Elomri, Kerbache, & El Omri, 2020).

Supply chains have become fundamental to getting goods and services quickly and safely to all those who are at risk of infection or who are working on the frontlines of the medical response. Therefore, business leaders had to make quick decisions and take immediate action to sustain business operations, serve consumers, customers and communities, as well as to protect and support their employees. COVID-19 not only disrupted the Supply Chains, but it deeply affected Supply Chains at all stages, from the supply sources to the final customers. Has shown that businesses are connected through complex networks of Supply Chains in which the actors at the upstream of a supply chain are seriously affected by the almost “erratic” behavior of downstream actors, essentially large companies, who experience disruptions and very sharp variations in demand (Leonard, 2020).

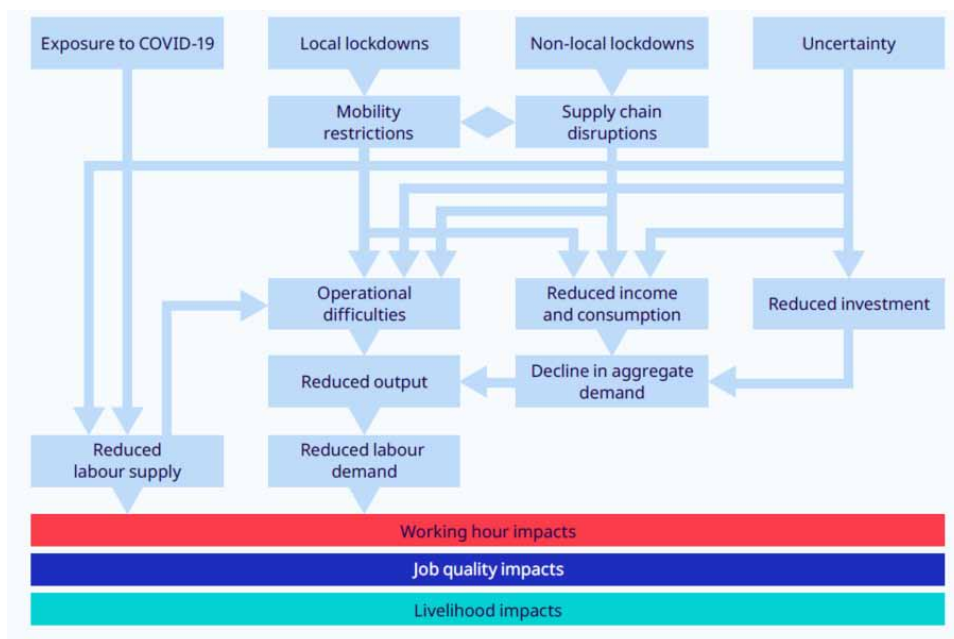
According to (Sherman, 2020), 94% of companies experienced supply chain disruptions caused by COVID-19, 75% of companies have already suffered negative or extremely negative impacts on their business and 55% of companies intend to lower their growth goals (or have already done so). Thus, the impact of the crisis

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caused by COVID-19 had repercussions on economies and on the labor market, saving few companies and workers. But, its degree, has varied consonant to the qualities of the company and the worker, not only but also through the countries, depending on their levels of income and economy.

Figure 1 presents a scheme in order to visualize different ways in which workers and companies were and continue to be affected by the crisis caused by COVID-19. It is important to be aware of these mechanisms so that better responses can be designed and projected.

Figure 1. COVID-19: the impact of a global crisis on workers and companies
Source: World Employment and Social Outlook (ILO, 2021b)

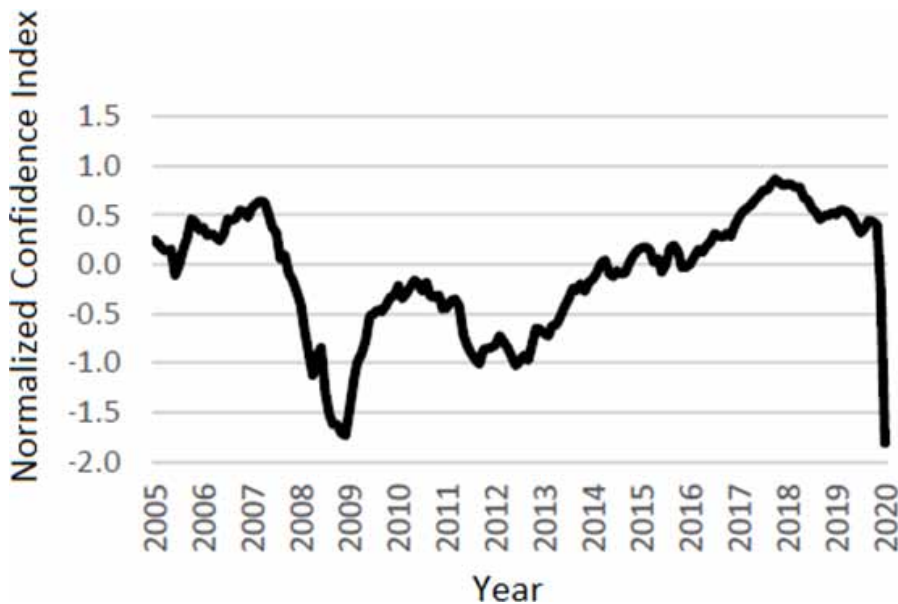


Restrictions in each country, in particular the closure have greatly affected the performance of companies, leading to a snowball effect on global supply chains, international trade and foreign direct investment (ILO, 2020b). In addition, it is necessary to highlight the change in consumer behavior during the pandemic with regard to the types of goods and services acquired as well as the buying methods used by consumers. During home confinement due to lockdown, there was an increase in reliance on the Internet to buy basic goods such as food, particularly in countries with high- and middle-income economies. On the other hand, spending on services such as tourism and restaurants fell abruptly (ILO, 2021a).

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Consumer confidence fell across the board at the fastest speed in recent history in March and April 2020. Based on available data, average confidence fell sharply in March and April, reaching the lowest levels measured during the 2008-09 financial crisis (Figure 2). During this latest crisis, it took 20 months for consumer confidence to decline so much, highlighting the extraordinary pace and scale of the crisis related to COVID-19. This graph illustrates the monthly unweighted average of a normalized index for consumer confidence from May 2005 to April 2020 across a sample of 40 countries. Normalization resizes the distance consumer confidence indices expressed in standard deviations around their mean. On April 8, 2020, the World Trade Organization estimated that global trade would fall between 13 and 32 percent by 2020: https://www.wto.org/english/news_e/pres20_e/pr855_e.htm

Figure 2. Consumer confidence dropped dramatically in 2020
Source: Adaptation of COVID-19 and global supply chains (Stefan Kühn, 2020)



The collapse of retail sales endangers the livelihoods of both those working in the retail sector and those producing the processed products. But not all processed products suffered an equal drop in demand during the COVID-19 crisis, food and pharmaceutical products, for example, are essential goods and have not suffered any declines. The decrease in demand also depended on the strict application of the imposed containment measures, and it was greater when the trade was closed and the physical distance rules were strictly applied. This policy summary classifies

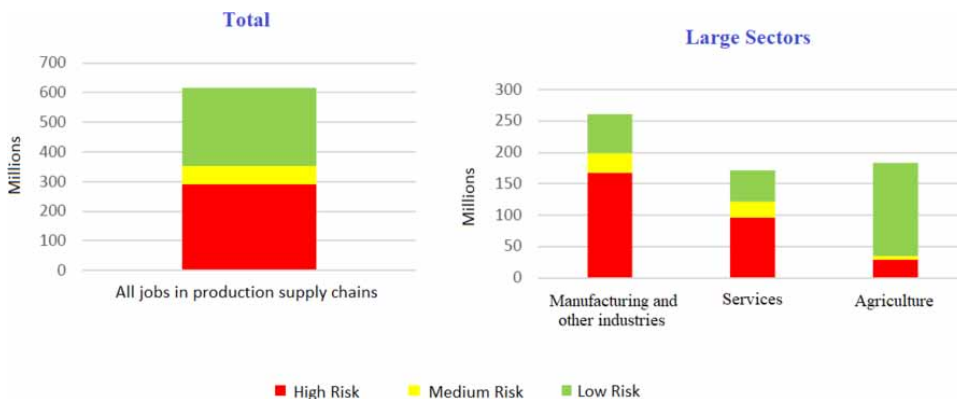
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industrial sectors according to risk (low, medium or high) considering a decrease in demand for their products as a reflection of the crisis, depending on the country where consumers make their purchases. This risk assessment is based on data relating to retail sales, sector indices of stock exchanges, as well as the strictness levels of the containment measures. This risk assessment is based on data retail sales data, sector indices of stock exchanges, as well as the strictness levels of the containment measures.

From 3 June 2020, 292 million jobs in production supply chains were found to be at risk due to falling consumer demand, and another 63 million jobs were at medium risk (Figure 3) (OIT, 2020b). In total, more than one in two jobs in production supply chains, and more than one in seven of all jobs, are currently at medium to high risk, despite the recent relaxation of containment measures in some countries. Most of these workers are subject to losing their job, reduced income, reduced working hours or other pressures of deteriorating working conditions and non-compliance with the provisions established in international standards, while their employers may suffer financial problems or even insolvencies, leading to cutbacks in investments and layoffs. Among the jobs that are at high risk, 167 million jobs belong to the manufacturing sector or other productive sectors. And 29 million of these jobs are in agriculture and 96 million in services, whose activities are responsible for providing inputs. Service workers are directly suffering from the crisis due to many factors, such as the drastic decline in tourism or the closure of trade and other businesses. Thus, the impact on service sector professionals through reduced demand for goods is considerable.

Figure 3. The drop in consumption related to COVID-19 puts jobs in production supply chains at risk (millions)

Source: Estimates based on data from 64 countries that represent 74 percent of the world's workforce, adapted from (Stefan Kühn, 2020)



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By 2020, there were 73 million high-risk jobs in the textile and apparel supply chains, representing one in four high-risk jobs (OIT, 2020b). The cancellations of orders and the inability to pay those in production, due to the lack of demand from consumers for clothing, threatened, in some cases, the ability of companies in these supply chains to pay the salaries of their staff, mostly women, from low- and middle-income countries. In addition, an estimated 54 million jobs in motor vehicle supply chains were at high risk (OIT, 2020a). The complete collapse of consumer demand for these goods, regardless of the levels of containment measures in a given country, means that jobs in these supply chains have automatically been at high risk.

Although some countries have recently started to relieve containment measures, people have not yet returned to pre-pandemic consumption patterns: in a survey conducted in the United States of America, 56% of consumers said they were cutting back on spending and 48% reported that economic uncertainty was constraining the purchases they planned to make. In China, where more than 90% of clothing stores have reopened, clothing sales, at least initially, remained 50 to 60 percent lower than in the pre-crisis period (AMED et al., 2020). In Germany, more than half of respondents reported not having purchased non-essential items, despite the reopening of stores (Thomasson, 2020).

The dramatic drop in consumer demand, such as for clothes, has had a devastating impact on international fashion brands, with the global fashion industry estimated to have shrunk by up to 30%, in 2020 (AMED et al., 2020). Fashion brands canceled orders for clothing and, in some cases, were unable to pay those already in production, affecting Asian suppliers and their workers. A survey of Bangladeshi employers found that one million people were laid off or made redundant. In many cases, they went home without any pay (Anner, 2020). The call to Action COVID 19 “Action in the Global garment industry” is a joint effort, endorsed by brands and manufacturers, trade unions and the ILO, to catalyze the entire international garment industry’s support for business and protect income, health and clothing sector employment (International Labour Organization, 2020). This support is of utmost importance as clothing and textiles constitute a significant part of the exported goods in several Asian economies: 91% in Bangladesh, 67% in Cambodia, 27% in Myanmar and 14% in Vietnam in 2018 (OEC, 2020). In Cambodia, for one in five families the clothing sector is their source of income (OIT, 2019). Globally, 91 million people were employed in the textile and clothing sector in 2019, of which 50 million are women, or 55 percent. In Asia and the Pacific, more than 5 percent of women worked in this sector, making it the largest employer among all industrial sectors, and the fourth largest in the world. Furthermore, considering the total value of jobs in the textile and apparel supply chain in the 64 countries with available estimates, 82 percent are located in Asia and the Pacific (International Textile Manufacturers Federation, 2020).

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The closure of activities in one country has potentially serious repercussions in other countries if the supply of production inputs from one country to another is interrupted. Disruptions to supply become even more impactful when many countries close down workplaces as a result of the pandemic. Once stocks are depleted, this can be a serious obstacle for companies to maintain their production and workers to earn income.

At the height of the first wave of the COVID-19 pandemic, nearly 60 percent of all imported inputs were disrupted due to the mandatory closure of all economic activities except those deemed essential. The ILO survey of SCORE Program (Sustainable Competitive and Responsible Enterprises) participants corroborates these estimates, finding that 67 percent of companies experienced supply shortages between February and April (ILO, 2020a).

In June 2020, companies in the manufacturing sector and their workers continued to experience an average decrease of 35 percent in the supply of imported inputs due to the closure of all activities, except essential ones, below the almost 60 percent recorded in early April, as we can see in Figure 4.

Figure 4. Level of disturbances in the supply of imported inputs due to the mandatory closure of activities

Source: This graph presents the weighted average share of jobs relative to the supply of imported intermediate inputs, from countries with necessary closure of all activities except essential ones. The calculations are based on data from 64 countries that represent 74 percent of the world's working population, adapted from (OECD, 2020).



This disruption of input supply chains is likely to contain the recovery of economic activities in countries that can open workplaces, all the more so as suppliers will need time to adapt to new circumstances before they can return to pre-existing levels

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of activity. crisis, once closures in the workplace are lifted. Moreover, the lack of just one essential input can disrupt the entire supply chain. Given this evidence, it is not surprising that 55% of companies surveyed by the ILO have estimated that supply shortages would continue throughout 2020 (ILO, 2020a).

RESILIENCE IN SUPPLY CHAINS

The concept of resilience was studied from the perspectives of different fields of knowledge, such as ecological, social, physiological, economic, organizational and risk in supply chains (S. Y. Ponomarov, 2012). Although there is, to date, no consensus on the definition of the term “resilience”, it appears that several definitions, more or less comprehensive, were created over time. However, it is possible to verify that, in the context of supply chain risk management, several recent studies have adopted the definition described below:

(...) “the adaptive capacity of the supply chain to prepare for unexpected events, respond to interruptions and recover from them, maintaining the continuity of operations at the level of connectivity and control over the desired structure and function (Serhiy Y. Ponomarov & Holcomb, 2009)

According to Scholten et al. (2014), resilience, in the context of the supply chain, is defined as “the adaptive capacity to prepare for unexpected events, respond to interruptions and recover from them, maintaining the continuity of operations at the same level. connectivity and control over structures and functions”. Resilience is also addressed as a characteristic of the company or the chain, based on capabilities. The authors discuss, in their article, the existence and relationship of the different capabilities that form resilience, from the perspective of the phases of a rupture, in order to correlate the importance and role of each capability according to the different moments or phases from the rupture to the resumption, in fact, of the operation.

For Christopher & Peck (2004) and (Tukamuhabwa, Stevenson, Busby, & Zorzini, 2015), the resilience of a supply chain is a network phenomenon resulting from connectivity and interdependence between companies.

In turn, the resilience of a company is determined, then, by the resilience of its network, since strategies implemented in specific actors (links), individually, can be harmful and not contribute to the formation of a strong chain. Furthermore, the strategy to be adopted to make a supply chain resilient is intrinsically linked to the types of risks it is exposed to (Sheffi & Rice, 2005).

(Hub, 2020) suggests that a resilient supply chain should be able to detect warning signs about the risks of an interruption, while also responding to these risks by

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shifting production or service provision to alternative sources, in addition to having a contingency plan that allows the use of substitute suppliers and logistical means.

Likewise, (Ambulkar, Blackhurst, & Grawe, 2015) understand that, when facing an interruption, a company must be able to assess what resources it has, identify which of them are available, where they are, etc., and be able to add new, recombine, or rearrange existing resource sets. In short, to achieve resilience, companies must be able to reconfigure their resources in the face of disruption. The authors also defend that significant importance, at a strategic level, must be given to the risk of interruption, which is the starting point for decision-making by managers, with regard to the establishment and reconfiguration of critical resources.

LESSONS LEARNED FROM COVID-19 AND THE FUTURE

The chaos caused by the COVID-19 pandemic created the perfect environment for a revolution in the supply chain. Fluctuating demand, unpredictable consumer behavior and commercial vulnerabilities, but they have also created a unique opportunity for business leaders to make smarter and bolder decisions in terms of their supply chains.

This is not a typical risk event and its impact surpasses anything most supply chain leaders would have anticipated. The exponential growth of this virus required continuous evaluation, optimization and monitoring. Therefore, companies needed to respond quickly and confidently, defining and executing a short-term tactical plan that mitigates human health risks and protects the functioning of global supply chains.

The COVID-19 pandemic is not just a short-term crisis. It has lasting implications for how people work and how supply chains work. There is a pressing need for organizations to build long-term resilience into their value chains to deal with future challenges. This requires a holistic approach to managing the supply chain. Organizations must create enough flexibility to protect themselves against future disruptions. Companies should also consider developing a robust framework that includes responsiveness and resilience in risk management operations. This capability must be technology-based, leveraging platforms that support applied analytics, artificial intelligence and machine learning. They must also ensure end-to-end transparency across the entire supply chain. In the long run, risk response will need to become an integral part of business protocols.

Around the world, organizations that have embraced innovation, change and development have realized the short-term competitive advantages and lasting value of more efficient supply chains. It's no wonder, then, that 75% of organizations are planning to adapt to build more resilient supply chains, according to recent surveys exploring how companies around the world have navigated the turmoil of

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COVID-19. So what have business leaders learned from 2020 on? And what will the supply chains of the future look like?

CONCLUSION

The best response to emerging challenges sometimes begins with lessons learned, lessons from past facts. In this line, from the verified, rather than a “return to the future”, it is important to follow a logic of “moving into the past”, recalling areas of strategic potential for the world, as it was in the past and as it will continue to be, the economy, in order to be well prepared for the “next day” of the post-crisis.

The COVID-19 pandemic is not just a short-term crisis. It has lasting implications for how people work and how supply chains work. There is a pressing need for organizations to build long-term resilience into their value chains to deal with future challenges. This requires a holistic approach to managing the supply chain. Organizations must create enough flexibility to protect themselves against future disruptions. Companies should also consider developing a robust framework that includes responsiveness and resilience in risk management operations. This capacity should be based on technology, taking advantage of platforms that support applied analytics, artificial intelligence and machine learning. They must also ensure transparency throughout the supply chain. In the long run, risk response will need to become an integral part of business protocols.

This pandemic and other disruptions have changed the priorities of many supply chain leaders. Now, more than ever, they need to balance cost and operational efficiency with greater supply chain resilience to protect their networks. As John (2014), said “Disruptions to supply chain operations have intensified in the past few years. This means that the cost of retaining multiple supply locations must be seen more as a cost of doing business, rather than an inefficiency”.

It will be in the capacity of the various countries to respond to the strategic challenges presented that future global resilience will lie. A more developed, stronger and more protected planet will be more likely to better resist threats and risks, whether they are presented in a microscopic, environmental or other form, for which the right, preventive, responsible and sustained investments must be promoted, knowing, however, that financial resources are always scarce. In the XIX century, the French physicist and mathematician, Laplace, considered that the future could be foreseen if he had enough information and time to develop the necessary calculations; today, we know that this will not be possible, not even in the most precise sciences, much less in economics (Samuelson, P. A. & Northaus, 1988), even more because of the countless variables and uncertainties brought about by the current pandemic. However, this does not imply that proper planning is not done, in

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a coherent and articulated manner. One thing is certain: a fragile economic health makes the country more vulnerable and subject to the worsening of its state, while a timely prophylaxis, with adequate and appropriate measures planned, will help to face emerging diseases, whether in the form of risks or threats.

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