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COVID-19 and transport costs: An impact on supply chain risk and companies' performance

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*Alla mia famiglia,
che ha reso possibile
tutto questo*

前言

新冠病毒于 2019 年 12 月下旬在中国湖北省武汉市出现，并迅速传播到亚洲、北美，欧洲的其他国家。2020 年 3 月 11 日，世界卫生组织 (WHO) 宣布其为大流行病。由于其迅速扩散，大多数国家的政府决定实施遏制措施，例如旅行限制、控制社交聚会和商业活动以及禁止货物运输，旨在降低新感染和死亡的比率。

除了首先是一场公共卫生危机之外，COVID-19 还对世界主要经济体产生了重大的经济和商业影响。在一个几乎所有经济活动相互关联且公司都是同一供应链一部分的世界中，影响企业的新中断可能会对与其有关系的所有其他实体产生相当大的影响。

这项工作的目的是评估 COVID-19 大流行对供应链的风险，特别关于意大利和中国的关系，并分析可能损害公司生存和稳定的物流和运输相关问题。

首先，本文概述了意大利和中国之间的贸易关系，以考察这两个国家之间供应链的演进。中国最近成为世界第一大经济体，其持续发展和外部增长使中国成为世界上最大的出口国和第三大进口国。由于这种增长，最近几年中国开始制定国家计划（如中国制造 2025）并参与多边协议（“一带一路”倡议）以保证其内部和外部扩张趋势。这些倡议对于像意大利这样的进口国非常重要，意大利将中国视为采购对国民经济至关重要的原材料和商品的主要合作伙伴。

第一章从简要分析两国贸易结构（包括主要进出口市场）入手，对 2010 年至 2020 年意大利-中国进出口流量进行调查，特别关注受这些国际关系的影响最大的部门和行业。统计数据 and 图表强调了意大利企业对中国的依赖程度，尤其是在中间产品的进口方面，这是造成超过 190 亿欧元的高贸易逆差的主要原因之一。

由于 COVID-19 扰乱了经济的正常发展，有必要对两国进出口流量的变化进行进一步分析，以了解国际供应链为何会出现重大中断。最后一部分考虑了国际供应链结构可能发生的变化，并提出了中国政府提出的新发展战略。

国际供应链的演变以及对其他国家的依赖，导致公司面临更大的风险情况，以及 COVID-19 大流行是一个明显的例子。考虑到这一点，第二章侧重于供应链风险，并解释了影响国际供应链的主要风险，特别关注自然灾害和流行病引起的风险，以及它们可能性和对公司影响的程度。首先，根据专家的研究，给出了供应链、供应链风险和中断的一般定义。然后，参考 ISO 31000 和 Supply Chain Risk Leadership Council 的理论，本章介绍供应链风险管理的定义及其实践。SCRM 包括在供应链风险方面指导和控制公司供应链的所有活动，并分为五个主要过程：

- 鉴定外部和内部环境：定义北京并鉴定来自公司内部和外部的可能威胁。这包括参与供应链发展的所有实体，例如供应商、制造商、物流和客户。该分析的结果是对供应链流程进行映射，以了解可能发生的潜在风险以及所涉及的实体。

- 辨认识别：此步骤涉及鉴定和描述可能影响公司的主要风险。这可以按照不同的方法进行，例如业务影响分析或历史分析。最后有一个潜在威胁的列表，根据它们是常见的还是不常见的风险，它们被分为不同的类别。

- 风险评估：它包括根据事件发生的可能性及其对公司的影响对风险进行优先排序。这是必要的，以便了解哪些风险更需要处理以及哪些策略需要实施。

- 风险处理：它侧重于管理和减轻风险的计划的实施。它包括保护供应链的措施、风险缓解计划和业务连续性计划。

- 风险监控：制定监控计划至关重要，以评估缓解计划的有效性和一致性并在需要时实施持续监控和改进策略的措施。

从这些理论假定开始，第三章涉及对 COVID-19 对供应链造成的风险的概念化和评估。首先是流行病风险的定义，其特点是长期中断、骨牌效应和高度不确定性。COVID-19 等流行病风险的特点是，从小型和有限的事件开始，然后迅速扩展并在许多地理区域传播。与供应链中的其他中断相比，流行病，尤其是 COVID-19 在几个方面（例如范围、地理、需求和供应、事先计划等）存在一些差异，根据 Moritz 的研究进行分析。

在简要考虑了此次大流行带来的整体经济形势后，以下段落将重点介绍物流和运输。由于运输和物流在国际贸易和供应链发展中发挥着重要作用，因此详细分析了与它们相关的主要问题。重点主要是海运、空运和原材料成本。分析集中在导致成本增加的因素上，这些因素可以是针对每个问题的，也可以是与所有这三个要素相关的。

与海运相关的主要问题是集装箱稀缺、船舶运力下降、空白航行、交货时间延长和延误、预订问题和港口问题。

在航空运输方面，主要问题是封锁、公司关闭和旅行限制，它们导致机场关闭以及国内和国际航班取消。这对沿供应链节点的货物运输产生了重大影响，相关部分将对此进行分析。

所有与海运和空运相关的问题都给公司采购原材料带来了进一步的复杂性。因此，最后一段涉及材料短缺和价格上涨。

在调查了与物流和运输相关的主要威胁之后，最后一章侧重于评估它们对公司经济和财务效益的影响。考虑到实际案例，本章旨在评估公司必须处理的经济和财务方面的实际后果，并提供案例模拟。案例模拟分为五个步骤，包括两个不同的场景。这些情景与运输成本对公司整体贸易成本的发生率（即 5% 和 30%）相关，五个步骤包括影响因素和潜在解决方案。最后几段将明确这种潜在的临时解决方案是否足够有效以防止供应链崩溃并鼓励公司的弹性。

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INTRODUCTION

COVID-19 emerged in late December 2019 in Wuhan, a city in the province of Hubei, China, and quickly spread to other countries in Asia, North America and especially Europe. On 11th March 2020, it was declared a pandemic by the World Health Organization (WHO). Due to its rapid diffusion, most of the countries' governments decided to implement containment measures, such as travel restrictions, controls on social gatherings and commercial activities, and bans on goods shipments, aimed at decreasing the rate of new infections and deaths.

Apart from being first and foremost a public health crisis, COVID-19 has had also significant economic and business impact on the world's major economies. In a world where almost all economic activities are connected to each other and companies are part of the same supply chains, a new disruption affecting a business can have considerable consequences on all the other entities that have a relationship with it.

This work aims to assess the risk of the COVID-19 pandemic on supply chains, with particular reference to Italy and China relations, and by analysing issues related to logistics and transports which can harm the survival and stability of companies.

First, this thesis provides an overview on trade relations between Italy and China, in order to examine the evolution of the supply chains between these two countries. China has recently become the world's largest economy, characterised by continuous development and external growth which have contributed to make it the largest exporter and third-largest importer in the world. As a result of this growth, in the last few years the country started to develop national plans (such as Made in China 2025) and to engage in multilateral agreements (the "Belt and Road" initiative) to guarantee its internal and external expansion trend. Such initiatives are very important for an import-based country like Italy, which sees China as a major partner for the procurement of raw materials and goods which are essential for the national economy.

Starting from a brief analysis of both countries' trade structures, comprising the main export and import markets, the chapter provides an investigation on Italy-China's import and export flows from 2010 to 2020, with particular attention to the sectors and industries most influenced by these international relations. Statistics and graphs underline how much Italian

companies depend on China especially for the import of intermediate goods, and this is one of the main reasons for the high trade deficit, which accounts for more than 19 billion euros. Since COVID-19 has upset the normal development of economies, it was necessary to carry out further analysis on the changes in import-export flows between the two countries, in order to understand why international supply chains are experiencing major disruptions. In the last section, possible changes in the configuration of international supply chains are considered, and new development strategies proposed by the Chinese government are presented.

The evolution of international supply chains and the dependence on other countries for the procurement of goods and raw material (inputs) and for the export of finished products (outputs), lead companies to be exposed to greater risk situations, and the COVID-19 pandemic is a clear example. With this in mind, the second chapter focuses on supply chain risks and provides an explanation of the main risks affecting international supply chains, with particular attention to those arising from natural disasters and pandemics, and of their probability and level of impact on companies. First, a general definition of the supply chain, supply chain risk and disruption are provided according to experts' studies. The chapter then develops with the definition of supply chain risk management and its practices, with reference to ISO 31000 and Supply Chain Risk Leadership Council theories. SCRM comprises all the activities to direct and control a company's supply chain with regard to supply-chain risks, and is divided into five main processes:

- Identification of external and internal environment: definition of the context and identification of possible threats coming from both inside and outside the company. This includes all the entities taking part in the development of the supply chain, such as suppliers, manufacturing, logistics, distribution and customers. The outcome of this analysis is the mapping of the supply chain process, in order to understand the potential risks that may occur as well as the entities involved.
- Risk identification: this step involves the identification and description of major risks that could affect the organization. This can be carried out following different methods, such as business-impact analysis or historical analysis. The identification phase ends with a list of possible threats divided into different categories depending on whether they are common or uncommon risks.

- Risk assessment: it consists in prioritizing risks according to the probability of the event to occur and to its impact on the company. This is necessary in order to understand which risks are more important to deal with and which strategies need to be implemented.
- Risk treatment: it focuses on the implementation of plans to manage and mitigate risks. It includes measures for protecting and securing the supply chain, risk mitigation plans, and business continuity plans.
- Risk monitoring: developing a monitoring program is fundamental to measure the effectiveness and consistency of the mitigation plan and to implement procedures for continuous monitoring and improvement of tactics if needed.

Starting from these theoretical assumptions, the third chapter deals with the conceptualization and assessment of the risks that COVID-19 has caused to supply chains. It begins with the definition of the epidemic risk, which is characterized by long-term disruption existence, ripple effect, and high uncertainty. Epidemic risks such as COVID-19 have the peculiarity of starting as small and concentrated events, but then scaling fast and propagating over many geographic areas. Compared to other disruptions in supply chains, epidemics and especially COVID-19 have some differences regarding several dimensions (such as scope, geography, demand and supply, prior planning, etc.) which are analysed according to Moritz studies. After a brief consideration of the general economic situation brought about by this pandemic, the following paragraphs concentrate on logistics and transports. Since transports and logistics play a significant role in international trade and the development of supply chains, the main issues related to them are analysed in detail. The focus is primarily on maritime transport, air transport and the cost of raw material. The analysis concentrates on the factors that led to the increase in their cost, which can be either specific for each issue or related to all these three elements.

The main problems associated with maritime transport refer to the scarce obtainability of containers, the decreased capacity on the vessels, blank sailings, longer lead time and delays, reservation problems, and port issues.

Regarding air transport, major problems have been caused by lockdowns, companies' closures, and travel restrictions, that led to airports' closures and the cancellation of national and international flights. This had significant consequences on the transportation of goods along the nodes of supply chains, which are analysed in the related section.

All the issues associated with maritime and air transport have caused further complications to companies for the procurement of raw materials. Therefore, the final paragraph deals with materials shortage and the increase in their prices.

Having investigated the major threats related to logistics and transport, the last chapter focuses on the assessment of their effects on the economic and financial performances of companies. Taking into account real examples, this chapter is aimed at appraising which are the practical consequences, in economic and financial terms, that the companies have to deal with, and provides a case simulation.

The case simulation develops into five steps comprising two different scenarios. The scenarios are related to the rate of incidence that transport costs have on the overall trade costs of the company (namely 5% and 30%), and the five steps include both impact factors and potential solutions. The first step focuses on the increase in transport costs, the second on the increase of raw material price. The third step deals with contractual conditions, and namely with debt towards suppliers that reduces from 60 days to 30 days. Step 4 attempts to provide a temporary solution to the high costs with the increase of the final price to customers, and the last step offers another buffer by reducing the credit towards customers to 30 days.

The last paragraphs will clarify whether such potential temporary solutions are efficient enough to prevent supply chain breakdown and foster companies' resilience.

CHAPTER 1. TRADE RELATIONS BETWEEN ITALY AND CHINA

1.1 China's economic outlook

In the last few years, China has become the world's second largest economy, experiencing continuous development and growth since 1978, when the major economic and social reforms were introduced.¹ During those years, China established itself as the world's manufacturing hub (the so-called "factory of the world"), with its secondary sector representing the largest share of its GDP, and opened itself towards foreign countries and international trade. Thanks to the open door policy (门户开放政策), foreign trade became China's major focus and it led to the creation of the special economic zones². After a period of continuous expansion, trade growth dramatically decreased due to the Asian crisis in 1997, causing a slowdown in the economy. However, since the country joined the WTO in 2001 it experienced rapid growth in both imports and exports, increasing its share in the world market and establishing itself as the largest exporter and third largest importer in the world in 2019.³

¹ In 1978, Deng Xiaoping announced the official launch of the Four Modernizations—agriculture, defense, industry and science and technology—which marked the beginning of the reform and opening-up policies. These reforms increased the role of market mechanisms and reduced government control over the economy. The measures included, among others, breaking down the collective farms, opening up China to foreign investment, encouraging business entrepreneurship, establishing Special Economic Zones and introducing market incentives in the state-owned companies.

² A special economic zone is an area in which the business and trade laws are different from the rest of the country. SEZs are located within a country's national borders, and their aims include increased trade balance, employment, increased investment, job creation and effective administration. To encourage businesses to set up in the zone, financial policies are introduced. These policies typically encompass investing, taxation, trading, quotas, customs and labor regulations. Additionally, companies may be offered tax holidays, where upon establishing themselves in a zone, they are granted a period of lower taxation. (source: Wikipedia)

³ Source: Eurostat

China among the world's largest traders of goods, 2019

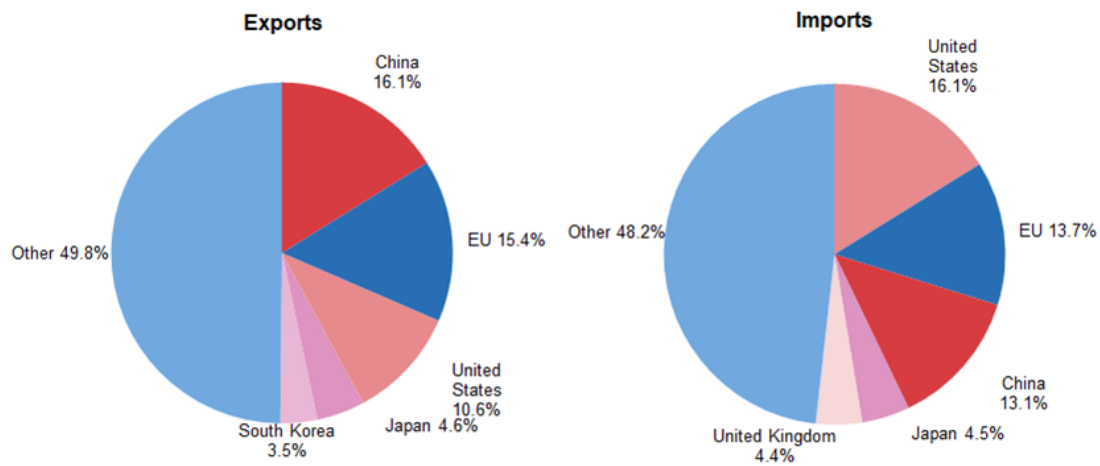


Figure 1. The world's largest traders of goods, 2019 (source: Eurostat)

The relentless industrial development and the openness towards foreign countries subsequently boosted the growth of its tertiary sector (i.e., service sector) which, since 2013, has made up the largest share of GDP.

Nonetheless, the new president Xi Jinping affirmed its willingness to change the country's economy rapid pace of growth and ensure a sustainable and more balanced growth model. In this regard, authorities are disposed to tolerate lower growth rates as a necessary condition to push forward economic reforms and to realize a "moderately prosperous society" (the "Chinese Dream" or also "the New Normal"⁴)

⁴The Chinese "new normal" embodies a focus on structural changes that can achieve still strong but lower economic growth (around 7% p.a. over the next five years) of a much better quality in terms of its social distribution and impact on the natural environment. The new model places a strong emphasis on: shifting the balance of growth away from heavy-industrial investment and toward domestic consumption, particularly of services; innovation, as a means of raising productivity and climbing up the global value chain; reducing inequalities, especially urban–rural and regional inequalities; and environmental sustainability, emphasizing reductions in air pollution and other forms of local environmental damage, as well as in GHG emissions. (source: F. Green, N. Stern, *China's "new normal": structural change, better growth, and peak emissions*, Policy Brief, June 2015)

As a result of the new economic trend, investment in manufacturing and infrastructure has begun to slow down, since the nation has shifted from an investment-driven growth model to one more focused on consumer demand, and from quantitative to qualitative growth.⁵

Moreover, over the past several years, the country has engaged in different bilateral and multilateral agreement and in various initiatives. One of the last and most noteworthy is the One Belt One Road Initiative (一带一路), which was launched at the end of 2013 by the Chinese government with the aim of connecting and promoting the economic and social growth of all Eurasian region.

"One Belt One Road" refers to the "Silk Road Economic Belt" and the "21st Century Maritime Silk Road" initiative. "One Belt" includes a terrestrial corridor covering all the countries along the original Silk Road, through Central Asia, Western Asia, the Middle East, Russia and Europe; and "One Road" includes the sea roads, which encompass a route from China's coasts to Africa and Europe via the South China Sea and the Indian Ocean, and another route from the coast of China through the South China Sea and the South Pacific.

This initiative relies on the existing bilateral and multilateral relations between China and the related countries (138 countries take part in this initiative, especially developing countries), and uses existing and proven regional cooperation platforms to actively develop economic cooperation partnerships with international countries along the route. The cooperative scope of this project includes infrastructure and development of transportation (ports, railroads, roads, airports etc.).

This initiative is worth mentioning because it does not only encompass East European countries. As a matter of fact, Italy plays a significant role for the development of the BRI,

⁵ From the website FOCUS ECONOMICS, China Economy - GDP, Inflation, CPI and Interest Rate

especially with the project “industry 4.0”⁶, which will be tightly linked to Chinese project “Made in China 2025”⁷.

The “Belt and Road” initiative can bring some benefits both to China and Italy, such as expanding investment opportunities and providing new interactive platforms in third-party markets. It can increase the income of the two countries, increase employment and the living standards of residents, establish cooperative relations, and improve infrastructures⁸.

However, recent US-China trade tensions have had a negative effect on the OBOR initiative, which has been seen by the major economies as a symbol of Chinese hegemony and growing power.

1.2 China’s trade structure

Since 1993, Chinese trade has experienced constant surplus. In only three decades its trade multiplied by nearly 100 to reach USD 4.2 trillion, and in 2013 it became the world’s biggest trading nation, outdoing the US.

As mentioned before, as a result of the open-door policy and the government’s massive investments, the country became a major manufacturing hub. This situation promoted trade

⁶ Italy’s “Industry 4.0” is a strategy aiming at supporting industrial change through a series of conjunctural measures. The measures seek to promote investments in innovation, technology and skills development while taking into consideration principles set by the fourth industrial revolution.

⁷ “Made in China 2025” is the first ten-years action plan of the Chinese government, aimed at implementing the strategy of making China a strong manufacturing country. This plan was officially released in 2015. The policy of this project relies on “innovation, quality first, green development, structural optimization, talent orientation”. Its goal is to realize the strategy of making a powerful country through the “three steps”. In particular, the first step is to enter the ranks of manufacturing powers by 2025; the second step is to reach the middle level of the world’s manufacturing powers by 2035; the third step is to enter the forefront of the world’s manufacturing powers by 2049. The proposal of this plan will provide more opportunities for cooperation with major European traditional manufacturing countries (Germany and Italy).

⁸ Source: “一带一路”与“中国制造 2025”为中意经贸提供新机遇 (academic text)

growth, particularly after the admission in the WTO in 2001, making Chinese economy highly integrated into the global trade system.

Notwithstanding the global economic downturn in 2008-2009, which led the country to reduce manufacturing outputs and consequently decrease its trade flows, China benefited from a stable improvement in terms of trade since 2000.⁹

With regards to Chinese exports, electronics and machinery make up around 55% of total exports, garments account for 13% and construction material and equipment represent 7%. Sales to Asia represent over 40% of total shipments, while North America and Europe have an export share of 24% and 23%, respectively. Although exports to Africa and South America expanded rapidly, they only account for 8% of total shipments.

Chinese total export volume in 2019 reached USD 2,499 billion (€ 2,233 billion).¹⁰

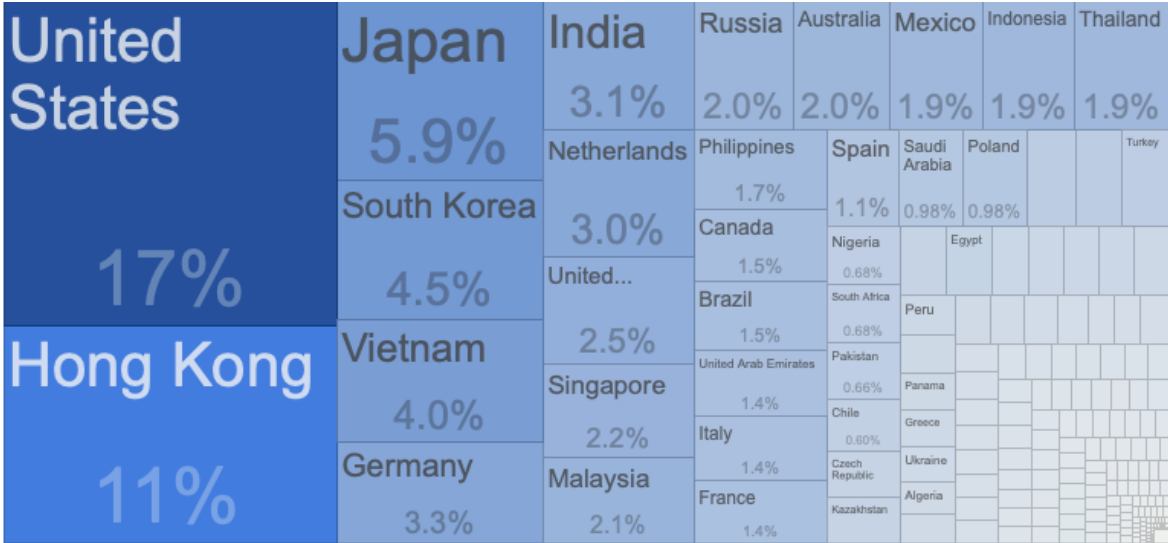


Figure 2. China Exports by Country (source: Trading Economics)

⁹ Source: FOCUS ECONOMICS, China Economy - GDP, Inflation, CPI and Interest Rate

¹⁰ Data from Info Mercati Esteri and FOCUS ECONOMICS

The country’s imports are mostly dominated by intermediate goods and a wide range of commodities, including oil, iron ore, copper and cereals. Supply of imports into China is mostly dominated by Asian countries, with a combined share of around 30% of total imports. Purchases from Europe and the U.S. account for 12% and 8%, respectively. As a major global buyer of commodities, imports from Africa, Australia, the Middle East and South America have increased strongly in the last decade and represent a combined share of around 50%.

Chinese total import volume in 2019 accounted for USD 2,078 billion (€1,857 billion).

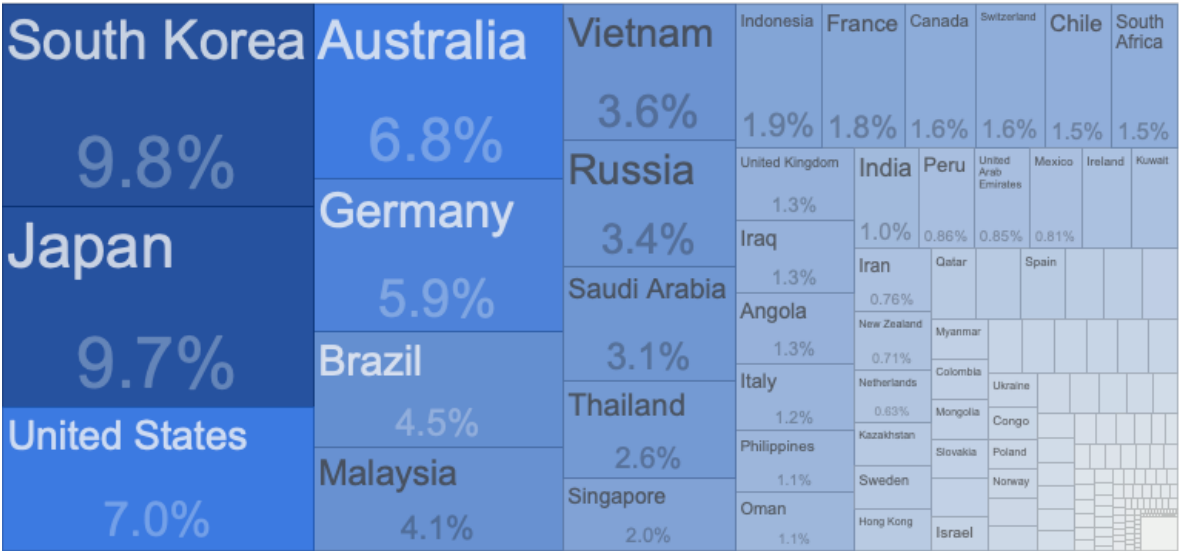


Figure 3. China Imports by Country (source: Trading Economics)

1.3 Italy’s trade structure

Italy is the world’s ninth biggest economy. Its economic structure relies mainly on services and manufacturing. The services sector accounts for almost three quarters of total GDP and its most important contributors are the wholesale, retail sales and transportation sectors. Industry accounts for a quarter of Italy’s total production, with manufacturing at the first place. The country’s manufacturing focuses on high-quality goods and is mainly run by small- and medium-sized enterprises, most of which are family-owned.

Against a tendentially weak domestic demand, the external sector’s performance is crucial for the Italian economy, which is characterized by the production of high-quality products in the machinery, textiles, industrial designs, food and furniture sectors. These products contribute

significantly to the country’s exports. However, as a country poor in national resources, it is highly dependent on imports.

Italy’s trade volumes increased significantly after the country joined the Eurozone. Despite growing global competition, in 2018 Italy ranked as the world’s 10th largest exporter and 7th largest importer (World Bank statistics). Italy’s main trading partners are inside the Euro area, in particular Germany, which is the country’s main exports destination (accounts for around 13% of Italy’s total exports) and France. Other important export destinations are the United States and Switzerland. Germany is also Italy’s top imports partner, followed by China and France.

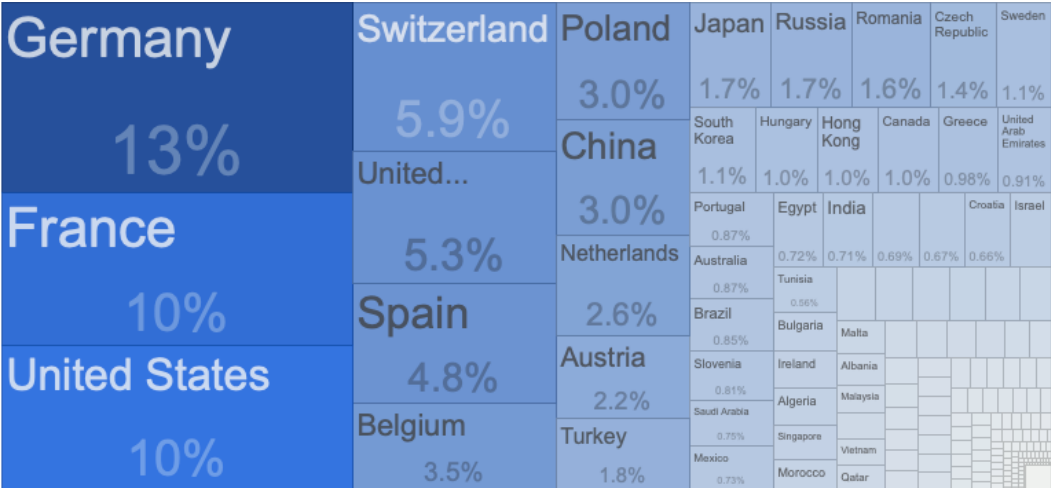


Figure 4. Italy exports by country (source: Trading Economics)

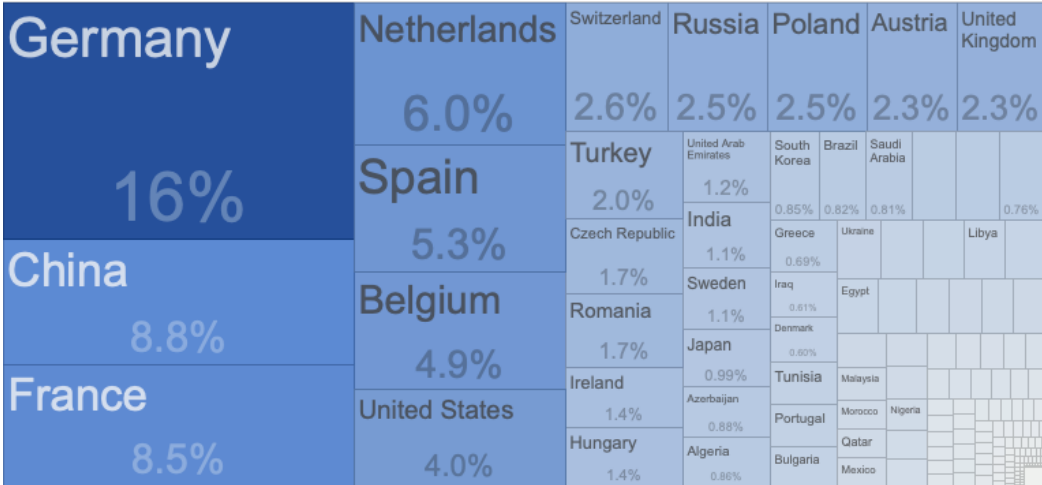


Figure 5. Italy imports by country (source: Trading Economics)

Concerning its export categories, the country's manufacturing sector is specialized in high-quality goods, therefore Italy plays an important role in the global market of luxury goods and occupies a special niche in the global market of fashion and clothing. The country's main exports are mechanical machinery and equipment, which account for around 24% of total exports, as well as motor vehicles and luxury vehicles (7.2%). Exports of clothing and footwear account for around 11.0% of the country's total exports. Other important exports include electronic equipment (5.6%) and pharmaceutical products (4.6%).

Italy's main imports are fuels, which account for around 17% of total imports. This is due to the country's lack of natural resources, which makes it highly dependent on energy imports. Other imports include machinery (14.2%), raw materials (10.0%) and food (7.0%)— Italy is a net food importer because the landscape is not suitable for developing agriculture.¹¹

1.4 Trade relations between Italy and China

Since the global crisis in 2008, it has become evident how dependent the global growth is on the development of the Chinese economy and on its relations with other players. This is because China not only is the biggest exporter of low-price products, but it is also a major importing country. For this reason, the country plays a significant role in the development of international supply chains, thanks to its interdependencies with other countries, including Italy.

Since the two economies' production structures are similar and complementary, Italy has always been a major trading partner for China. Over the last decade, China and Italy's economic and trade relations have shown rising signs of growing interdependence, both in terms of trade and investment. This indicates that several manufacturing sectors, which are the backbone of both countries' economies, are becoming increasingly interdependent.

¹¹ Source: FOCUS ECONOMICS, Italy Economy - GDP, Inflation, CPI and Interest Rate

Furthermore, both the Italian and Chinese economies are heavily export-oriented, and their exports increasingly depend on foreign inputs. Besides this, Italy is becoming more and more reliant on foreign inputs embedded in production exports, with China playing an increasingly important role. Similarly, in many sectors, the share of Italian inputs in Chinese production and exports grew. As a result, China's future export potential is dependent in part on cooperation with high-tech companies in highly industrialized countries like Italy.

Moreover, new industries are becoming increasingly relevant for China-Italy bilateral relations in the future. Growth estimates and rising food spending in China, combined with the country's rapidly aging population and their impact on health-care spending, will create new opportunities for collaboration in the agroindustry and pharmaceutical sectors, where Italian skills, expertise, and products can perfectly fit Chinese consumers' growing sophistication. Similarly, Chinese manufacturers have a big opportunity to upgrade into high-value-added supply chains, where Italy has developed some of the most advanced skills and technologies in the world.¹²

In the following paragraphs an overview of the trade relations between Italy and China will be briefly presented, with reference to the last decade (2010-2020).

Taking into consideration the period between 2010 and 2015, Italian exports to China had a strong increase of 21.1%. They are mainly related to a few number of sectors, with machinery and mechanical appliances in the first place, which, however, experienced a decline of 17.2% throughout those years. Other main exports have increased over the same years, of which vehicles (+164.2%), pharmaceutical products (+362%), apparel and clothing (+210%), furniture (+171.6%) and leather articles (+322.9%).

¹² Adapted from ISPI, A. Amighini, *Economic and trade relations between Italy and China: trends and prospects*

Sector	2010	2011	2012	2013	2014	2015	% 2015
Machinery and mechanical appliances	4,105,037,686	4,513,398,155	3,508,713,879	3,609,158,196	3,695,218,147	3,400,576,917	32.6
Vehicles	241,809,330	379,906,545	401,357,051	654,447,868	952,705,319	638,925,466	6.1
Electrical machinery	586,290,472	513,971,729	378,469,566	467,111,716	498,424,941	503,702,986	4.8
Pharmaceutical products	106,475,674	185,748,011	186,723,807	298,408,379	357,459,297	491,885,672	4.7
Optical, photo and measuring apparatus	256,952,637	262,547,479	315,564,901	329,859,937	430,301,108	478,789,728	4.6
Apparel and clothing, not knitted	121,948,401	180,077,852	253,619,874	301,617,741	361,291,128	378,174,251	3.6
Plastics	280,234,051	266,647,231	252,948,675	254,489,331	302,428,392	363,286,434	3.5
Furniture	117,551,677	160,719,495	164,470,149	206,427,001	251,003,243	319,321,652	3.1
Raw hides and skins and leather	301,985,547	334,576,209	294,853,636	325,654,625	310,581,964	302,923,661	2.9
Leather articles	68,816,177	126,179,012	170,131,866	215,369,821	250,974,872	291,005,581	2.8

Source: Elaboration from Eurostat

Figure 6. Italian top 10 exports to China (source: ISPI)

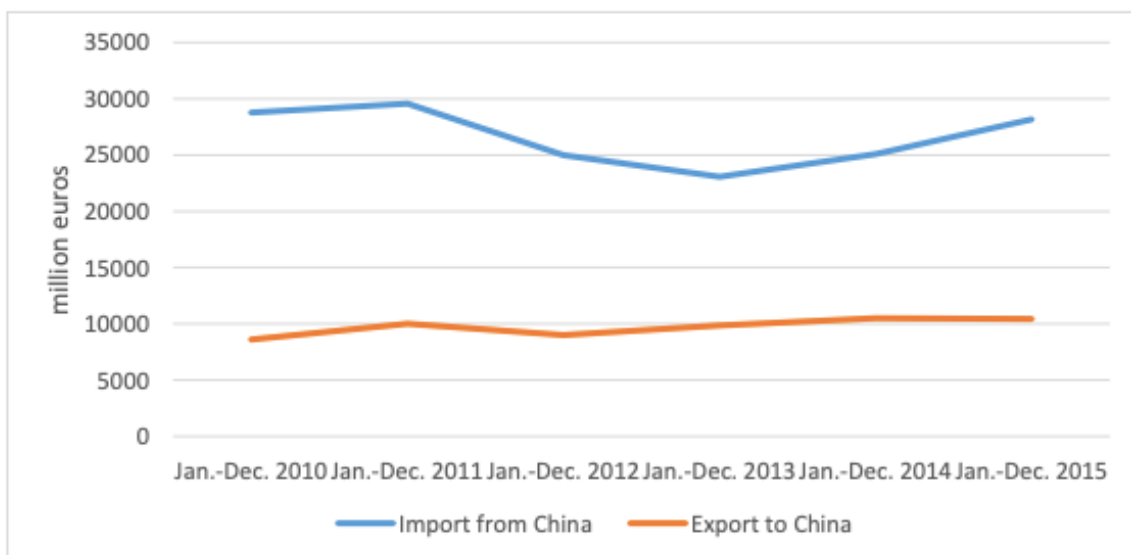
Similarly, Italian imports from China are also very concentrated on a few sectors, mainly machinery (18.8% of total Italian imports from China in 2015) and mechanical appliances (16.1% of total Italia imports from China in 2015).¹³

Sector	2010	2011	2012	2013	2014	2015	% 2015
Electrical machinery	7,282,351,419	7,141,774,661	4,673,287,546	4,024,410,758	4,373,689,902	5,295,166,395	18.8
Machinery and mechanical appliances	3,802,723,438	4,455,679,010	4,563,368,096	4,241,926,331	4,456,754,480	4,522,054,212	16.1
Apparel and clothing (not knitted)	1,874,535,987	1,888,769,192	1,581,652,771	1,403,621,103	1,503,078,915	1,630,308,807	5.8
Iron and steel	789,165,279	958,703,971	563,723,483	613,136,382	1,003,071,369	1,430,175,978	5.1
Apparel and clothing	1,620,474,994	1,601,881,544	1,373,005,197	1,225,130,236	1,251,265,973	1,280,666,729	4.5
Optical, photo and measuring apparatus	752,280,472	789,283,950	839,044,879	844,988,820	944,714,065	1,151,443,901	4.1
Organic chemicals	663,161,577	774,296,011	812,231,843	775,980,005	808,397,642	1,012,254,127	3.6
Leather articles	980,338,336	988,494,713	956,531,673	847,631,532	913,526,762	1,006,944,926	3.6
64	819,289,205	849,725,139	823,263,459	799,743,075	848,688,609	966,426,087	3.4
Furniture	798,643,406	764,670,634	709,376,353	711,266,575	813,480,135	930,618,546	3.3

Source: Elaboration from Eurostat

Figure 7. Italian top 10 imports from China (source: ISPI)

¹³ Data taken from ISPI, A. Amighini, *Economic and trade relations between Italy and China: trends and prospects*



Source: Elaboration from Eurostat

Figure 8. Trade flows between Italy and China, 2010-2015 (source: ISPI)

Italian imports from China have increased since 2013 mainly in relation to the strong demand in major industrial sectors such as machinery and mechanical appliances (+18.9%), iron and steel (+81%) and optical, photo and measuring apparatus (+53.1%).

In 2016 there was a moderate recovery in the Italian trade deficit with China (from 17.8 to 16.2 billion), fostered by an increase in value of Italian exports of 6.4% (from 10, 4 to 11.1 billion in total value) and a decrease in imports from China of 3,4% (reduced from 28.2 billion euros to 27.2 billion euros).

However, Italy's commercial presence in China continues to be marginal when compared to other European countries such as Germany and France, mainly due to a lack of common planning that facilitates entry into the Chinese market. Even in that period, the majority of Italian products exported to China came from the mechanical sector (38.8% of total exports) and manufacturing (14.4%), in particular luxury consumer goods (clothing, jewelry, food, tiles) symbol of Made in Italy. A strong increase was also reported in the auto sector (6.6%), furniture (6.3%), chemicals (6.2%), metallurgy and metal products (4.5%) and electronics (3,

8%).¹⁴ Moreover, since the Chinese authorities have become more willing to focus on high value-added products, paying more attention to the technological content and the level of environmental impact, the mechanics and products of Made in Italy can play an important role and have ample room for growth.

The world economy experienced an acceleration in 2017, and the change of pace of the Asian continent is the main novelty. In particular, the acceleration of Chinese imports revived the Asian demand, which the previous year remained on the margins of growth.

The development of the Chinese economy has had an impact throughout the region, activating increasingly interconnected supply chains within the Asian continent and with the others as well. The imports from abroad of automotive, mechanical, electrical engineering and intermediate products revealed a double-digit growth, putting the development of the industrial sector as the engine of Chinese growth. Part of the acceleration in 2017 was supported by public authorities also with the aim of improving the climate of confidence in the economy on the occasion of the October Party Congress.¹⁵

Italy-China bilateral trade data indicate continued growth and a reduction in the Italian trade deficit. The trade in 2017 accounted for 42 billion euros, up by 9.2% compared to the previous year. The Italian trade deficit decreased by 1.37 billion euros, to 14.9 billion euros, with an increase in exports of 22.2% compared to the previous year, to 13.5 billion euros, while imports rose to € 28.4 billion, up 4% compared to 2016.

While in 2015 and 2016 Chinese exports to the world had registered negative growth rates, from 2017 they started to grow again and in 2018 reached the highest growth since 2011. The value of USD 2.487 billion of exports was achieved in the expectation of the full effect of US tariffs that came into effect in mid-2018. However, the trade war with the United States had a limited impact on the Chinese performance with the rest of the world in 2018. Imports also

¹⁴ Data elaborated from ISTAT database

¹⁵ Data from RAPPORTO ICE-PROMETEIA, *evoluzione del commercio con l'estero per aree e settori, 2017*

increased compared to the past, reaching the share of 2.135.905 billion dollars, with a growth rate of 15%.¹⁶

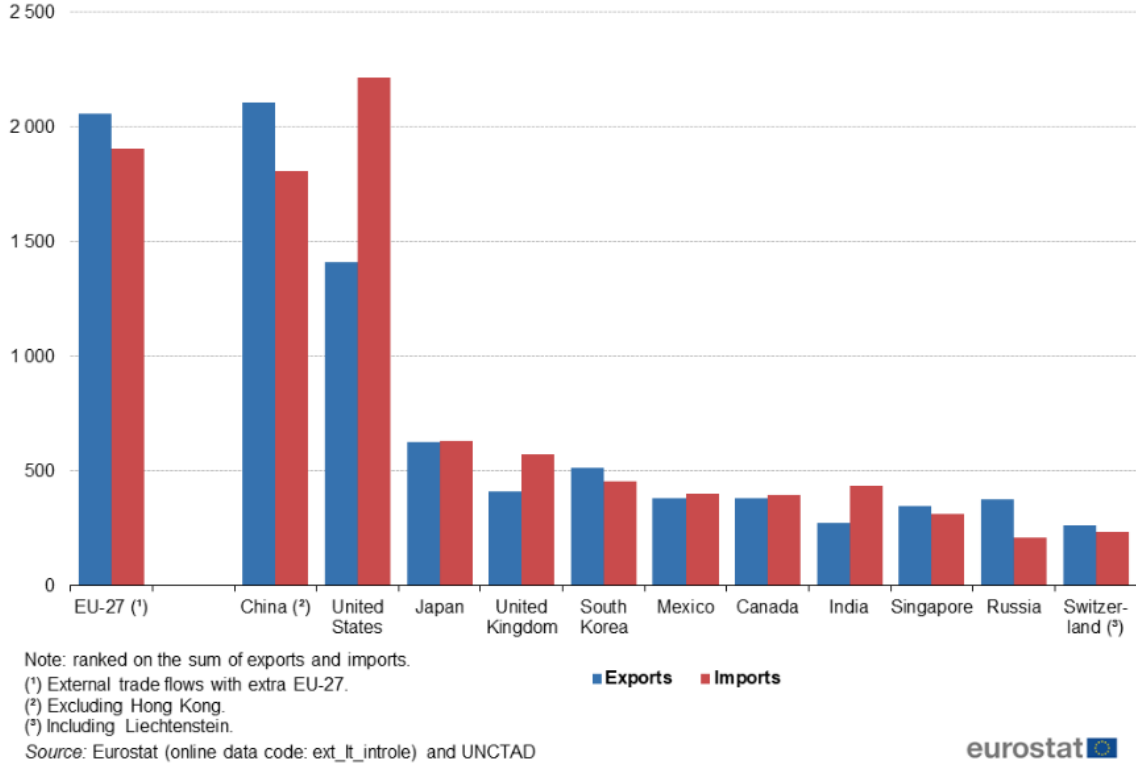


Figure 9. Main players for international trade in goods 2018, billion EUR (source Eurostat)

According to the Italian source ISTAT, for the year 2018 there are values of about 13 billion for Italian exports to China and 30 billion euros for imports (The overall trade with the country exceeded 43 billion euros). In that year, Italy was confirmed fourth supplier among European countries (Eurostat data). China was the ninth destination market for Italian exports and the first in the Asian continent.

¹⁶ From Fondazione Italia-Cina, highlights- X rapporto annuale -Cina 2019, scenari e prospettive per le imprese

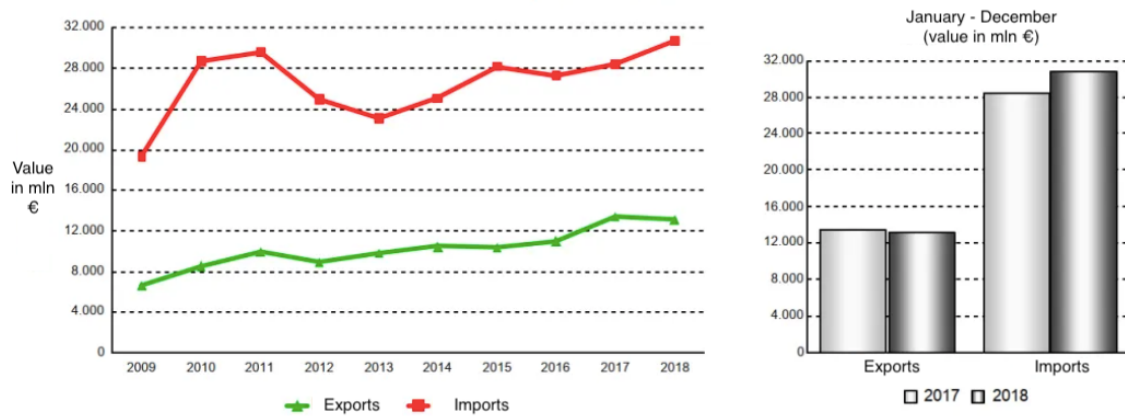


Figure 10. Italy-China trade flows, 2017-2018 (source: ICE)

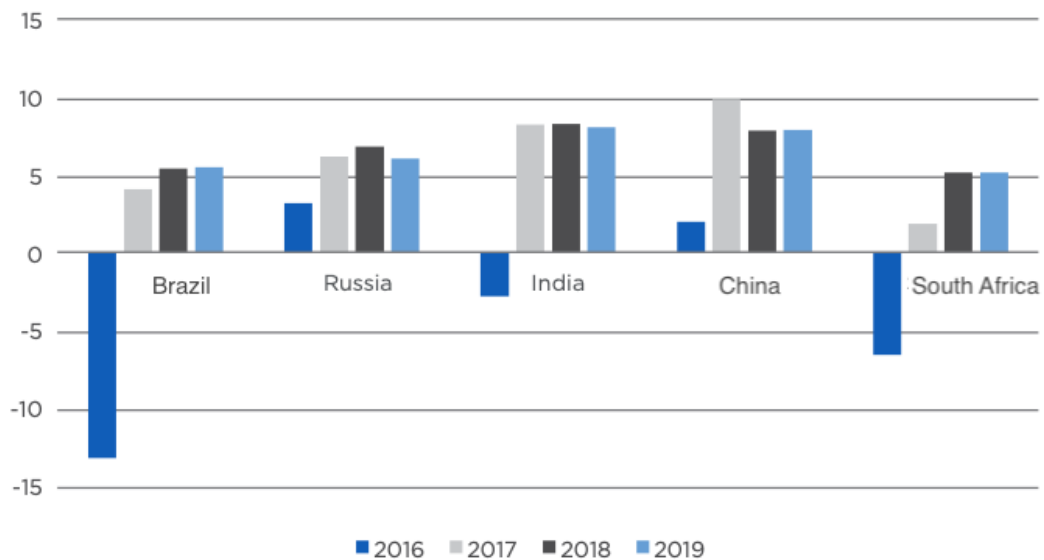


Figure 11. imports from BRICS countries, 2016-2019 (source: Prometeia)

Figure 11 highlights the variation of Chinese imports flows from Italy between 2016 and 2019. The increase of flows to China is closely related to the reactivation of the global value chains, for which the Asian giant represents a reference. Besides the relevant role in international trade, there have been other factors that have affected the growth of imports in the last few years. This is the case, for example, of the significant increase in imports to replace domestic production in the most polluting sectors, in view of the renewed efforts in the environmental field by the Chinese authorities.

According to Eurostat data, in 2019 the trade between Italy and China was 44.6 billion euros (+ 1.46%) of which 13 billion (-1.02%) due to exports and 31.7 billion euros (2.5%) to Italian imports from China.

The composition of Italian exports to China in 2019 essentially maintains the same structure as in previous years. Exports of machinery and equipment remained quite stable (+0.69% compared to 2018). Exports from the auto sector experienced the greatest decrease, falling from 1.815,93 MLN euros in 2017 to 642,46 MLN in 2019 (with a variation of -64.62% between the years 2017-2019, and a variation of -23.12% in 2018-2019). Other means of transport saw a decrease in exports as well (-19.01% compared to 2018). Electrical material and equipment (-8.16%) and computer and electronic products (461,67 million; -15.24%) were also lower than the previous year. However, other important sectors of Italian export are growing, including pharmaceuticals (1.078,01 MLN; + 19.72% compared to 2018 and +64.75% compared to 2017), which becomes the second voice of Italian exports, clothing (1.030,27 MLN; + 9.19%) and furniture (482,89 MLN; + 2.17%).¹⁷

Italian exports to China	2017	2018	2019		
Total value (million €)	13.509,45	13.188,66	12.992,63		
Variation (%)	22	-2,7	-1		
Top 15 exported goods (mln €)	2017	2018	2019	variation (%) 2017- 2019	variation (%) 2018-2019
Machinery and equipment	3.865,46	3.849,81	3.876,52	0,29%	0,69%
Vehicles, trailers, semi-trailers	1.815,93	835,68	642,46	-64,62%	-23,12%
Chemical products	847,38	940,24	936,31	10,49%	-0,42%
Leather goods(except for clothing)	837,55	906,27	932,84	11,38%	2,93%
Clothing	689,5	943,55	1.030,27	49,42%	9,19%
Pharmaceuticals	654,34	900,43	1.078,01	64,75%	19,72%
Computer and electronic and optical products; electro-medical equipment, measuring equipment and clocks	495,12	544,67	461,67	-6,76%	-15,24%
Electrical equipment	477,28	472,01	433,48	-9,18%	-8,16%
Furniture	450,65	472,62	482,89	7,15%	2,17%
Textile products	440,42	463,14	425,93	-3,29%	-8,03%
Metal products, excluding machinery and equipment	371,62	363,36	343,75	-7,50%	-5,40%
Products of other manufacturing industries	368,49	379,15	369,17	0,18%	-2,63%
Other products and activities	367,08	306,52	176,98	-51,79%	-42,26%
Rubber articles and plastic materials	295,89	300,65	298,63	0,93%	-0,67%
Other means of transport (ships and boats, locomotives, aircraft and spacecraft, military vehicles)	275,06	277,71	224,91	-18,23%	-19,01%

Figure 12. Italian exports to China (source: Info Mercati Esteri, Elaborations of the Embassy of Italy on ICE Agency data from ISTAT source)

¹⁷ Data from Info Mercati Esteri (CINA -rapporti con l'Italia)

With regards to Italian imports from China, in 2019 the main sectors were computer, and electronic products (5.458,41 MLN; +3.14% compared to 2018, and +26% compared to 2017), electrical material and equipment (3.645,14 MLN; + 4.41%) and machinery (3.769,66 MLN; + 5.05% compared to 2018 and +13.73% compared to 2017). Imports of furniture (+ 13.73%), metal products (+7.27%) and vehicles (+6.94%) are growing. These sectors determine the increase in the value of imports compared to 2018 and are obviously also determined by Italian production in China destined for the global market. On the other hand, clothing imports decreased (2.531,49 MLN; -0.39% compared to 2018 and – 4.24% compared to 2017), which represents the fourth largest import item from China. Other sectors saw an important decrease as well, such as other means of transport (-17.94%) and chemical products (-3.53% compared to 2018, however with an increase of 18.54% compared to 2017).

In 2019 Italy confirmed itself as the fourth customer country of China after the Netherlands (whose position is influenced by the flows entering the EU through the port of Rotterdam), Germany, and the United Kingdom.

Italian imports from China	2017	2018	2019		
Total value (million €)	28.412,91	30.831,65	31.665,44		
Variation (%)	4.1	8.5	2.5		
Top 15 imported goods (mln €)	2017	2018	2019	variation (%) 2017- 2019	variation (%) 2018-2019
Computer and electronic and optical products; electro-medical equipment, measuring equipment and clocks	4.331,93	5.291,98	5.458,41	26,00%	3,14%
Electrical equipment	3.347,66	3.491,08	3.645,14	8,89%	4,41%
Machinery and equipment	3.314,55	3.588,51	3.769,66	13,73%	5,05%
Clothing	2.643,68	2.541,41	2.531,49	-4,24%	-0,39%
Products of other manufacturing industries	2.140,94	2.166,76	2.287,92	6,87%	5,59%
Leather goods (except for clothing)	1.723,87	1.682,44	1.762,43	2,24%	4,75%
Textile products	1.637,92	1.728,64	1.769,78	8,05%	2,38%
Chemical products	1.513,69	1.859,97	1.794,34	18,54%	-3,53%
Metal products, excluding machinery and equipment	1.429,10	1.514,46	1.624,51	13,67%	7,27%
metallurgy products	1.305,40	1.592,27	1.553,95	19,04%	-2,41%
Rubber articles and plastic materials	1.162,27	1.149,25	1.205,76	3,74%	4,92%
Vehicles, trailers, semi-trailers	565,82	587,39	628,15	11,02%	6,94%
Other means of transport (ships and boats, locomotives, aircraft and spacecraft, military vehicles)	527,16	536,94	440,63	-16,41%	-17,94%
Other non-metallic mineral processing products	524,96	587,94	568,33	8,26%	-3,34%
Furniture	506,58	517,61	588,67	16,20%	13,73%

Figure 13. Italian imports from China (source: Info Mercati Esteri, Elaborations of the Embassy of Italy on ICE Agency data from ISTAT source)

It is to be noticed that despite the tensions and uncertainties that characterized 2019, such as the protectionist escalation of US trade policy, the Brexit issue, and socio-political crises in some of the developing economies, Italy and China trade relations have experienced a constant increase, marking an important achievement in the development of integrated supply chains.

1.5 The effect of COVID-19 pandemics on trade flows

COVID-19 is a worldwide humanitarian crisis. This pandemic that broke out in the first months of 2020 now continues to spread across the world, not only putting health-care systems under unprecedented stress, but also bringing about economic and social disruptions, which have resulted in a significant reduction in global trade. This situation is negatively impacting the existence and development of international supply chains, which are increasingly reliant on external relations between countries.

As a matter of fact, overall world trade recorded a drop in value of about 9 per cent in 2020, with trade in goods declining by about 6% and trade in services decreasing by about 16.5%.

COVID-19 had the greatest impact on global trade in the first half of 2020. In Q3 2020, it started to recover, and in Q4 2020, it improved even further. The rebound in goods trade in the second half of 2020 was primarily responsible for the recovery. Trade in services continues to lag substantially below averages. On a quarter-over-quarter basis, global trade in goods increased by around 8% in Q4 2020, while trade in services stagnated at Q3 2020 levels.

Most of the major economies experienced significant declines in both imports and exports of goods in the first half of 2020. Despite some progress, the value of trade remained lower for nearly all major economies in the third quarter of 2020 than in the same quarter of the previous year. The only exception was China, whose goods' exports increased by almost 3%.

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¹⁸ Source: Global trade update, UNCTAD

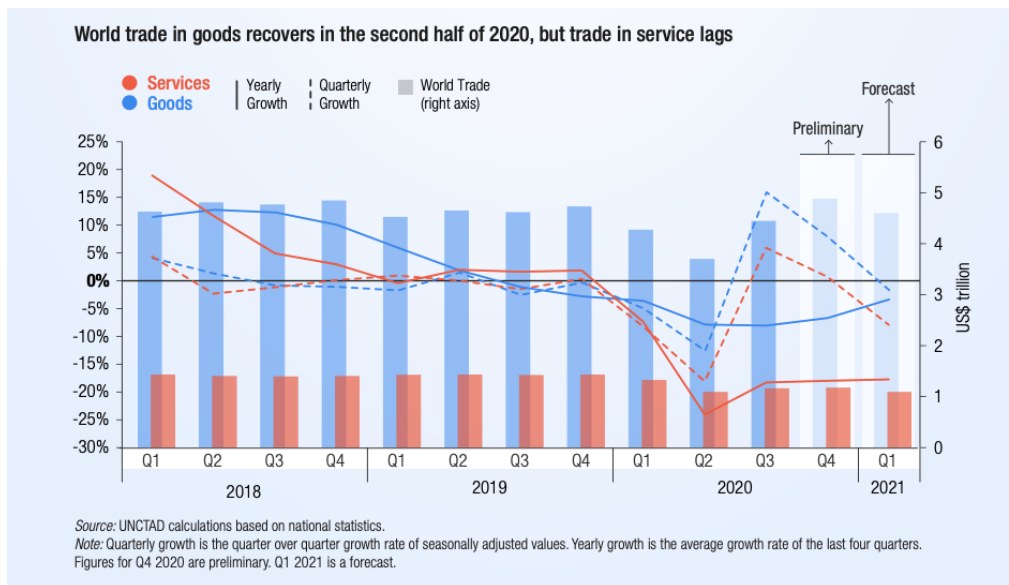


Figure 14. trade in goods and services 2020 (source: UNCTAD)

Not only did COVID-19 consequences impact the global demand, but they also had a significant effect on the countries' relative competitiveness. Although most countries' exports have decreased, some nations have increased their global market share, as their economies managed to withstand the pandemic's challenges better than others.

As an example, during the COVID-19 pandemic, China was able to gain market share in a variety of sectors, including some of the most severely affected ones (transport equipment and road vehicles). However, in some of the sectors where trade increased during COVID-19, China's export competitiveness eroded (e.g. communication equipment and office machinery).

Throughout the year, China's trade structure has diverged from other economies. China's economy was the first to be affected by COVID-19 (since it was the first country in which the pandemic broke out) and after experiencing a decrease in the early months, Chinese exports stabilized in Q2 2020 and recovered strongly in Q3 2020, with year-over-year growth rates of nearly 10%. Overall, the level of Chinese exports for the first nine months of 2020 was comparable to that of 2019 over the same period. On the import side, after a fall in Q2 2020, Chinese demand for imported goods has recovered, albeit at a slower pace than exports. Imports stabilized in July and August until increasing significantly in September.

EXPORTS	January	February	March	April	May	June	July	August	September
Brazil	↓19%	↓1%	↑5%	↓9%	↓15%	↓5%	↓3%	↓11%	↓9%
Russian Federation	↓2%	↓18%	↓20%	↓33%	↓36%	↓26%	↓28%	↓32%	
India	↓1%	↑4%	↓34%	↓61%	↓35%	↓12%	↓10%	↓13%	↑4%
China	↓22%	↓10%	↓7%	↑3%	↓3%	↑1%	↑7%	↑9%	↑10%
South Africa	↑10%	↑6%	↓1%	↓61%	↓28%	↓6%	↓14%	↓3%	
United States	0%	↑2%	↓9%	↓29%	↓36%	↓24%	↓15%	↓15%	
Japan	↓4%	0%	↓8%	↓19%	↓27%	↓25%	↓18%	↓15%	
Republic of Korea	↓7%	↑4%	↓2%	↓26%	↓24%	↓11%	↓7%	↓10%	↑8%
European Union	↓2%	↓3%	↓8%	↓31%	↓32%	↓9%	↓10%	↓9%	

Source: UNCTAD calculations based on national statistics. Year-over-year growth rates, in \$US. Data excludes intra-EU trade.

Figure 15. Exports variation (%), 2020 (source: UNCTAD)

IMPORTS	January	February	March	April	May	June	July	August	September
Brazil	↓1%	↑5%	↑11%	↓15%	↓11%	↓20%	↓35%	↓29%	↓25%
Russian Federation	↑4%	↑2%	↓2%	↓20%	↓13%	↓4%	↓13%	↓11%	
India	0%	↑4%	↓28%	↓60%	↓51%	↓48%	↓30%	↓26%	↓20%
China	↓7%	↓10%	↓1%	↓14%	↓17%	↑3%	↓1%	↓2%	↑13%
South Africa	↓3%	↓4%	↓17%	↓38%	↓40%	↓43%	↓39%	↓31%	
United States	↓4%	↓4%	↓7%	↓21%	↓25%	↓13%	↓8%	↓5%	
Japan	↓5%	↓13%	↓1%	↓3%	↓25%	↓14%	↓21%	↓21%	
Republic of Korea	↓5%	↑1%	0%	↓16%	↓21%	↓11%	↓12%	↓16%	↑1%
European Union	↓3%	↓7%	↓12%	↓26%	↓28%	↓12%	↓15%	↓10%	

Figure 16. Imports variation (%), 2020 (source: UNCTAD)

Economic disruptions brought about by COVID-19 had a greater impact on some sectors more than others. For example, the value of global trade in the energy sectors has dropped by more than 35%. Steeper declines were also observed in the automotive sectors (motor vehicles and transport equipment). Machineries and the metals and ores industry also saw a major decrease in trade. In contrast, most agri-food sectors (with the exception of tobacco and

beverages) have remained stable or increased slightly. The textile sectors saw a major growth in trade (10% relative to the same period of 2019). Such increases are linked to the COVID-19 pandemic as these sectors include protective equipment such as surgical masks. COVID-19 had a minor impact on the office machinery sector as well, which benefited from increased demand for home office equipment.

On the whole, a sharp decrease is affecting several intermediate goods sectors, in as much as they suffered from the disruption of global value chains (GVC), caused by the widespread interruption of production activities.

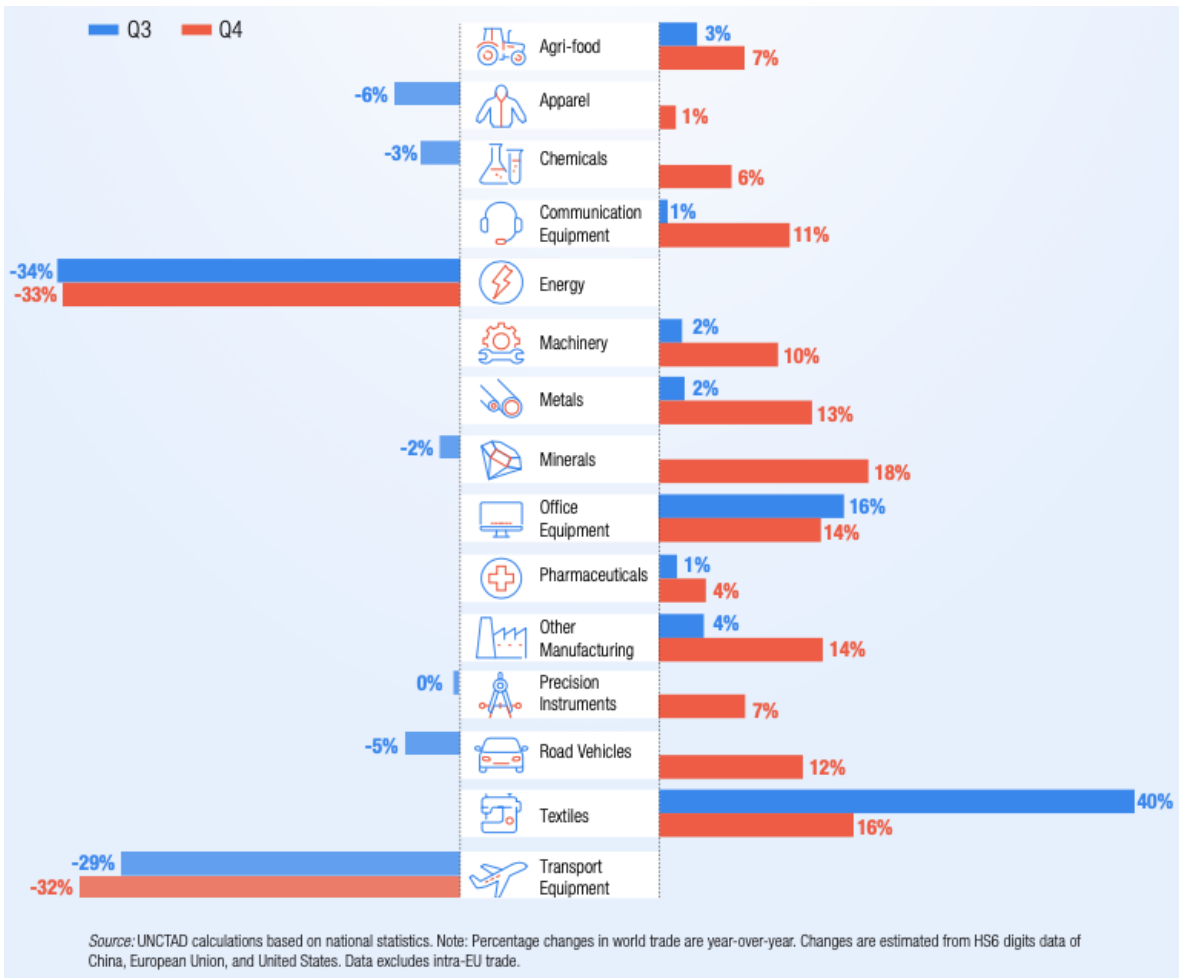


Figure 17. International trade in goods per industry (source: UNCTAD)

The Covid-19 pandemic has therefore highlighted the importance of GCS and the subsequent implications of their interruption, even if temporary. This is particularly evident for Italy, whose exports are an important driver of growth and where there are only few production chains that do not depend on imports from abroad. As a matter of fact, Italy ranks among the

most integrated countries involved in activities with a high level of innovation and is particularly integrated within the context of international supply chains.

With respect to Italy-China trade relations, according to the ICE database, between January and April, Italian exports to China decreased by 20% from 4.1 to 3.2 billion euros, while imports fell by only 5% from 10.3 billion to 9.7 billion. In June, as stated by ISTAT, exports to China recorded a trend decrease of 3% while imports increased by 24% (though the reason was not specified).

In December 2020, ISTAT data reveal that both exports and imports increased significantly on an annual basis to China (+ 18.3% and +18.4% respectively).

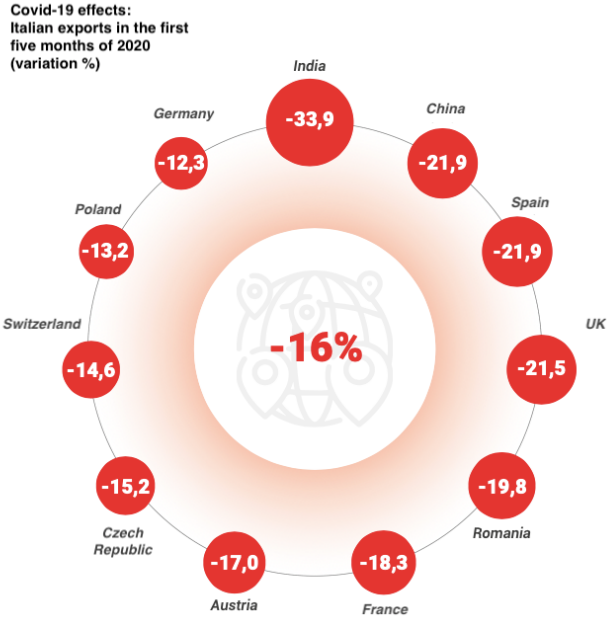


Figure 18. Italian exports in the first 5 months of 2020 (source: ICE)

Chinese customs’ data for the first two months of the year reveal a decrease in Chinese exports to Italy of 18.5%, and a decline in Chinese imports of 12.5%, with an overall reduction in trade of 16.2%.¹⁹

Overall, in 2020 Italian exports to China accounted for 12.887 million euros (compared to 12.969 million in 2019), and imports increased from 31.663 million in 2019 to 32.144 million

¹⁹ Source: Info Mercati Esteri

euros in 2020. These trends show that the recent pandemic did not really affect the trade relations between the two countries.

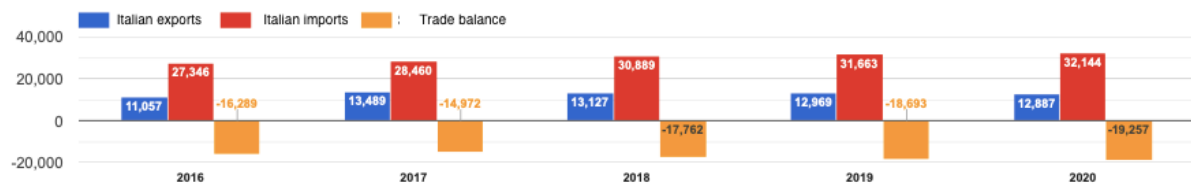


Figure 19. Italy-China trade flows 2016-2020, mln € (source: Osservatorio Economico)

As for the sectors, the automotive exports recorded the lowest performance (in four months they decreased from 237 to 107 billion), and industrial machinery, which make up most of the Italian exports, decreased by 16%. Leather articles experienced a decline as well (from 197 to 112 million), while the furniture sector had a more contained loss, and fell from 144 million in exports in 2019 (January-April) to 106 million in 2020.²⁰

On the contrary, exports of chemicals towards China continue to grow, mainly due to pharmaceutical products (+11.6% in 2020). As the first country affected by the Coronavirus, China was also the first one to get out of the lockdown phase, and an encouraging recovery in the Italian sales is expected from next year.²¹

With regard to Italian imports, there was a significant increase in textiles, which tripled from 243 million in 2019 to 712 million, and a slight increase from 612 to 614 million for telecommunications equipment. Clothing imports were almost stable at 561 million against 571 million in the same period of 2019.

It is important to take into consideration that the close trade relations with China affect the development of various economies, especially in South East Asia, which are highly integrated

²⁰ Data collected from ICE database

²¹ With a rapidly aging population, China presents increasingly favorable prospects in the pharmaceutical and health sector. Even before the Covid-19 emergency, the government expressed its commitment to promote access to basic medical and health services to as many citizens as possible with an ad hoc law which will give priority to the development of facilities and services in the most remote areas of the country. The epidemic has brought even more attention to the importance of the national health system, suggesting a further increase in investments in the sector in the coming years. Italian companies supplying medical equipment, pharmaceuticals and biotechnologies can therefore look positively at a market in which their exports have already almost doubled between 2014 and 2019, reaching a value of approximately 1.5 billion euros.

in the regional value chains and whose main market is the Country of the Dragon. These economies were affected by the stop to production put in place by Beijing between February and April 2020 and consequently struggled to compensate for the damage suffered in recent months; likewise, the gradual recovery of the Chinese economy expected from the second half of the year could guarantee them a driving force for a restart. All this is reflected in the Italian exports to these markets, as in the case of the Philippines and Myanmar, where the contraction in Italian sales is more than 20% in 2020 and, despite a good recovery expected next year, will not be able to return to pre-crisis levels before 2022. The drops expected in 2020 for Italian exports to Hong Kong and Indonesia are slightly lower, but in these cases the recovery in the next year will be more pronounced.²²

These are all signs of the fact that economic disruptions in one country greatly affect the fate of all the other players with which it has relations, therefore it is becoming increasingly important to develop an efficient and accurate supply chain risk management plan, in order to prevent or at least minimize such consequences.

1.6 A glance at the future

The next chapters will analyze in detail the effects of the economic disruptions caused by the COVID-19 pandemic on Italian companies and on their performances. It is clear that the consequences will be different depending on sectors and markets; however, this black swan²³ has put a strain on Italian supply chains which, due to the increasing connectiveness and their dependence on other countries, have become more fragile and more exposed to different risks (such as longer delivery time of products, higher costs of carriers, noncompliance of suppliers etc.).

²² From SACE, Rapporto export 2020, *Open (again) una ripartenza all'insegna dell'export, 2020*

²³ COVID-19 pandemic is also known as "*The black swan*". This expression was used for the first time in 2007 by the philosopher and mathematician Nassim Nicholas Taleb in his essay "*The black swan*".

This pandemic has shown that an adjustment of these international value chains is appropriate if not necessary (through reshoring and nearshoring for instance²⁴), nevertheless companies must pay attention and avoid narrowing them excessively, because the potential related costs could be very high (an example can be inventory management). Companies can also consider rethinking their investment strategies abroad, without forgetting, however, that the control of markets, especially those geographically and culturally more distant, remains an important factor of competitive advantage. Therefore, they should find a balance between international cooperation and a more strategic autonomy (which does not mean self-sufficiency), in order to decrease their dependence on certain economies and increase their resilience.

Besides the possible repercussions of COVID-19, another factor is worth mentioning. In October 2020, at the fifth Plenum meeting in Beijing, the leaders of the Chinese Party outlined their 14th five-year plan for economic and social development. The guidelines for the plan focused on President Xi Jinping's "Dual circulation" strategy²⁵ (hereinafter referred to as DCS), which advocates superior growth that encourages domestic markets, innovation, and reform. DCS intends to boost China's domestic demand (internal circulation) and develop the export market (international circulation) by focusing on internal circulation. The aim of this program is to minimize China's exposure to the increasingly volatile external market conditions caused by the growing trade tensions with the United States.²⁶

²⁴ Reshoring is the practice of transferring a business operation that was moved overseas back to the country from which it was originally relocated. Nearshoring is the practice of transferring a business operation to a nearby country, especially in preference to a more distant one.

²⁵ The term 'dual circulation development model' refers to the inter-play between 'domestic circulation' of production, distribution, and consumption (i.e. the domestic economic cycle) and international circulation (i.e. the international economic cycle), and most importantly to the weight each of the two cycles is given in the model. International circulation has been the focus of China's export-oriented development model since the launch of Deng Xiaoping's reform and opening up policy in 1978. Shifting the focus of China's development model more to the domestic market is, however, not an entirely new idea. It has been pursued for the last 15 years, although this objective has only been achieved within certain limits. (China's economic recovery and dual circulation model, European Parliament briefing)

²⁶ Source: "Five things to know about China's new five-year plan", IHS Markit

Expanding domestic demand essentially involves stimulating private consumption, whose weight on China's GDP is lower than the world average, about 40% compared to 58%, with peaks of 68% in the United States. Domestic consumption is expected to grow at a rate of 5.5% per year for the next 15 years, leading the Chinese domestic consumption economy to overtake the European economy by 2030.²⁷

The step from high private saving rates to rising Chinese household spending is facilitated by elements such as growth in per capita income (there will be a significant contraction in the share of the low-income population, which will decrease from 36.9% in 2015 to 11% in 2030). Alongside the greater economic availability, other factors will contribute to achieving the goal, such as the development of the e-commerce channel, the consequent availability of products and the progressive sophistication of the needs and tastes of the Chinese consumer.²⁸ This last element might have a positive influence on the Italian exports of luxury goods, already increased due to the COVID pandemic and the impossibility to buy such products abroad.

An essential aspect of the dual circulation is the development of the Country's supply chain, so as to avoid dependence on imports. Concerns about the future of the Chinese supply chain affect the energy and food sectors as well as the technology sector. (In 2019 China imported almost 85% of the oil consumed and over 40% of gas). To be less dependent on imports, China has decided to focus on renewable energy, in addition to the diversification of international relations with regard to the energy sector.²⁹ Will this change have an impact on the country's trade relations with Italy?

DCS also implies the need for greater dependence on internal technology, therefore it is expected a trend towards higher R&D spending within investment budgets over the next few years (the focus will be on quality rather than on quantity). This strategy will be carried out also with the plan "Made in China 2025", already mentioned before. The program has the

²⁷ Source: "Cina e consumi interni: trend e prospettive", Camera di commercio Italo-Cinese

²⁸ The group of Chinese "big spenders", which today accounts for 2.6% of the population, is expected to grow, and in 2030 could represent 14.5% of the population.

²⁹ Adapted from "Cina: meno export, più consume interni", Wall Street Italia

potential to have a major impact on bilateral relations between Italy and China. As a matter of fact, it aims to develop in China some macro-industrial sectors that are crucial for the country's development. Some of these, such as advanced mechanics or the agricultural machinery sector, are in direct competition with Italian productions. The Chinese goal is to enhance the industrial production considered strategic and increase its efficiency (for instance by the use of subsidies for technology transfer, and of favorable conditions for companies that produce in China). This is therefore a twofold challenge for Italian companies. On the one hand, it may become more difficult to be competitive on the Chinese market, unless with a strong local presence, on the other hand, Chinese companies might become much more competitive on third markets, with the risk of stealing market share from Italian companies already present in them.³⁰

However, with respect to the global market, the strategy intends also to lower import tariffs and trade barriers, improve export policies, improve the level of international two-way investment and to continue the organization of international exhibitions³¹. This in turn could increase the export of Italian products to the Chinese market, especially those goods that suffer more from trade barriers such as food and luxury products. It could be a great opportunity for decreasing the trade deficit with China, though only if it is feasible. It is important to consider that the exports of products by Italian companies could also have negative implications for them (such as custom problems, lack of carriers or transport problems). Therefore, a question naturally arises: could this “opportunity” actually have positive effects for Italian companies?

³⁰ Source: G. Gabusi, G. Prodi “Reality check”: le relazioni bilaterali Italia-Cina in ambito economico dagli anni Settanta alle “nuove Vie della Seta” , *OrizzonteCina*, Vol. 11 (2020), n. 2: 12-25 , 2020

³¹ Source: “AN ANALYSIS OF CHINA’S 14TH FIVE-YEAR PLAN”, MS Advisory

CHAPTER 2. SUPPLY CHAIN RISK MANAGEMENT

2.1 Definition of Supply Chain

In the last few decades, countries trade relations and interdependencies for the procurement of goods and raw material (inputs) and for the export of finished products (outputs) are constantly increasing, as analysed in the first chapter. This situation led to the creation and development of international supply chains, which have now become the cornerstone of international trade. But what are supply chains? Several experts attempted to give a definition to this phenomenon.

La Londe and Masters (La Londe and Masters, 1994) proposed that a supply chain is a set of firms that pass materials forward. Normally, several independent firms are involved in manufacturing a product and placing it in the hands of the end user in a supply chain—raw material and component producers, product assemblers, wholesalers, retailer merchants and transportation companies are all members of a supply chain.

Another expert defines a supply chain as the network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services delivered to the ultimate consumer (Christopher, 1992).³²

For the purpose of this paper, the most suitable definition is provided by Handfield and McCormack (2007) in their publication, where a **supply chain** is defined as “a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer”.³³ This

³² Source: Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining supply chain management. *Journal of Business logistics*, 22(2), 1-25.

³³ Source: Handfield, R., & McCormack, K. P. (Eds.). (2007). *Supply chain risk management: minimizing disruptions in global sourcing*. CRC press.

definition encompasses all the activities associated with the movement and transformation of goods from the raw material stage to the end user, as well as the related information flow.

Starting from this description, researchers recognized three levels of supply chain complexity: a **direct supply chain**, an **extended supply chain**, and an **ultimate supply chain**. A direct supply chain consists of a company, a supplier, and a customer involved in the upstream and/or downstream flows of products, services, finances, and/or information. An extended supply chain includes suppliers of the immediate supplier and customers of the immediate customer, all involved in the upstream and/or downstream flows of products, services, finances, and/or information. The entities involved in all the upstream and downstream flows of products, services, finances, and information from the ultimate supplier to the ultimate customer make up the ultimate supply chain.³⁴

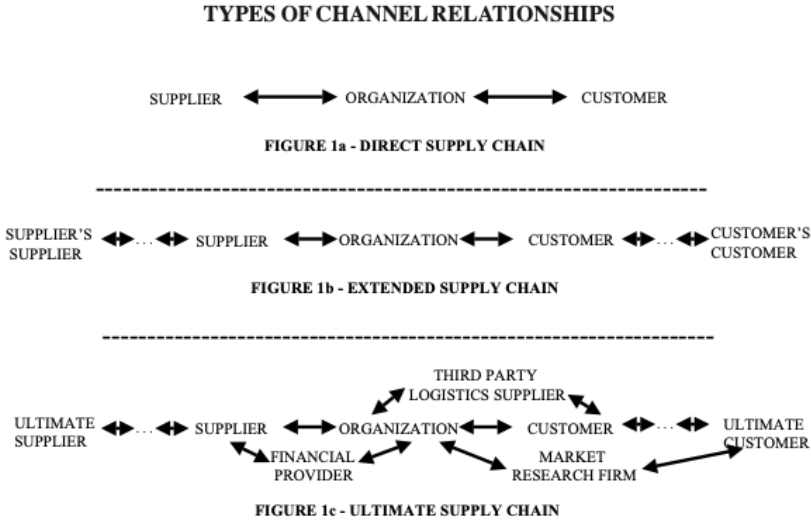


Figure 20. Degrees of supply chain (source: Mentzer et al., 2001)

Since they are strongly associated to trade relations between different countries, supply chains are not static. As claimed by MacCarthy et al. (2016), they can adapt and change in

³⁴ Excerpt from Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining supply chain management. *Journal of Business logistics*, 22(2), 1-25.

terms of size, shape and configuration, and in how they are coordinated, controlled and managed. New supply chains may emerge for a variety reasons, and others may also deteriorate and disappear when demand is no longer sufficient to drive the chain.³⁵

There are different factors that affect the development of supply chains. The most significant are economic and technology drivers, that call for an ongoing adjustment and modernization according to the current situation (global sourcing strategies, for instance). However, there are also other elements, such as sustainability issues, political factors and natural reasons (e.g. natural disasters) that can influence the structure and configuration of supply chains, and the COVID-19 pandemic is a clear example.

The increasingly intricate nature of existing supply chains leads companies to be exposed to greater risk situations, especially with reference to their extended or ultimate supply chains. They are becoming more dynamic and are coordinated by a complex network of different partners (even from the other side of the world), hence being difficult to manage.

2.2. Supply Chain Risk

There is a wide variety of risks firms face when dealing with their partners in international supply chains. The new pace of life characterized by IT³⁶ has made product lifecycles shorter, and in many sectors rapid obsolescence has become the new normal. Business processes have become less strictly defined and more automated, and without accurate monitoring and management, minor problems and risks can easily escalate. Not only has increased outsourcing and global sourcing made companies more dependent on third parties, thus increasing the number of nodes and the complexity of the networks, but it has also made it more difficult to detect, respond to and mitigate risk events on time.

³⁵ Source: MacCarthy, B. L., Blome, C., Olhager, J., Srai, J. S., & Zhao, X. (2016). Supply chain evolution—theory, concepts and science. *International Journal of Operations & Production Management*.

³⁶ Information Technology

According to Qazi and Gaudenzi (2016) publication, Jüttner et al. (2003) defines supply chain risk as a “variation in the distribution of possible supply chain outcomes, their likelihood, and their subjective value”. Zsidisin (2003a, 2003b) defines supply risk as “the potential occurrence of an incident associated with inbound supply from individual supplier failures or the supply market, in which its outcomes result in the inability of the purchasing firm to meet customer demand or cause threats to customer life and safety”.³⁷

Lastly, the Supply Chain Risk Leadership Council³⁸ (2011) defines supply-chain risk as the likelihood and consequence of events at any point in the end-to-end supply chain, from sources of raw materials to end use of customers.³⁹

Handfield (Handfield et al., 2011) assumes that supply chain risk is characterized by both the probability of an event and its severity given that an event occurs. Such risks are difficult to detect and manage, since their complex interactions with all the companies’ business processes make them hard to characterize properly, also due to the lack of well-defined tools and techniques for supply chain risk management. They can arise anywhere in the supply chain and can affect and are affected by all the activities and partners in the supply chain.

Supply chain risks can cause a lot of problems and sudden changes in business operations due to disruptions and delays. A disruption is defined as a major breakdown in production or distribution nodes that impacts other nodes in the supply chain.⁴⁰ Bradley (2014) asserts that supply chain disruptions interrupt the flow of goods, causing delays for customers and lost

³⁷ Source: Qazi, A., & Gaudenzi, B. (2016). Supply chain risk management: creating an agenda for future research. *International Journal of Supply Chain and Operations Resilience*, 2(1), 12-50, pg 14.

³⁸ The SCRLC is a cross-industry organization including world-class manufacturing and services supply-chain organizations and academic institutions that work together to develop and share best practices in supply-chain risk management. Its mission is to create supply-chain risk management standards, processes, capabilities, and metrics that reflect current best practices and can be widely adopted.

³⁹ Source: Council, S. C. R. L. (2011). Supply chain risk management: A compilation of best practices. *Unpublished document*.

⁴⁰ Source: Handfield, R., & McCormack, K. P. (Eds.). (2007). *Supply chain risk management: minimizing disruptions in global sourcing*. CRC press.

revenue for companies whose supply chains are disrupted. Disruptions can be minor in nature, such as those arising from machine breakdowns, or late deliveries; or they can be major in nature, such as from plant fires or tsunamis that level buildings and destroy infrastructure.⁴¹ They can be both frequent or infrequent (depending also on their seriousness) and short or long term (catastrophic events are rarer but can disrupt supply chains for extended periods). According to experts, supply chain disruptions have become more common, probably as a result of firms' increasingly global supply chains, which expose them to risks all around the world. Indeed, the propensity to outsource processes to global suppliers and the multiple hand-offs in these international supply chains increase the probability of such interruptions, that from a simple bottleneck in one of the nodes, can result in an entire network shutdown. Furthermore, consequences to these situations not only have a direct impact on performances and revenue of the single company, but they indirectly also affect the firm's trading partners (both in demand and supply side), since the interconnection of the supply chain has a ripple effect on the entire ecosystem.

Consequently, it is necessary for companies to develop strategies in order to assess and mitigate risks in their supply chains. However, even if firms are aware of the threat of such disruptions to their performances and revenue stream, such strategies are not yet well-defined and properly developed, and most of the times companies try to manage them with an ad hoc approach.

Since they can cause severe consequences, supply chain risks need to be analyzed and managed in an integrated fashion. This is because examining risk factors in isolation makes it hard to comprehend their connections. Failing to understand the situation comprehensively can bring to increased costs for risk management (since companies may unnecessarily hedge certain risks which are actually offset by others), and failure in detecting important risks in the

⁴¹ Source: Bradley, J. R. (2014). An improved method for managing catastrophic supply chain disruptions. *Business Horizons*, 57(4), 483-495.

network, as well as in estimating the company's risk exposure⁴². Even for well-known risks, it needs to be considered the overall impact on the organization and on the entire supply chain, otherwise mitigation attempts may only shift the risks to other parts of the organization, or even introduce new risks.

Therefore, it is important to develop a supply chain risk management strategy in order to assess, mitigate and even anticipate risks and disruption along the supply chain network.

2.3. Supply Chain Risk Management

Handfield (2007) defines Supply Chain Risk Management (SCRM) as the integration and management of organizations within a supply chain to minimize risk and reduce the likelihood of disruptions through cooperative organizational relationships, effective business processes, and high level of information sharing. Likewise, the Supply Chain Risk Leadership Council (2011) defines supply-chain risk management as the coordination of activities to direct and control an enterprise's end-to-end supply chain with regard to supply-chain risks.

Successful risk management practices can play a significant role in improving companies' performance from the moment a new product is conceived to its end use. There are two major trends that provide new opportunities for companies to manage risks in their supply chains. The first is financial innovation. Nowadays, firms have the possibility to use new financial products that enable them to face particular risks (such as sensitivity to weather changes, energy costs); financial markets have also developed new methods to transfer and repackage risks to be resold to different investors; finally, increase of auctions and spot markets makes it possible to diversify the risks. Besides, it is worth mentioning that e-commerce offers greater price transparency for product in the marketplaces, and this enables companies to easily determine a broad set of risk factors. The second major element is the improved access to companies' information. The development of software packages to support and manage

⁴² Risk exposure is a quantitative assessment of how vulnerable the business could be to various sources of business risk. (source: Gan Integrity. *Compliance Glossary – Risk Exposure*. Extracted from www.ganintegrity.com/compliance-glossary/risk-exposure)

business processes allows firms to easily collect transparent and standardized data. Such systems are becoming increasingly integrated, both within companies' departments and between supply chain partners.

However, whilst companies have greater opportunities and possibility to develop SCRM plans to manage risks, just a few of them consider these practices as a necessary part of their business plan.

Supply chain risk management should be an integral part of management and decision-making and should be incorporated into the structure, operations and processes of the organizations. Obviously, approaches for identifying, evaluating, treating, and monitoring supply chain risk will differ across individual companies depending on their industry, the nature of their extended supply chains, and their tolerance for risk (risk appetite)⁴³. However, risk management strategies are generally based on ISO 31000⁴⁴ and include risk identification, risk assessment (prioritization) and risk treatment (mitigation).

⁴³ According to ISO Guide 73:2009, risk appetite is the amount and type of risk that an organization is willing to pursue or retain.

⁴⁴ ISO 31000 is a family of standards relating to risk management codified by the International Organization for Standardization. ISO 31000:2018 provides principles and generic guidelines on managing risks faced by organizations. ISO 31000 seeks to provide a universally recognized paradigm for practitioners and companies employing risk management processes to replace the myriad of existing standards, methodologies and paradigms that differed between industries, subject matters and regions. (source: Wikipedia)

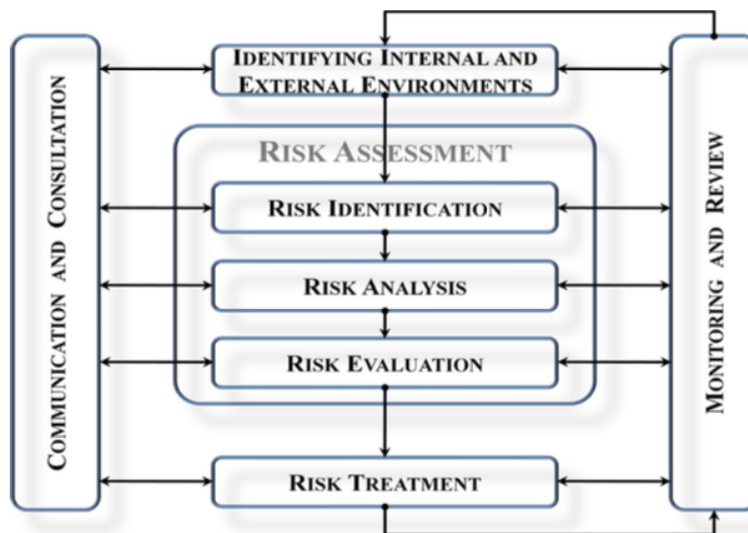


Figure 21. Risk management process (source: Council, S. C. R. L., 2011)

2.3.1 Identify internal and external environment

The identification of the internal and external environments is the first part of the process. It is common that companies tend to concentrate on internal risks, such as inadequate policies, failing strategies or organizational structures, or employees' noncomplying behavior, which are easier to detect and manage. Nonetheless, the external environment in which a firm and its network operate needs to be taken into consideration, because it will also present different risks, which may be more difficult to assess and mitigate properly. Such threats comprehend for instance meteorological risks of suppliers, transportation risks etc. Risks exist at different levels and entities within a company and its supply chain, and firms need to be able to identify and manage them at each level they exist, in order to tailor the most suitable risk-reduction strategy to their own network.

The presence of differing risks highlights the importance of defining the context within which the risk-management program will be implemented, and this includes all the entities taking part in the development of the supply chain, such as suppliers, manufacturing, logistics, distribution and customers (these elements vary by industry).

As reported by Handfield (2007), it is desirable that the process begins by mapping the structure of the supply chain, in order to identify the risks present at each critical node. It is

necessary to screen the different potential points that are most likely to become critical along the network, considering both the probability of the risky event to occur and its severity.

Since nowadays companies' relations are characterized by international sourcing, the number of nodes in a network has increased, thus amplifying the risk of the network as a whole. Therefore, it is necessary to identify such points that are at the highest risk for disruptions. In order to do that, it is important to consider some elements (regarded as "amplifiers"), which can increase the probability of such disruptive events. All these amplifiers fall into two categories: global sourcing and constrained dependencies.

Global sourcing

Nowadays, the reliance of company on global sources of supply is greatly increasing, mainly due to the low-cost nature of several countries such as China, India, Eastern Europe etc. Whilst the decision to source globally is mainly based on the guarantee to have lower costs, it often underestimates the potential amplification of risk that occurs when these channels are developed. Risk nodes include supplier plants or instability of supplier environment, inbound transportation, customs regulations, port operations, length of lead-time and others factors that may become critical for a ripple effect to occur.

<i>The probability of supply chain disruptions is increased when any of the following parameters increases in a given supply chain:</i>
Instability of supplier's environment
Number of brokers
Length of lead-time
Concentration or clustering of suppliers
Scarcity of qualified labor
Instability of workforce
Degree of customs regulations
Level of specialization of storage requirements
Level of security requirements
Level of demand for product (volume and variability)
Level of legislative actions related to importing/exporting
Poor communication
Level of regional/country political instability
Number of transfer points
Lack of vessel capacity and channel overload
Strain on port infrastructure
Potential for terrorism
Level of natural disasters
Lack of visibility of entire system/supply chain

Figure 22. Global sourcing amplifiers of disruptions (source: Handfield et al., 2007)

Constrained dependencies

The number of constrained dependencies is related to the number of global sourcing nodes, but it refers also to other elements. There are several factors that drive the number of these dependencies, including: use of proprietary technology, limitation on the number of sources (when a product is sourced from a single supplier, and this experiences problems, the disruption is amplified), level of stringent quality requirements, the uniqueness of sourced parts and the lack of supplier manufacturing capacity and flexibility. If such elements characterizing constrained dependencies increase, the magnitude of the “domino effect” through the multiple nodes of the chain increases as well.

<i>The probability of supply chain disruptions is increased when any of the following parameters increases in a given supply chain:</i>
Use of proprietary technology
Limitations on the number of sources
Level of stringent quality requirements
Lack of supplier manufacturing capacity and flexibility
Level of uniqueness of sourced parts

Figure 23. Constrained dependencies (source: Handfield et al., 2007)

Starting from these assumptions, a key decision in developing the program is the scope of supply chain to include. Companies can either focus on tier 1 suppliers, and even prioritize among tier 1 suppliers, or can broaden the area to tier 2 partners. Generally, the scope comprehends all tier 1 suppliers and customers of the company. Subsequently, in determining how much of the supply chain to include beyond the first tier, companies can characterize inputs by the number of suppliers and number of customers. For instance, for products that require a large number of suppliers for their production it is not necessary to go beyond the first tier in considering supply chain risks (it would be very difficult to detect all the nodes and related risks); for materials with few or only one supplier, instead, it is better to consider risks among second-tier suppliers as well. Between these two extremes, companies need to evaluate the importance of each particular component or how easily a supplier can be replaced, and consider supply risks in tier 2 only for critical components or suppliers.

Afterwards, firms can proceed with the mapping of the supply chain process, so as to understand the potential risks that may occur as well as the entities involved. The Supply Chain Risk Leadership Council (2011) provides an example of a possible map (ref. Figure 5).

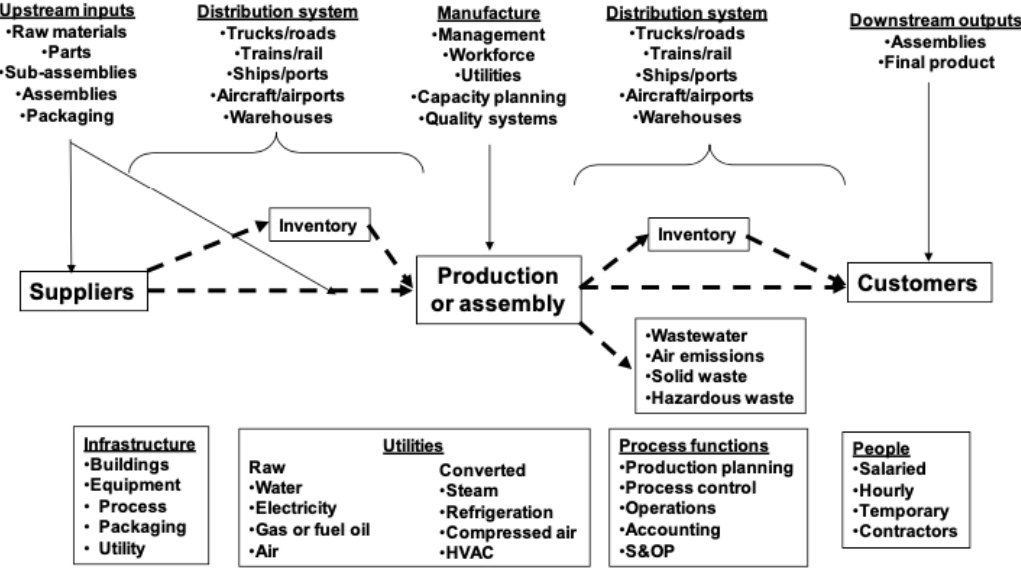


Figure 24. Notional Supply-Chain process flow (source: Council, S. C. R. L., 2011)

The upper part of the figure indicates the inputs (raw material, parts and assemblies) needed for the production of goods, as well as all the systems necessary to deliver the final product to the customers, such as the distribution systems (both for the components that go to the inventory of manufacturers, and for products that arrive to the customers), which include all the means of transport used.

In the lower section there are clusters in which possible sources of risks for each step are identified, including infrastructure, utilities, process functions and personnel. Not all these nodes will generate risks for all operations, but all of them should be taken into consideration to develop a comprehensive approach. Information flows should also be documented and reported, both upstream and downstream.

Companies should outline the supply chain elements for which they are directly responsible, and they should also expand the plan at least one tier up and down, considering direct partners (suppliers and customers) including transportation and information nodes.

With the aim of identifying sources of risk, companies can benefit from different criteria, including pareto analysis (also known as A-B-C analysis)⁴⁵ or portfolio analysis⁴⁶.

Once a firm understands how to recognize critical nodes and risks, it should undertake risk identification and assessment.

2.3.2 Risk identification

The purpose of risk identification is to find, recognize and describe risks that might help or prevent an organization achieving its objectives (ISO 31000:2018)

First of all, companies should develop an initial risk register in order to identify baseline risks. Risk identification process should therefore begin with a brainstorming session, collecting previous risk assessments, surveys and all other data useful to identify potential risks within supply chain processes.

There are different techniques an organization can use to find and categorize uncertainties; in any event, the following factors and the relationship between them should be taken into account:

- tangible and intangible sources of risks
- causes and events
- threats and opportunities
- vulnerabilities and capabilities
- changes in the internal and external context

⁴⁵ Pareto analysis refers to a criterion that enables firms to identify the proportion of goods and suppliers on which they are most dependent in terms of profitability or criticality, and hence the goods and suppliers that can pose the most risk to the supply chain (Source: Council, S. C. R. L., 2011)

⁴⁶ Portfolio analysis identifies goods by both their value and the vulnerability of supply, and lead firms to focus their SCRM plan first on strategic or critical goods of high value and high supply vulnerability. This may include scarce or high-value items, major assemblies or unique parts which may have natural scarcity, few suppliers and difficult specifications. (Source: Council, S. C. R. L., 2011)

- indicators of emerging risks
- the nature and the value of assets and resources
- consequences and their impact on objectives
- limitation of knowledge and reliability of information
- time-related factors
- biases, assumptions and beliefs of those involved.⁴⁷

An example for a preliminary assessment could be a business-impact analysis, which allows companies to consider the threats they might face and their related consequences. It starts with a presentation of a “worst-case” scenario, concentrating on the business processes that are most critical to recover and how they can be managed. This analysis identifies critical business functions and assigns a degree of importance to each function based on the operational and financial consequences. It also sets recovery-time objectives and the resources needed.

Another way to identify potential risk factors is through historical analysis. Companies can examine historical events to gain insights for future potential risks, by focusing on events that had negative outcomes. These are identified and then categorized by assessing the risk factors that triggered the event. From a supply chain point of view, such occurrences may include port shortages, sudden shifts in customers demand, production problems and quality difficulties. However, historical analysis presents some disadvantages. The first is that significant risk events happen infrequently. This drawback could be overcome by including also events affecting other companies with similar business characteristics. Another drawback is that this analysis assesses only risks which brought about difficulties in the past. This may lead to underestimating possible critical risks that may happen in the future, especially related to new technologies, business practices and dynamics which have never occurred before.

⁴⁷ ISO 31000:2018, Risk Identification

Once decided which assessment method to use, companies should draw up a list of possible threats. There are different categories of risks that firms can include. Firstly, companies should divide between common and uncommon risks.

Common risks are all day-to-day risks caused by the normal challenges of doing business and comprehend:

- customer demand changes
- unexpected transit delays
- problem at suppliers, which delay critically needed components
- theft
- production problems
- warehouse shortages that cause serious delays in customer shipments
- cyber security ⁴⁸

Uncommon risks are related to disruptions that are more difficult to detect and manage, because they have low frequency but high impact. These include epidemics, tsunamis, terrorism and other disasters, which usually cannot be predicted but should be taken into consideration by companies in order to draft a risk management process to mitigate and minimize the impact of such events. COVID-19 pandemic falls into this category of risks.

From this differentiation, firms can consider several categories of risks, according to their position along the supply chain and the industry in which they operate. The most common are:

- *external, end-to-end risks*: these include natural disasters, terrorism, war and labour unavailability, accidents, political uncertainty, market challenges and technological trends

⁴⁸ Source: Global Supply Chain Institute (2014). Managing risk in the global supply chain

- *supplier risks*: related to physical and regulatory risks, financial losses and premiums, upstream supply risks, production problems and management risks
- *distribution risks*: such as infrastructure and labor unavailability, lack of capacity, warehouse inadequacies, cargo damages or theft, long and multi-party pipelines
- *internal enterprise risks*: which can refer to operations, personnel, demand or financial uncertainty, planning failures, supplier relationship management, enterprise underperformance and others

In the appendix a complete framework of potential risk provided by the Supply Chain Risk Leadership Council (2011) is provided.

The Global Supply Chain Institute (2014) presented a ranking of risks referring to supply chains.



Figure 25. Supply Chain Risks ranking (source: Global Supply Chain Institute, 2014)

The survey data show that the first risk considered by surveyed companies is potential quality problems. This is connected to the fact that long global supply networks make it very difficult to recover from quality issues that may occur along the chain. This risk is mainly related to outsourcing and global sourcing, especially if companies rely on low-cost suppliers in order to save money for the production of their products. As mentioned before, such suppliers can be convenient in terms of costs for the firms, but on the other hand can lead to different

problems which are often underestimated and difficult to control, mainly due to the long distance between the two partners, and may cause a far more considerable loss to the company. If firms developed an appropriate SCRM plan, this problem could be avoided or at least mitigated by implementing quality controls in place.

The second kind of risk relates to the need of increased inventory due to a longer supply chain. This, too, is connected to distant sourcing and global supply chains. The extended network requires companies to keep at least 60 to 75 days of supply in additional inventory, thus leading to an additional burden on the company working capital and cash flow. However, as will be analyzed in the next chapter, inventory could also play a significant role as mitigator of other risks related to the supply chain, mainly due to pandemic situation.

Natural disasters represent the third risk perceived by companies. This is understandable if people consider the frequency and impact of recent disaster that happened around the world (such as the Japanese tsunami, or the Australian fire).

These are just examples of risks that can affect companies' life, both in the short and in the long term. In the next chapter risks and consequences related to recent COVID-19 pandemic will be thoroughly analyzed, with particular reference to their impact on supply chains and on companies' performance.

2.3.3 Risk assessment

Once identified all the potential risks, companies should deal with risk assessment. In other terms, they should prioritize risks according to some criteria.

With this process, companies should assess the likelihood of occurrence of these risky events and their potential consequences, and accordingly prioritize them for developing the right mitigation strategies. Firms can rank such events based on a qualitative overall risk level. Even if it is a simplistic approach, it is useful for the initial risk register, in order to quickly select those risks that require highest attention. Companies should understand that it is impossible to manage and solve all possible risks occurring along their network, therefore it is better to select those that are more likely to have the greatest impact on their performance.

There are several methods in order to prioritize risks. One of them is the Failure Mode and effect Analysis (FMEA), a method developed in 1940s that makes use of three measures to assess risk in product and processes: detection, probability, and impact. Since detection is a fundamental point for the assessment, analyses are usually conducted in advance, and are based on theoretical considerations. Several companies have applied this approach to identify high-priority risks along their networks. This method enables them to assess which risks need a mitigation plan and which are so unlikely to happen or have such a low impact that do not warrant the effort.

In any case, risks are usually prioritized by a two-dimensional matrix whereby the axes are related to probability and impact⁴⁹ of the event.

This is necessary in order understand the difference between the risk tolerance of the company (the acceptable risk level) and the actual risk level given by the assessment. If the likelihood and impact of the risk are higher than the risk tolerance, then companies should devise further and more appropriate risk treatments to reduce such level of risk. Handfield et al. (2007) assess the criticality of the potential disruptive event by multiplying its probability to its impact. This method is based on the prioritization of risk by nodes along the supply chain, and by adding the probability for the potential disruptions affecting each node. To properly assess it, events should be thoroughly and completely identified for each node, and probability should be sufficiently accurate.

From this framework (also called risk “frontier” graph⁵⁰), companies may consider some risks to be of such low probability or to have such limited impact that they do not require further consideration or prioritization. Those of greater likelihood and impact, instead, should be mitigated through various methods. Sheffi (2005) claims that “high-probability/low-impact

⁴⁹ There are several metrics companies can rely on to measure the impact of risks, these include lost revenue (Handfield et al., 2008; McCormack, 2008), operating cost (Tomlin, 2006), and duration of disruption (Zsidisin, Ellram, Carter, & Cavinato, 2004). However, estimating impact relies on specific knowledge about the supply chain in question.

⁵⁰ Source: Council, S. C. R. L. (2011). Supply chain risk management: A compilation of best practices.

events are part of the scope of daily management operations. . .[and] part of the cost of doing business” whereas “low-probability/high-impact events, on the other hand, call for planning and a response that is outside the realm of daily activity.” Such distinction could relate to normal (or common, as defined beforehand) risks and catastrophic risks (or uncommon).

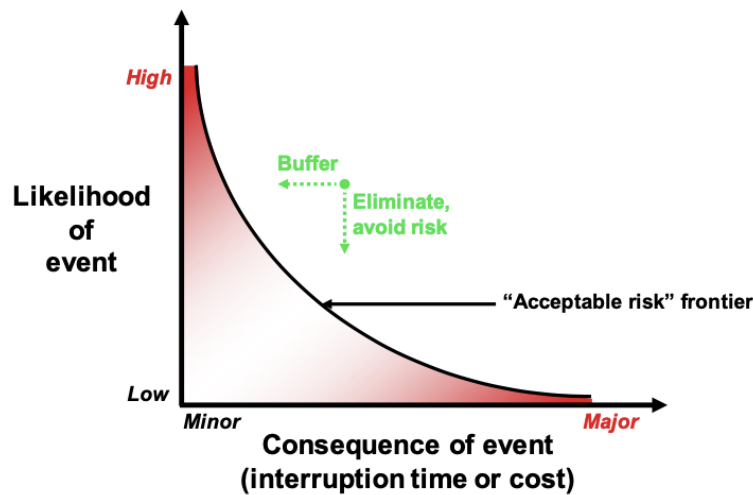


Figure 26. Risk "frontier" graph (source: Council, S. C. R. L., 2011)

Another way to measure risks according to their likelihood and consequence level is the “heat-map”. It is an easy method to detect and prioritize risks, but it needs to be related to well-defined criteria for the assessment of the probability and impact of the event.

	almost certain	Moderate	Major	Critical	Critical	Critical
	likely	Moderate	Major	Major	Critical	Critical
	possible	Moderate	Moderate	Major	Major	Critical
	unlikely	Minor	Moderate	Moderate	Major	Critical
	rare	Minor	Minor	Moderate	Moderate	Major
		insignificant	minor	moderate	major	critical
LIKELIHOOD						
		CONSEQUENCE				

Figure 27. "Heat" Map (source: Council, S. C. R. L., 2011)

2.3.4 Risk Treatment

Once risks identification and prioritization is completed, companies should develop a method in order to address and treat them. Risk treatment plans should be implemented in collaboration with the firm's partners (such as suppliers, carriers and logistics providers), and should comprehend measures to protect the supply chain from risks, plans to respond to events caused by such risks, and programs to continue the business operations while recovering. This step should also involve the measurement of the effectiveness of the plan, through a continuous monitoring and review process. This is necessary in order to assess if the current plan is suitable to respond to future risks and changes in conditions along the supply chain, or if it needs further modifications and improvement.

As an example, several current mitigation plans developed by companies were not able to properly safeguard the entity from risks and challenges brought about by the COVID-19 pandemic, because they did not comprise pandemic's related risks and disruptions (this is mainly because it is considered a rare event). In this situation, firms found themselves unprepared to face such challenges, and needed to implement new programs in order to assess and mitigate such risks appropriately.

Protecting and securing the supply chain

An effective program should guarantee that a company and its network develop the right measures to secure the flow goods and components from the starting point to the final destination, regardless the types of risk. Supply chain security and protection is essential, and includes basic standards for physical security (suppliers, carriers and logistics providers should have physical security methods to prevent unauthorized access to facilities and shipments), access controls, personnel security, education and training (companies should establish efficient security-training program to educate employees about security procedures), procedural security (with security manual and published policies), IT security, business partners security (by ensuring that any partner employs practices to guarantee the security of the shipment and is compliant with the security guidelines), and conveyance security (related

to transportation, these are procedures that suppliers and shippers should follow, including inspection and sealing of containers and storage)⁵¹.

These are basic procedures that companies need to implement in order to secure their supply chain. However, they obviously do not cover all the possible risks entities may face along their network. Therefore, it is necessary to develop the right mitigation strategies that will better contain the top risks assessed during the prioritization.

Responding to events with risk mitigation plans

Risk mitigation plans are implemented to reduce significantly either the probability of occurrence and/or the level of impact of the risky event. They should also involve early warning systems, in order to prevent or to catch events on time, which can in turn be managed more successfully with the right strategy.

The global supply chain institute (2014) drew up a list of elements that companies generally use in their plans, such as:

- insurance: even if it is not really considered by companies as mitigation approach, insurance can play a key role in minimizing the financial effects of both daily supply chain risks and catastrophic disruptions. Insurance companies can help firms find the best solutions (which are not necessarily costly) to avoid day-to-day problems that eventually result in losses, thus avoiding several disruptions. Based on an objective cost-benefit analysis, an approach is to calculate the “expected loss” for each major supply chain risk. This is determined by multiplying the cost of loss for the subjective probability of loss. Once assessed, the expected losses⁵² can be compared with the cost of insurance needed to cover them.

⁵¹ Source: Council, S. C. R. L. (2011). Supply chain risk management: A compilation of best practices.

⁵² The expected loss includes the product value, the customer and lost sales impacts, and the expediting costs to recover. (Source: Global Supply Chain Institute, 2014. Managing risk in the global supply chain)

- Inventory: this is the most often used approach to mitigate risks. Companies should calculate the amount of additional inventory needed to cover problems in the movement of goods, especially along global supply chains. It can be an efficient method to guarantee continuous supply of products during a disruption (in case of a pandemic such as COVID-19, increased inventory proved to be a “salvation” for preventing companies from breakdown). However, this approach also leads to disadvantages, such as the increased impact on working capital. Firms try to offset this drawback by extending payment terms using higher payables, or by decreasing the amount/time of receivables.
- Expedited shipping: in order to prevent higher losses, companies can opt for expedited shipments for part of their goods, mainly through airfreight.
- Competent partners: although it can be expensive, it turned out to be very useful to have a second (better domestic or at least nearer) source that can replace the first-choice supplier in case of disruptions. Therefore, companies should spend time and effort in searching a strong (also from the financial point of view) and competent partner to rely on.
- Supply chain event management (SCEM): this is implemented by the use of early warning systems along the supply chain. For instance, if a container of critical components faces a delay, the SCEM system sends an alert to allow such problem to be tackled and solved quickly.
- Contingency planning: companies should draw up a contingency plan for risks that are more likely to have a devastating impact. This may include explaining what would happen if a company lost a major supplier (for instance, because of COVID-19 pandemic, some companies lost key partners for bankruptcy), a factory or production plan, or a distribution channel.
- Forward buying or hedging: hedging is a way for companies to minimize or even exclude foreign exchange risk and the risk of commodity price increase (as it happened lately with the escalation of raw material cost)
- Supplier segmentation: this approach is based on the idea of segmenting suppliers by their total financial impact on the company, at least for the most critical ones.

These are just some of the practices that companies can implement to mitigate top risks in their supply chain. Obviously, they depend on the type of risks and on the industry in which

firms operate. Nonetheless, all the entities of the network should be considered and should participate in implementing such strategies.

Responding to risk events also involves crisis management. As defined by the Supply Chain Risk Leadership Council (2011), crises are events that threaten the organization, characterized by intense time pressure, high stress, and the need for rapid but careful decision making. They involve an impending abrupt or significant change that require urgent attention and action to protect life, assets, property, operations or income, the environment and reputation. Crises can be related to uncommon, catastrophic risks, and may include natural disasters, major fires, political unrest, security threats and pandemics. Crisis management⁵³ tactics are implemented to assess and respond effectively to such threats, which are more difficult to manage than day-to-day risks. They provide comprehensive planning and response activities at all levels inside an organization and enhance emergency response plans present at each unit and facility along the network. Crisis management connects activities that react to an emergency and those supporting the company's recovery⁵⁴ and resumption⁵⁵ of operations.

The general process of crisis management (shown in fig.9) starts by continuous monitoring of the supply chain for potential risks. If an event occurs, members of the crisis management team assess its consequences by gathering sufficient information, directly contacting the suppliers in the region affected or through direct feedback from suppliers, partners or customers, in order to find the best way to control such event and implement resolution tactics. Once the risk is contained and the company has defined the right approach to recover

⁵³ Crisis management activities comprehend preparation, response (risk assessment, critical incident planning, risk mitigation, emergency response and communication to stakeholders and media relations), recovery and business resumption, and finally testing, training and plan maintenance

⁵⁴ Recovery comprises all actions implemented to return the organization's processes and support functions to operational stability

⁵⁵ Resumption is about restarting defined business processes and operations to a predetermined level

its operations, it is necessary to carry out a detailed evaluation on the firm’s response to the event, to define possible improvements for the future.

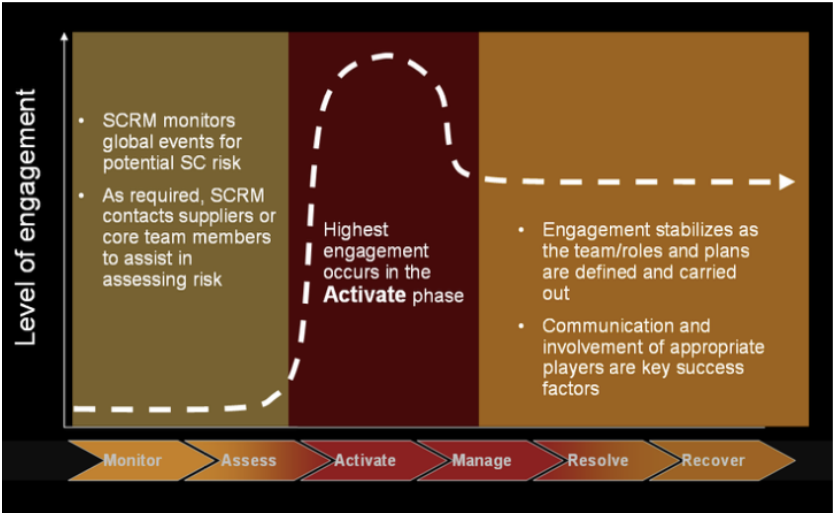


Figure 28. Crisis management activation process (source: Council, S. C. R. L., 2011)

Continuity of business operations

Companies should develop business continuity plans to mitigate, react and recover from supply chain disruptions, disasters and emergencies. Such plan has to be implemented prior to an incident and should be an ongoing process. An integrated plan should allow companies to respond effectively to an emergency, protect its employees, stakeholders, and assets, and restore the most important business activities on time (through the establishment of recovery priorities and validation of business recovery strategies). Business continuity planning may include employee assistance (with health-insurance programs for instance), business-impact analysis, emergency-response planning, crisis management planning, and business recovery planning (devised for each unit within the organization).

2.3.5 Risk Monitoring

Once a company has devised its supply chain risk management plan, it should establish a monitoring program as well, assessing procedures and tactics through periodic evaluation and review. The aim is to measure the effectiveness and consistency of the program and to implement procedures for continuous monitoring and improvement of tactics if needed. This is necessary in order to have a plan that fits with the current situation and is able to mitigate

the most critical events. If the program is not updated, it will prevent the company from allocating the right resources and recovering quickly from a risk situation.

Albeit no risk management plan can fully predict, mitigate or avoid all risks and their consequences, companies that proactively devise a SCRM program will be more prepared to face real risks and resilient to preserve their business continuity.

CHAPTER 3. COVID-19 IMPACT ON SUPPLY CHAINS

This chapter deals with the analysis of the epidemic risk, focusing on the propagation of COVID-19 and its effects on international supply chains.

3.1 The epidemic risk

As stated by Ivanov (Ivanov, 2020), supply chain risks comprehend epidemic outbreaks, which are specifically “*characterized by a long-term disruption existence, disruption propagations (the ripple effect), and high uncertainty*”.⁵⁶

Epidemics fall into the category of *uncommon risks* (as described in the previous chapter), that refer mainly to low-frequency but high-impact events, as opposed to *common or operational risks* which are related to day-to-day instabilities in supply chain operations.

Such uncommon risks usually have a very strong and abrupt impact on the supply chain and all its network of companies and partners, because, inter alia, they lead to temporary unavailability of some factories and plants, suppliers, and transportation and logistics links. These difficulties, combined with potential material shortages and delivery delays, spread along the whole SC and cause a ripple effect on its entities, partners and stakeholders in terms of revenue loss, lack of adequate service level, productivity and performance decrease.

Epidemic risks such as COVID-19 have the peculiarity of starting as small and concentrated events, but then scaling fast and propagating over many geographic areas. This is true if one considers that the Coronavirus outbreak came from a city in the Chinese Wuhan region, but easily spread across Europe and the US impacting imports and exports and the correct functioning of supply chains across the world.

⁵⁶ Ivanov, D. (2020). Predicting the impacts of epidemic outbreaks on global supply chains: A simulation-based analysis on the coronavirus outbreak (COVID-19/SARS-CoV-2) case. *Transportation Research Part E: Logistics and Transportation Review*, 136, 101922. Page 1

As anticipated earlier, such category of risks is characterized by three main elements:

- Long-term disruption existence and its unpredictable scaling
- Simultaneous disruption propagation in the supply chain and epidemic outbreak propagation in the population
- Simultaneous disruptions in supply, demand and logistics infrastructure.⁵⁷

These components, together with the nature of this epidemic, create a lot of unknowns and uncertainties which make it difficult for companies to determine the real impact on the supply chain and on their performance and to select the right measure in order to react and mitigate such effects.

In the following paragraphs the new COVID-19 pandemic will be analyzed from an economic and risk point of view, with particular focus on the problems it has brought about in supply and logistic along the supply chain and the related consequences on companies' operations.

3.2 COVID-19 and other disruptions

In his paper, Moritz (Moritz B., 2020) makes a comparison between COVID-19 and other disruptions in supply chains, taking into consideration seven dimensions: geography, scope, demand vs. supply, prior planning and experience, financial system, term, and human impact and behavior.⁵⁸

⁵⁷ Ivanov, D. (2020). Predicting the impacts of epidemic outbreaks on global supply chains: A simulation-based analysis on the coronavirus outbreak (COVID-19/SARS-CoV-2) case. *Transportation Research Part E: Logistics and Transportation Review*, 136, 101922.

⁵⁸ Moritz, B. (2020). Supply chain disruptions and COVID-19. *Supply Chain Management Review*, 27(3).

Dimension	Typical Disruptions	COVID-19
Geography	Most disruptions are local or regional	COVID-19 is widespread & global, impacting all regions
Scope	Limited scope: Fewer industries affected (i.e., a hurricane disrupts the petrochemical industry)	Widespread scope impacting both goods (like toilet paper) and services (haircuts, restaurant meals). Knock on closure of sporting events, cruise ships, schools/universities, etc.
Demand vs. Supply	Disruptions most often impact supply, sometimes demand	Impacts demand, and possibly supply
Prior Planning & Experience	Disaster planning has been done, and prior experience is available	Limited disaster planning for global pandemic, with limited prior experience (1918 Spanish Flu?)
Financial System	Low to moderate correlation with global financial system	High correlation with global financial system
Term	Short-term needs for emergency services (i.e., flood rescues)	Longer-term emergency service needs (i.e., hospital beds, ventilators)
Human Impact & Behavior	Localized human impact, with limited duration. Public fear is short-term, and most risks are visible (i.e., experiencing a tornado or earthquake) .	Widespread human impact, with unknown duration and unknown impact. Public fear is longer-term and risks are invisible / unknown.

Figure 29. Dimensions of supply chain Disruptions for COVID-19 (source: Supply Chain Management Review)

For what concerns geography, supply chain disruptions due to uncommon risks (such as natural disasters) are usually confined to a single region or country. This is the case of hurricanes, earthquakes, or tsunamis, which may have a strong impact on a specific area, but can be mitigated using the resources of the region affected or with the support of another region. However, COVID-19 has proven to be very different from these disruptions, because even though it started in a single region, it easily spread across all countries and impacted the entire world. There were no resources and countries that could help confine its effect and prevent a large-scale propagation.

Regarding its scope, no other disruption has ever affected so many sectors than COVID-19. They usually impacted only a few key industries, which could be quite easily restored after some months (depending on the scale of the impact). On the contrary, the novel coronavirus impacted both the goods and service industries, and affected nearly all the entities along supply chains regardless their sector. However, even if shortages of goods did not greatly affect demand, COVID-19 caused an important decrease in demand of services, which could not be stockpiled or manufactured as soon as the factories reopened. This comprises services of all kinds, such as sporting events, travels (cruises, air flights), shops, restaurants and hotels.

Still related to demand and supply, several SC disruptions affected supply, and this is also the case of COVID. However, contrary to other events, it is also having a strong impact on demand. An example can be the cancellation of international flights by major airlines and the reduction of their domestic capacity, which not only concerns the travel industry, but has also indirect consequences on the transportation of goods (this will be thoroughly analyzed later in the chapter). More remarkably, demand can also decrease even if the supply does not experience major disruptions (mainly because people may reduce their spending and consumption of non-necessary goods due to lower disposable income). Besides, in comparison to other disruptions in which the financial impact was relatively limited because there was low correlation with financial systems, the demand shock caused by this pandemic can result in a financial disruption as well, leading to global stock markets collapse and banks and governments difficulty in supporting the economy.

Additionally, disaster planning has been carried out for other disruptions, and mitigation plans have been developed thanks to experts' research, studies, and prior experience. However, in case of COVID-19, few entities were prepared to deal with such event, mainly because of little expertise on this field and lack of experience in case of global pandemic. One element that is worth considering is the fact that other epidemics, for example those affecting animals or plants, such as MCD (mad cow disease), have been successfully treated by limiting the areas affected and eliminating the infected entities to prevent large-scale propagation of the virus. This past experience could not be applied to COVID pandemic, mainly for two reasons: it is about humans, and it is not circumscribed to a single area. The fact that it was not possible to limit its impact in the first stages of its expansion is mainly due to the lack of experience and experts' knowledge to deal with such a global event.

Another difference is the long-term nature of this event. While the term for other disruptions could be easily predicted and quantifiable, and demand for emergency services was limited to a short period, the duration of COVID-19 is unknown and full of uncertainties, therefore the need for emergency services cannot be adequately assessed and limited to the short-term.

One last consideration is about its impact on the global economy. Being an increasingly interconnected and globalized world, a lot of countries rely on other nations' resources for the development and survival of their economies. In the last few decades, dependence on

China has greatly increased, and the country soon became one of the most important international suppliers of goods, especially intermediate goods which are fundamental for global production. Moreover, the PRC and the city of Wuhan play a crucial part in international shipments of manufactured goods, thanks to their multiple hubs and ports. The factories closures and the lockdowns imposed in the country have greatly affected the production of Chinese outputs, leading to a ripple effect on international supply chains. Among others, major consequences for countries (including Italy) comprehend: shortages of materials, critical parts and finished products, which cannot be easily procured from other sources; exponential increase in transport costs, mainly related to maritime container freights and air freights; delays in shipments and longer lead times, especially due to the lack of means of transport, hubs congestions and new export/import measures and restrictions issued by governments.

Figure 2 shows supply chain disruptions caused by COVID-19, due to China’s manufacturing and industrial sectors decrease. In February they fell to all-time lows.

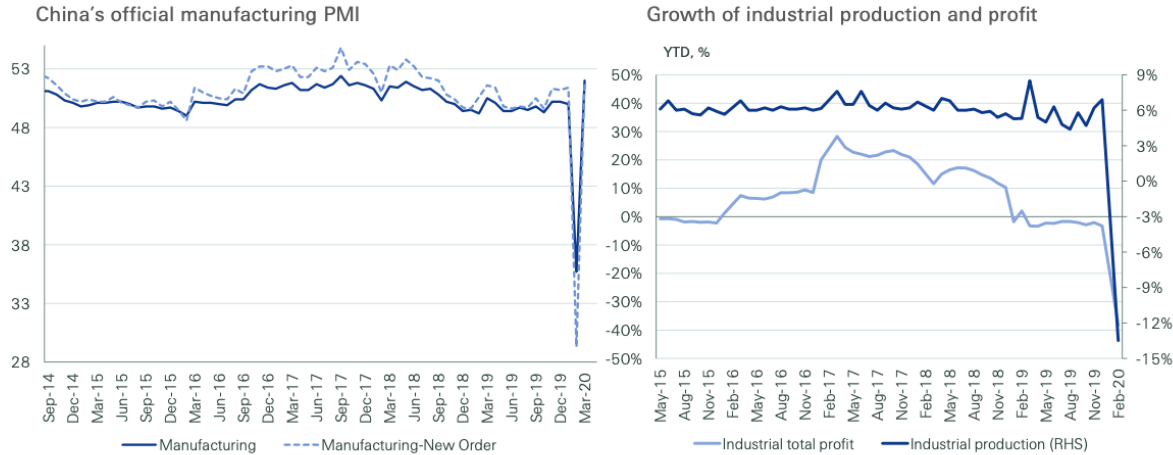


Figure 30. China's manufacturing and industrial sectors fall to record lows (source: Swiss Re Institute)

As already analyzed in the first chapter, the outbreak of COVID-19 and the consequent decrease in Chinese production led to a sharp decline in trade flows with major countries, in particular with Europe (Fig.3)

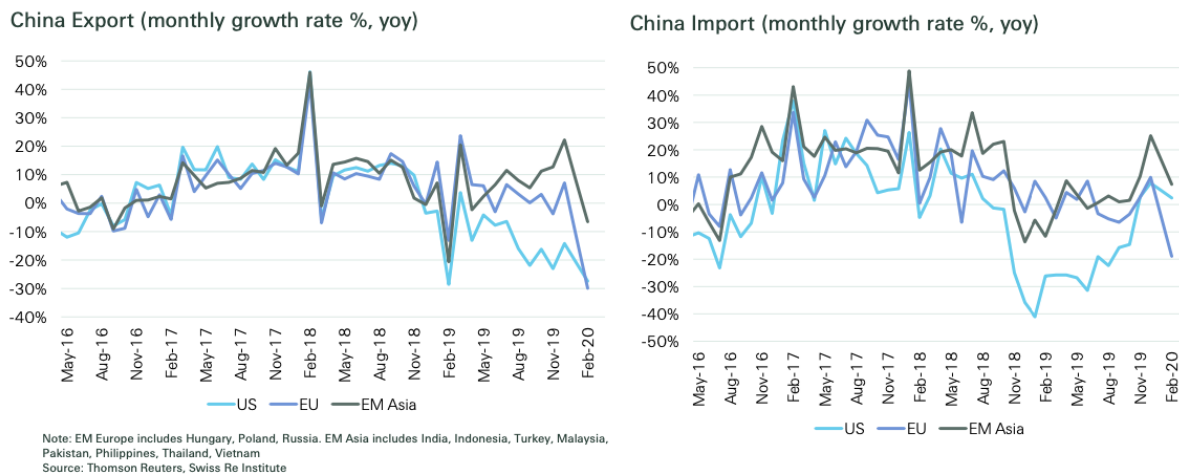


Figure 31. Decline in trade with major partners due to COVID-19 (source: Swiss Re Institute)

Setting aside the general economic situation brought about by COVID-19 and all its health and human implications, the following paragraphs concentrate on logistics and transports, and investigate major problems that companies operating in international supply chains have encountered during the pandemic, with particular reference to maritime transport, air transport and cost of raw materials.

3.3 Maritime transport

90% of international trade takes place by sea, and maritime transport has become the most important and reliable service for the import and export of goods, both intermediate and finished products.

During the last few decades, maritime transport did not represent a balanced sector, since the global transport of goods was mainly carried out by three top carriers: Maersk, MSC and Cosco, which alone detain 45,3% of the merchant fleet. These carriers are divided into three main global alliances, which manage nearly the whole global market of containers' sea transport:

- 2M, made up by MSC and Maersk
- Ocean Alliance, which gather together five major shipping companies: CMA, CGM, Cosco, APL, OOCL, Evergreen
- The Alliance, composed by HAPAG LLOYD, UASC, NYK, K LINE, MOL and YML.

Due to these alliances, the market situation does not allow free competition, because it is characterized by oligopoly, in which such companies have an unrivalled powerful position and are able to set prices at their own conditions.

This pandemic is having a significant impact on transport and logistics, and transport and travel costs have been clearly affected. It is worth considering that, from a business point of view, transport and travel costs represent an important percentage of trade costs, and account for 15-31% depending on the sector. For example, for manufacturing trade they account for 31% (the highest rate), but they constitute an important percentage also for distribution services (retail and wholesale), with a 19% of total trade costs.⁵⁹

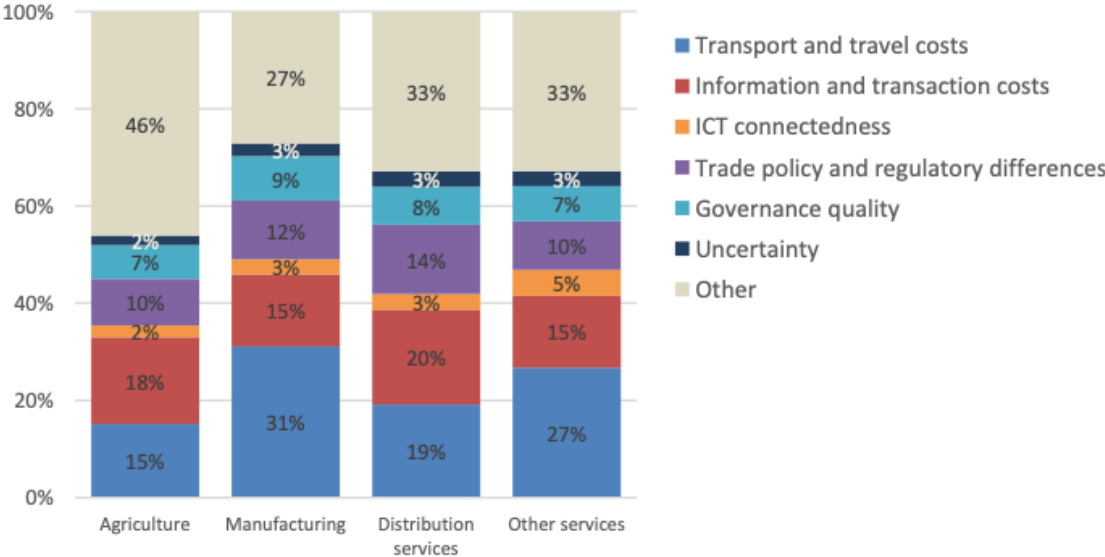


Figure 32. Determinants of trade costs (source: World Trade Organization)

COVID-19 and all the related measures to contain it, such as travel restrictions and border closures, have directly affected trade in goods, and maritime transport is one of the hardest hit sectors, with increased costs as a major consequence.

⁵⁹ World Trade Organization. TRADE COSTS IN THE TIME OF GLOBAL PANDEMIC. INFORMATION NOTE. 12 August 2020

From an interview with an expert in the logistics and transport sector⁶⁰, it has emerged that there are several factors that led to the exponential increase of maritime transport costs, and are all related to these main issues:

- Scarce obtainability of containers
- Decreased container and cargo capacity on the ship
- Reservation problems
- Longer lead time and frequent delays
- Port issues.

An important consequence that results from this pandemic is the change in the conception of the transport itself. In other words, the chartering of containers can no longer be seen as a service provided by companies, but it must be considered in the same way as raw materials, with its price that is subject to fluctuations in demand and supply.

At the outbreak of COVID, the relationship between supply and demand was unbalanced, since most of the companies stopped their production and shut down in response to lockdowns. Due to a sudden decrease in international trade and logistics disruptions along the supply chains, shipping companies decided to reduce and adapt their supply to the current weak demand, thus reducing and withdrawing some ships from the market. They began to phase out and deactivate the oldest vessels in order to renovate or even dismantle them and concentrated the volume of goods on the remained container ships, cancelling (blank sailing) or interrupting the services and blocking new orders for the purchase of new vessels.⁶¹

⁶⁰ The interview was carried out in June 2021. The interviewee is the Chairman and Ceo of Fischer & Rechsteiner Company, international freight forwarders specialized in maritime and air transport.

⁶¹ Adapted from: CONFINDUSTRIA, AREA COESIONE TERRITORIALE E INFRASTRUTTURE. DINAMICHE DEI PREZZI DEI TRASPORTI MERCI VIA CONTAINER (*estratto dalla nota per il CO.PRE. e il CO.GE. del 24-3-2021 con ultimi aggiornamenti*)

By reducing the supply of cargo, they were convinced that the remained vessels would have travelled at full capacity and would be profitable, thus allowing freight rates to remain strong.

However, during the second and third quarter of 2020, demand for containers abruptly increased due to a first economic recovery, mainly in China and US. This led to several difficulties in logistics, given that even if containers were available, there was no space on the vessels for their shipping. This problem has not been solved yet, and it is likely to extend up to 2023-2024, because new spaces will not be available in the short term.

In addition, a further problem arises even for available ships, and it is related to their capacity. An expert in the logistic sector has made a comparison between the situation before and after the outbreak of the pandemic.

Concerning the containers' capacity, he claimed that prior to COVID (year 2019) the most used containers for maritime transport were 40' containers, which usually travelled at full capacity, or at least with 85% efficiency. Such containers were filled in the containers freight stations (C.F.S), which are big warehouses where containers are opened and filled in with the goods for their transport (They could carry goods from different loaders). The C.F.S. employed a lot of staff to be fully operational, with at least 3 shifts of 20 people 24-7. Moreover, the loading clause applied for containers was LCL, *Less than Container Loaded*, where goods were packaged in shared containers and these had more than one loader. This implied a reduced tariff, because a 40' container, for instance, was filled by six companies with the same destination, therefore the cost was shared between several loaders. Another factor which is important to take into consideration is that under these circumstances, the use of cranes at ports was reduced to the minimum, because containers were mainly of 40' and could be loaded with a single movement of the crane.

With COVID there is almost the opposite situation. The most used containers for maritime transport have become those of 20', which do not travel at full capacity, but just with an average yield of 35% (half empty). This leads to the need for more containers and consequently to the need for more vessels in order to transport them (storage criteria have changed consequently). The number of container yards has increased as well, (one loader has one container) because they became full of empty 40' containers which are no longer used.

Another problem is that in the C.F.S the personnel was temporarily laid off because containers were no longer filled in the container freight station, but each one was directly filled at the loader's facility, and then emptied by a single receiver. The loading clause was no longer LCL, but it became F.C.L, *Full Container Loaded*, with containers loaded and emptied directly at the company's facility in order to prevent repeated disinfections (which are required at each opening). At the same time, the use of cranes for the loading and unloading increased exponentially, because if in the past their use was minimized thanks to the employment of less 40' containers but with 85% capacity, now the same volume of cargo is contained in three 20' containers (smaller and lighter), therefore cranes need to move more of them. This brings to another significant consequence, which is the increase of the loading and unloading time at ports (this matter will be discussed later in this chapter).⁶²

This situation led to higher demand for containers, which have become very difficult to find, and consequently to an increase in their prices.

Another factor that adds to their unavailability dates back to the period before the pandemic (late 2019) but was largely affected by it, and refers to US-China trade relations. In October 2019, The US President Trump decided to introduce higher import tariffs on products made in China in order to reduce the volume of US imports. This situation brought companies to search for more space and containers as possible to stock up on Chinese goods prior to the implementation of such policies. Therefore, during the last months of 2019, a lot of containers full of Chinese products arrived in the US, but with the outbreak of the pandemic and the consequent closure of factories they remained stuck at US major ports causing strong port congestion, because no operators were present to unload them (due to lockdowns). Additionally, even if, after long waiting times, containers managed to be loaded on trains or trucks to be delivered to companies, they eventually remained unused because firms were closed. Thereby, their organic cycle, which has always permitted their continuous circulation, failed to function correctly, and this led to an excess and overcapacity of empty containers in

⁶² Content taken and adapted from the Youtube video *Logistica dei trasporti – Effetti della pandemia sul traffico dei containers* (www.youtube.com/watch?v=Zt6DKz2tzuQ)

the US which could not be easily returned without any cargo, thus bringing about an increase in their prices. The same situation happened also in Europe, in which empty containers were blocked due to countries' restrictions and lockdowns.

All of this was happening when the Chinese economy started to recover and most of the companies reopened. Chinese firms found themselves short of containers, also due to their uneven trade balance, since they export 3 containers for every one imported⁶³. As western demand for Chinese goods increased in the second half of 2020, competition between shippers for available containers has led to a significant increase in transport costs, thus creating what experts defined as a *Mafia of prices*⁶⁴. Chinese companies were willing to pay any price to secure a passage for their goods, therefore some private Chinese firms began to store containers which were made available to the highest purchaser. As a result, suppliers needed to pay extra to find containers from private yards.

As an attempt to solve the problem, Chinese manufacturers have increased containers production, reaching 440.000 units per month in January 2021⁶⁵ in order to keep up with demand, but they are still not sufficient and increasing shortages of raw materials are now slowing down the production.

European companies are experiencing an additional problem related to their shortage. Aware of the current situation, shipping companies decided to send empty containers (stuck in the US or Europe) to China in order to fill them with goods and then export them to Western countries, because it turned out to be more profitable for them, since Chinese companies

⁶³ Source: Reuters. *Boxed out: China's exports pinched by global run on shipping containers*, December 10 2020 (<https://www.reuters.com/article/us-global-shipping-container-idUSKBN28K0UA>)

⁶⁴ Ref. Previous Note

⁶⁵ CONFINDUSTRIA, AREA COESIONE TERRITORIALE E INFRASTRUTTURE. DINAMICHE DEI PREZZI DEI TRASPORTI MERCI VIA CONTAINER (estratto dalla nota per il CO.PRE. e il CO.GE. del 24-3-2021 con ultimi aggiornamenti)

were willing to pay whichever price to buy them. There are two main reasons for this phenomenon:

- Shipping empty containers from one port to another reduces the lead time, since there are no delays caused by the loading and unloading of cargo and by all the necessary controls and inspections (disinfection, quarantine, etc.)
- Freight rates from the Far East to the Pacific are even higher than those between Asia and Europe, therefore it is more convenient to ship empty containers ready to be filled in China.

All these factors contributed to the increase of ocean freight rates, which are recorded to be seven times higher compared to 2019 with respect to Asia-Europe routes. Data obtained by Freightos Baltic Index (FBX)⁶⁶ show that:

The current Global Container Freight Index is \$6,505 (data of 16 July 2021), compared to \$1,779 in July 2020 and to \$1,342 in July 2019.

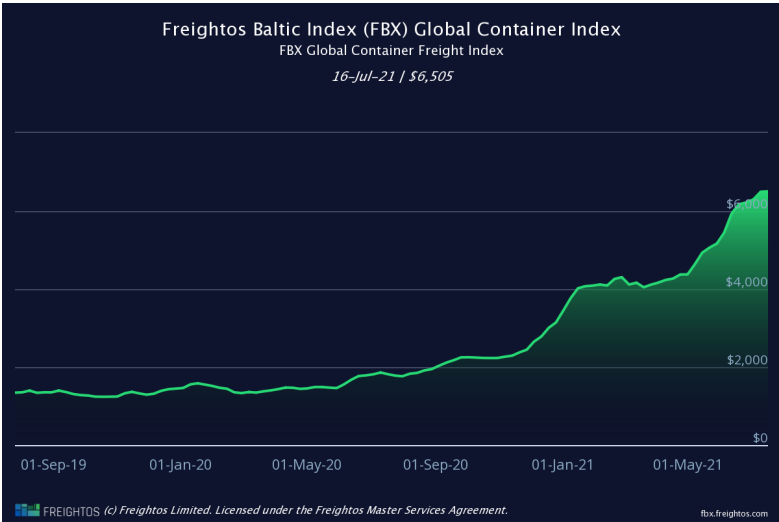


Figure 33. FBX Global Container Index (source: Freightos)

⁶⁶ The Freightos Baltic Index is the leading international Freight Rate Index, in cooperation with the Baltic Exchange, providing market rates for 40' containers (FEUs)

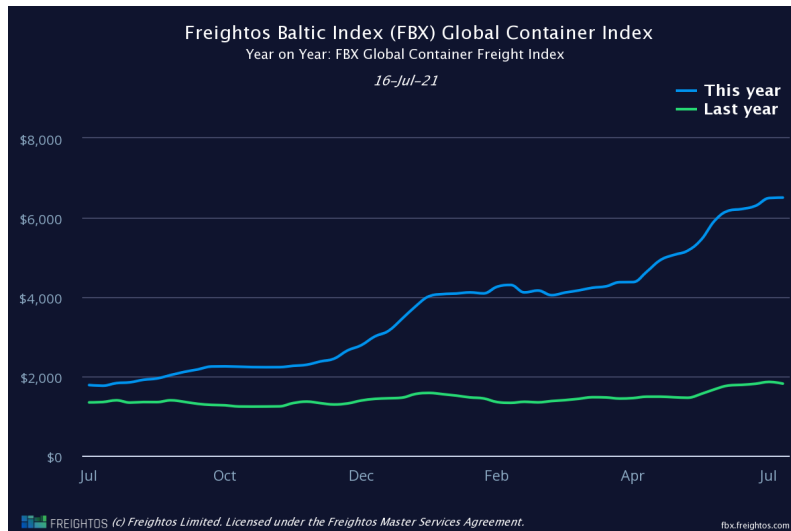


Figure 34. FBX Global Container Index Year on Year (source: Freightos)

China/East Asia to North Europe (Suez) route records a freight rate of \$13,188 (16 July 2021), with a pricing range that goes from a minimum of \$ 11,799 to a maximum of \$18,108. It is ten times higher compared to \$1,679 of the previous year and to \$1,326 of 2019.

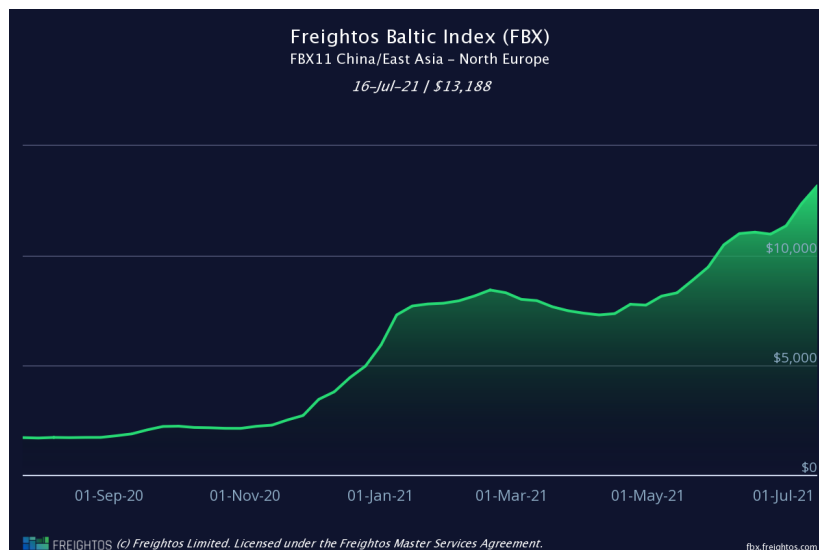


Figure 35. FBX China/East Asia - North Europe (source: Freightos)

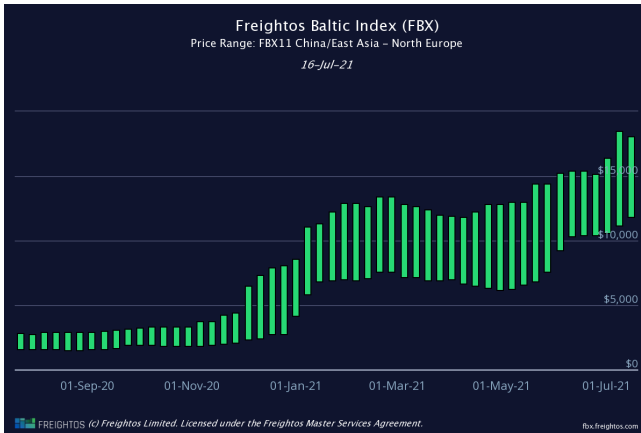


Figure 36.1 - 36.2. FBX China/East Asia - North Europe Pricing Range (source: Freightos)

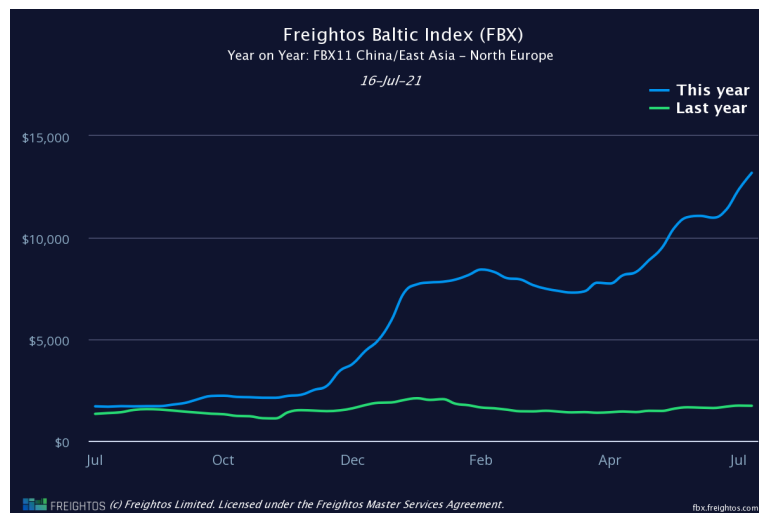


Figure 37. FBX China/East Asia - North Europe Year on Year (source: Freightos)

China/East Asia to Mediterranean (Suez) index is \$11,924 (data of 16 July 2021), compared to \$ 1,789 of the same period in 2020 and to \$1,497 of 2019. Its current pricing range is between \$11,171 and \$ 15,580.

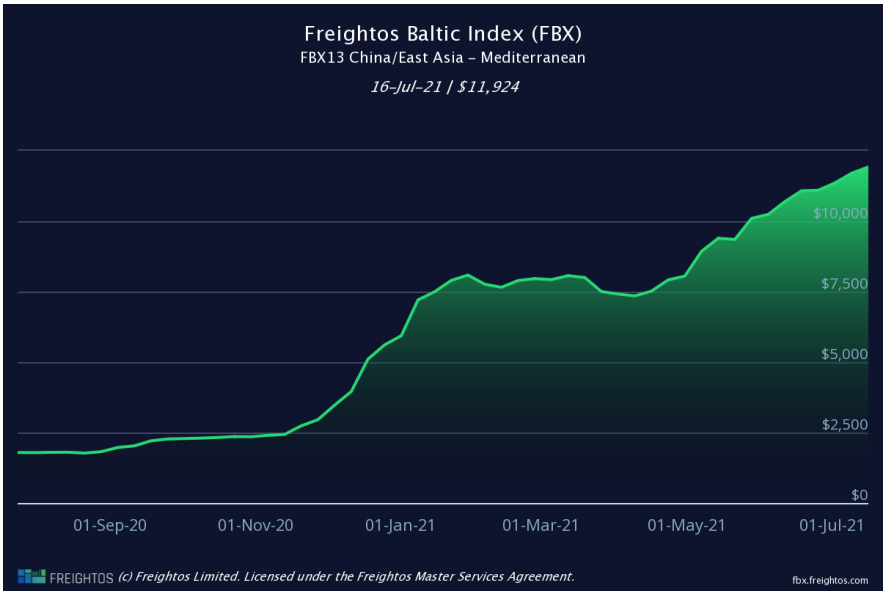


Figure 38. FBX China/East Asia - Mediterranean (source: Freightos)

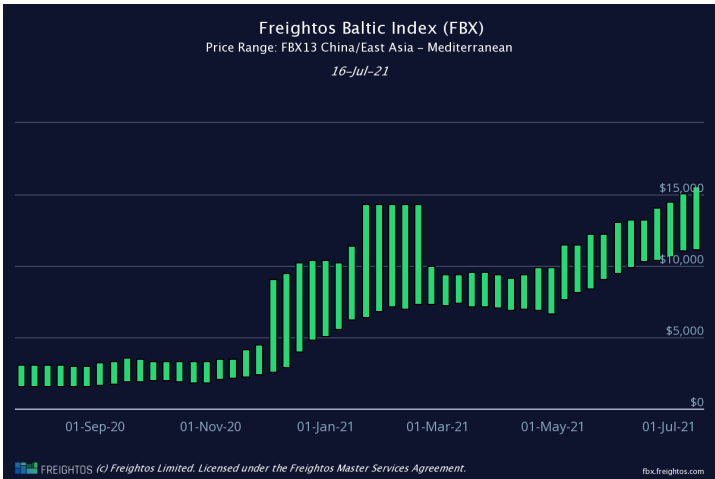


Figure 39.1 - 39.2. FBX China/East Asia - Mediterranean Pricing Range (source: Freightos)

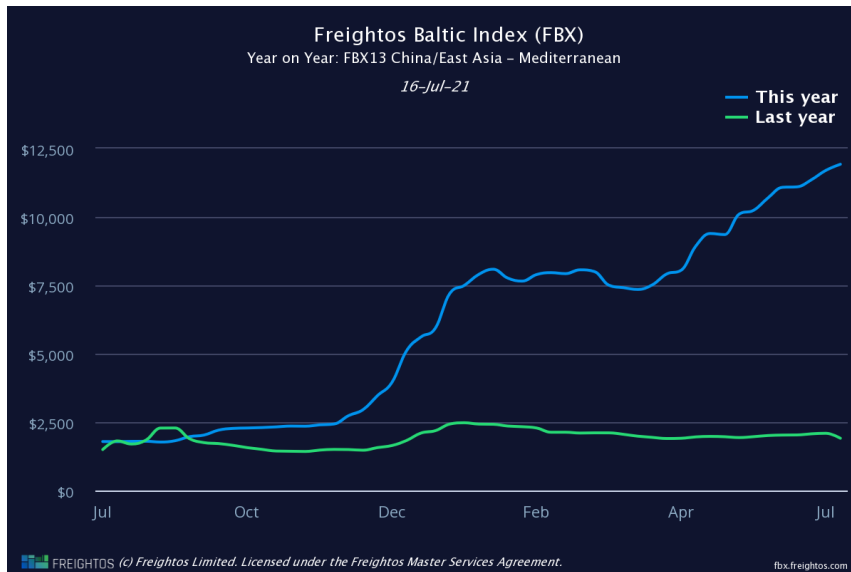


Figure 40. FBX China/East Asia - Mediterranean Year on Year (source: Freightos)

For what concerns the Pacific route, from China/East Asia to North America West coast the price index on 16th July 2021 is \$ 5,841, compared to \$ 2,711 of 2020 and \$ 1,512 of 2019. What is worth considering is the pricing range, that fluctuates between a minimum of \$4,826 to a maximum of \$18,430, with a very wide gap (in June it reached the highest rate of \$ 22,791).

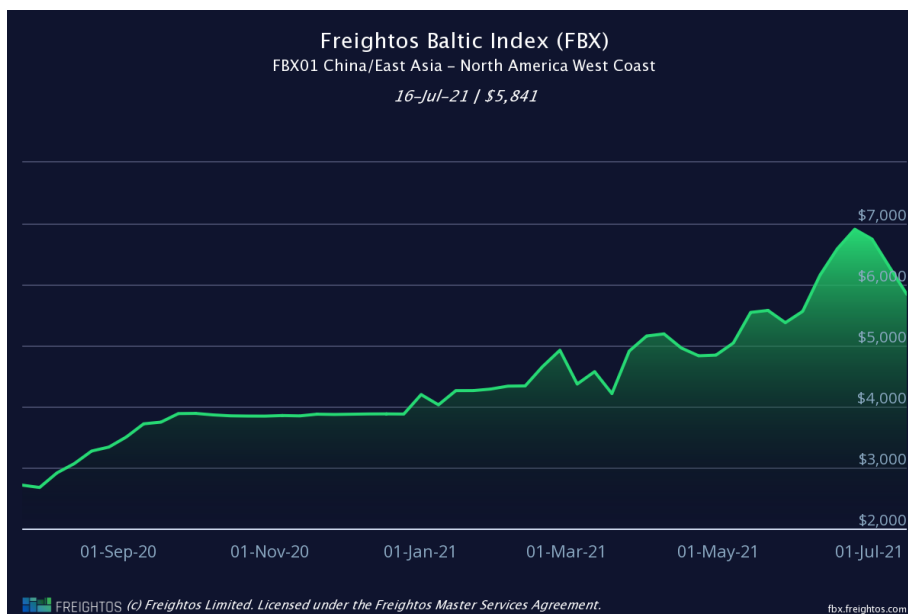


Figure 41. FBX China/East Asia to North America West Coast (source: Freightos)

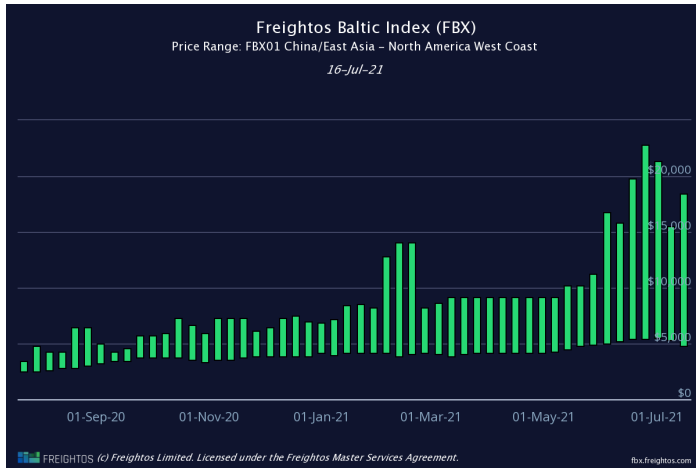


Figure 42.1 - 42.2. FBX China/East Asia to North America West Coast Pricing Range (source: Freightos)

The China/East Asia to North America East coast route registered a rate of \$ 9,816, compared to \$ 3,232 of last year and \$ 2,932 of 2019, with a pricing range between \$ 6,426 and \$ 18,664.

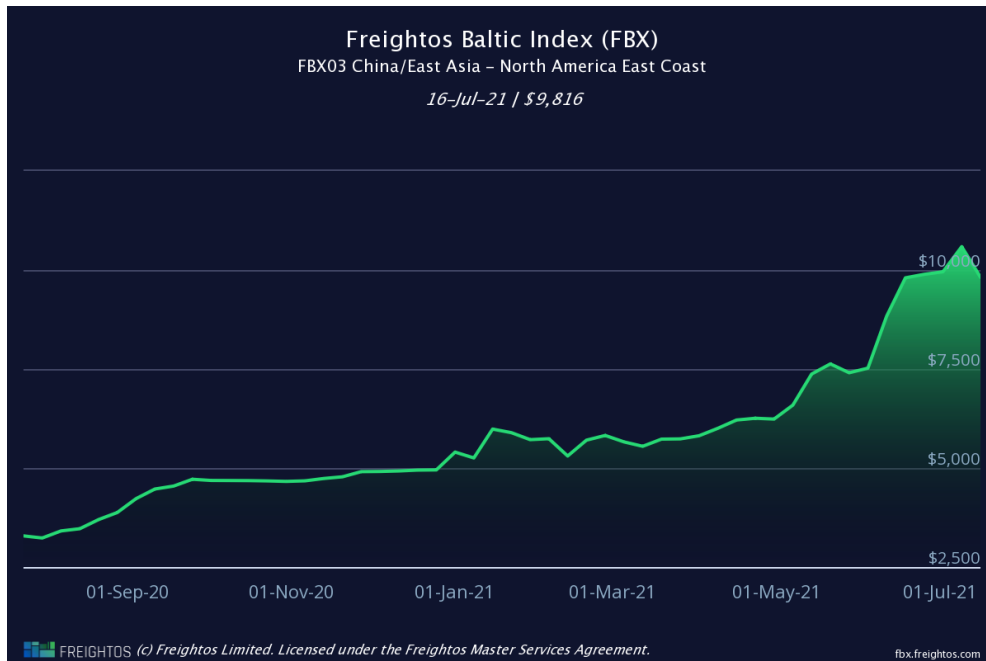


Figure 43. FBX China/East Asia to North America East Coast (source: Freightos)

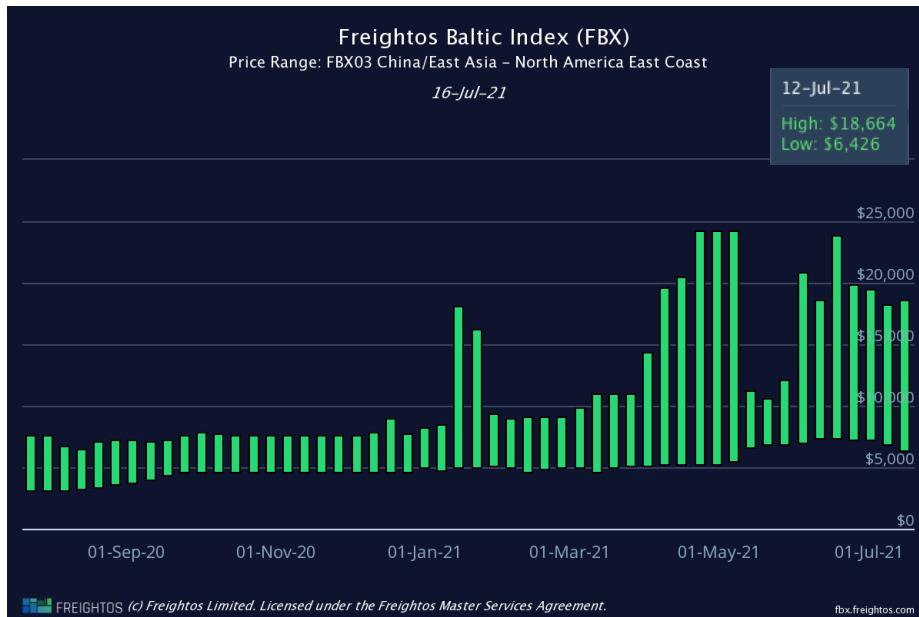


Figure 44. FBX China/East Asia to North America East Coast Pricing Range (source: Freightos)

From these data, it is evident how much transport costs and in particular ocean freights are having a great impact on companies' income statements. All these factors not only affect their business performances, but they also force firms to allocate part of these costs to their final customers, thus increasing their products' prices and decreasing their competitiveness on the market. This is a problem especially for Italian companies, which are strongly oriented to export and international competition. Italian export is running the risk of losing competitiveness and of being replaced by more convenient offers of other countries in its export markets, especially outside the European Union.

In addition to these elements, there are other dynamics that contribute to problems in maritime transport and to higher prices. As previously mentioned, blank sailing is one of them. In order to adapt the supply of containers to the current demand, shipping companies started to cancel ship departures or stopovers to several ports. Therefore, if a vessel was already in transit and had no possibility to reach a seaport, containers were grounded and had to wait for a connecting vessel from the same company to continue the transport. Port experienced a surplus of containers which could not be easily managed, thus preventing other upcoming containers from entering and be unloaded. This obviously resulted in longer transit time, with significant consequences for the goods moved. Perishable products are likely to expire or deteriorate, and even with non-perishable goods there are problems, because they run the

risk of not being delivered or of arriving late at destination. If they are semi-finished or intermediate goods, this situation leads to a delay in the finalization of the product; if they are finished products and are not delivered to the final customers, these latter are not likely to pay (or may request a refund / discount), thus creating liquidity problems for suppliers⁶⁷. Just considering the year 2020, the global amount of blank sailings reached 7 millions TEUs, with Maersk and MSC as first companies adopting this strategy. Concerning the main East-West routes, the cancelled services from April to July 2020 were 257, equal to nearly 3 million TEUs.

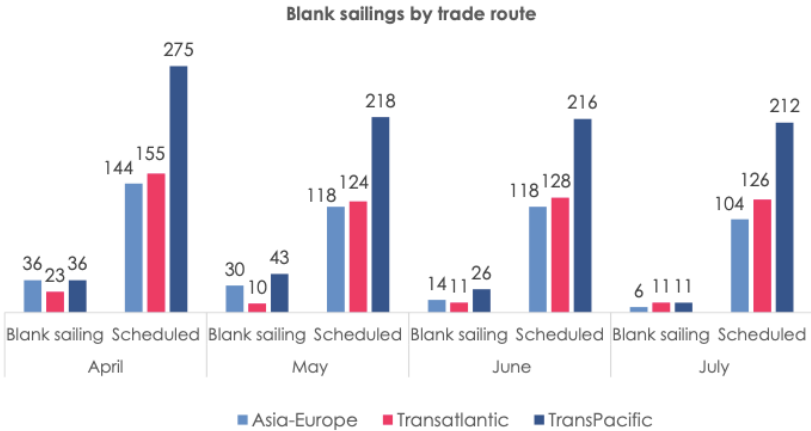


Figure 45. COVID-19: blank sailing on East-West routes (source: SRM)

The additional unavailability of containers caused by this phenomenon has undoubtedly contributed to the increase in their cost. By leveraging the relationship between supply and demand, blank sailing has caused an increase in the cost of freight for a container by virtue of a contraction of the available space which was followed by an increase in demand.⁶⁸

Apart from blank sailing, there are other circumstances that cause delays and increase the lead time. Due to shortages of vessels, blockages in ports have become more frequent,

⁶⁷ Content extracted from the interview.

⁶⁸ Source: Michael Menafra, Savitransport. *Blank Sailing*. 5 May 2021 (www.savitransport.com/blank-sailing-shipping-marittimo)

resulting in an overcapacity of containers in seaports that wait for their shipment and cannot be moved. Port operators are facing several logistics problems, because they have run out of space to stock containers full of goods and are forced to prevent ships from entering into those ports to unload the cargo. This in turn leads to the blockage of other departures or stopovers, because there is not sufficient time and space to manage all the ships. However, overcapacity of containers is not the only element affecting the transport time. Due to this pandemic, further and specific controls and inspection of containers have become a necessity in order to secure goods and receive the approval for their transport. These processes require time and personnel, which was not fully operational because of lockdowns and local restrictions, and this caused delays in all operations. An example of strict controls are the US, where goods arriving at ports must be subject to fumigation in order to get through security checks and obtain the certification. This requires more time than the simple unloading of containers, and if goods do not undergo such inspections or are not compliant with regulations, they cannot be unloaded and are stuck in the containers.⁶⁹

All of these delays entail an additional expense for companies. Cost of storages of containers have increased exponentially due to their prolonged storage time. They relate mainly to demurrages and detention costs⁷⁰, and comprehend not only the cost of the land but also the expense related to the chartering of containers, that implies additional fees for longer chartering (from \$10 to \$100 per day).

These charges have nearly doubled in 2021 compared to 2020, going up +104% (it is equal to \$666 for each container).

⁶⁹ United Nations, United Nations conference for trade and development. *COVID-19 IMPLICATIONS FOR COMMERCIAL CONTRACTS. Carriage of goods by sea and related cargo claims*. Geneva, 2021

⁷⁰ Demurrage & Detention costs refer to containers that are not delivered back within the allowed free days. The free days determine the number of days a shipper can use the container for free. If the free time is exceeded, the user has to pay a demurrage and detention charge. Demurrage charges always relate to the time a container is inside a terminal. On the other hand, detention is a charge for extended use of the container until it's returned empty to the shipping line and refers to the time outside the port. (source: Xchange, *Demurrage and Detention Benchmark 2021*)

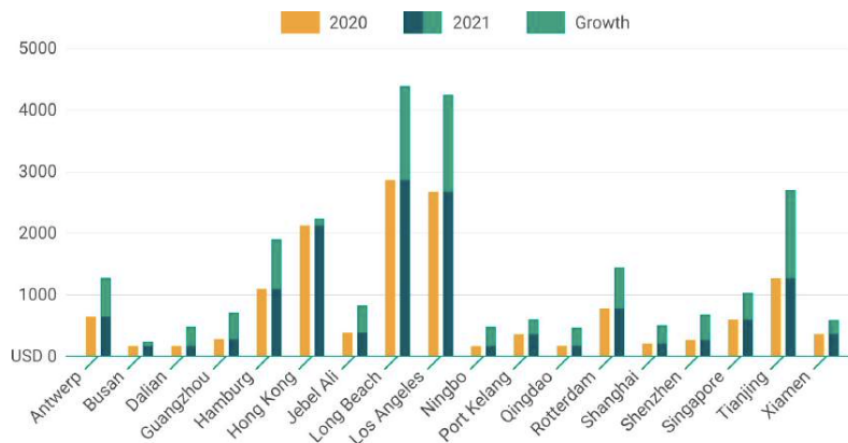


Figure 46. Demurrage and detention charges in USD, 2020-2021 (source: xChange)

The most important Chinese ports had the greatest increase of +126% in demurrage and detention costs after two weeks in 2021.

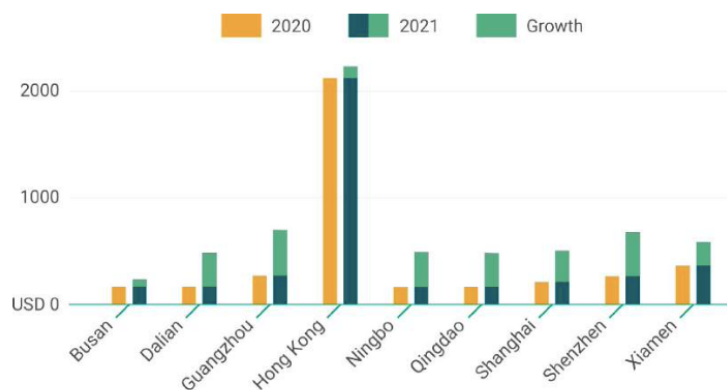


Figure 47. Chinese ports' demurrage and detention charges in USD, 2020-2021 (source: xChange)

All these costs are borne by companies, that have no choice but to accept them to make their goods arrive at destination, even without knowing the right delivery day.

Furthermore, it is important to consider that from the beginning of the pandemic, carriers have been offering sailings which were already delayed of two-three weeks due to the lack of capacity, and transit time, especially from Asia to Europe, has gone from 60 to 100 days.⁷¹

One last consideration is related to containers' booking. In the past, companies were used to rent a container according to their actual necessities and to the average delivery time required. However, due to COVID and the consequent unavailability of containers and delays, they are no longer able to do that, because departures and containers have already been booked well in advance. In these circumstances, companies started to rent several containers in advance, without knowing their real needs, and then they organize the departures of their goods on more vessels in order to use all the reserved containers. This strategy is very expensive for firms, because they end up booking departures blindly. This may result in over availability of containers which are not actually needed and that cannot be called off because of the new regulations, and companies are obliged to pay an additional fee if they do not use them. This situation, coupled with further reservation problems due to suppliers' difficulties, contributes to the unavailability of space on the vessels, and to the consequent increase of ocean freights.

All these problems affect all the entities operating along international supply chains, and include not only ocean operators (carriers, loaders, shipping companies etc.), but also manufacturing companies, retailers, suppliers and final customers, because they are all connected in international networks.

Considering that it is the most convenient and cost-effective used transportation strategy, maritime transport was the hardest hit sector in the shipping industry, and it significantly affected companies' balances and accounts. However, albeit not at the same level, other sectors have suffered the effects of the pandemic, and air transport is one of them.

⁷¹ Reuters. *Boxed out: China's exports pinched by global run on shipping containers*, December 10 2020 (<https://www.reuters.com/article/us-global-shipping-container-idUSKBN28K0UA>)

3.4 Air transport

The average value of goods carried by air makes up one third of global trade, and it corresponds to above \$6.7 trillion. As for the other sectors, COVID-19 had a strong impact on air transport as well, especially during the first period (Q1 and Q2 of 2020). Lockdowns, companies' closure, and travel restrictions resulted in airports' closures and cancellations of flights, both domestic and international. The OpenSky Network reported that flights worldwide fell around 80% between early January and mid-April 2020. The

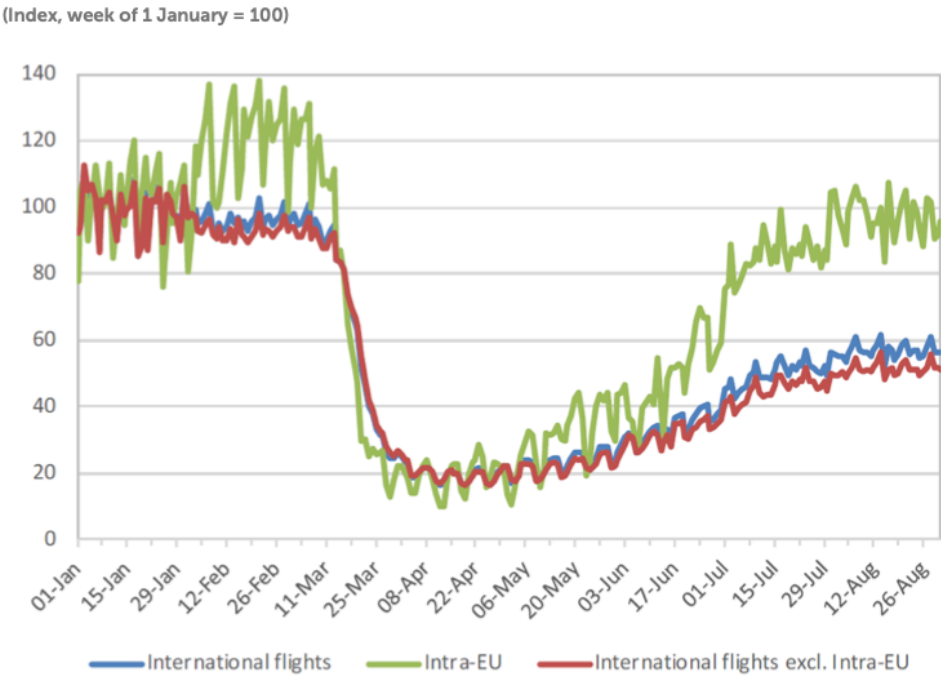


Figure 48. International commercial flights Jan-Aug 2020 (source: WTO)

Airports Council International (ACI)⁷² assessed that this caused a decline of more than 4.6 billion passengers globally for 2020, and airports revenue would suffer losses of more than

⁷² Airports Council International (ACI) is the airport industry body.

\$45 billion, with Europe and the Asia-Pacific region as the hardest-hit areas in terms of international capacity and revenue impacts.⁷³

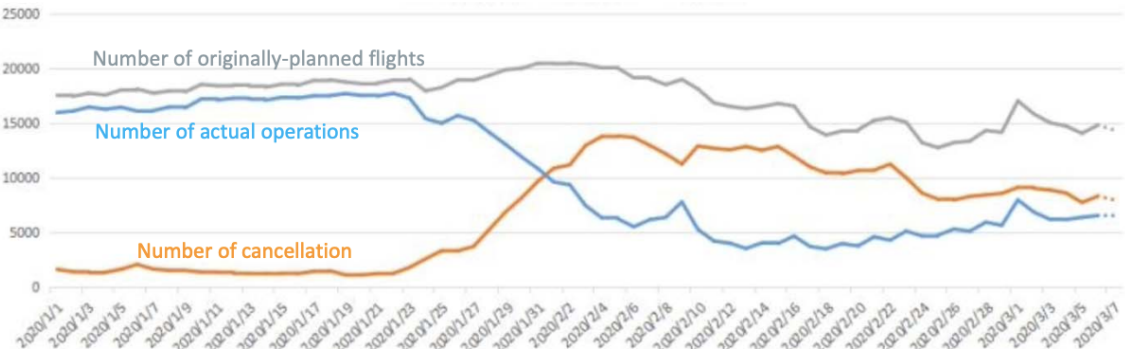


Figure 49. COVID-19 impact on China Air Traffic (source: ICAO)

Besides damaging tourism and the service sector, this had great effects on the transportation of goods, since most products travel in the belly of passengers’ aircrafts (cargo aircrafts are just a small part). IATA⁷⁴ data revealed that belly capacity for international air cargo decreased by 43.7% in March 2020 compared to the previous year, and just 20% of belly cargo has been flying in recent months.

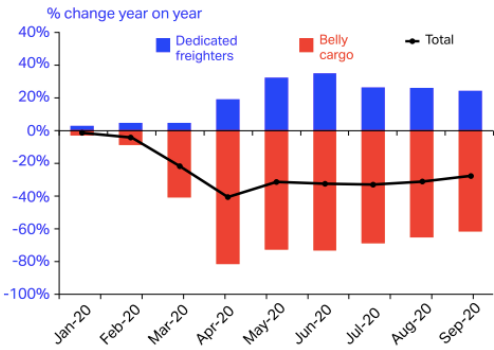


Figure 50. Air cargo capacity shortage, 2020 (source: IATA)

⁷³ World Trade Organization. TRADE IN SERVICES IN THE CONTEXT OF COVID-19. INFORMATION NOTE. 28 May 2020

⁷⁴ International Air Transport Association

The closure of the most important international traffic routes, the unavailability of containers for the maritime transport and the reduced capacity of air cargo caused two major consequences to the air transport of goods. The first one is the steady increase in air freights, the second is the drafting of short-term contracts and ad hoc agreements by airlines to secure the delivery of goods for companies, thus further increasing the volatility of rates.

Since the outbreak of the pandemic, demand for medical appliances such as PPE increased abruptly, and shippers and governments decided to employ aircrafts for the transport of such essential goods (also including medicines and raw material). IATA data estimated 1.5 million metric tons of PPE and medical supplies delivered by air, with more than 46.000 special flights dedicated to their transport. This necessity, together with major companies' (such as Apple, Samsung and Sony) reservation of a great part of all-cargo aircrafts and cargo-only passenger aircrafts to transport their devices, contributed to the strong increase of tariffs.

The TAC index reveals air freights trends in the last few years. For the route Frankfurt - North America, in December 2020 rates reached the peak of \$5 per kg, compared to \$1,75 of the same period the previous year. In 2021 they began to decrease, and in July 2021 they recorded \$4,10 per kg, though remaining high compared to \$2,11 of July 2019.

Concerning Hong Kong – Europe route, May 2020 recorded the highest rate of \$5,88 per kg (compared to \$2,65 of May 2019). As for the first route, they started to decrease in 2021 and are now at \$4,58 per kg (compared to \$2,67 in July 2019).

Hong Kong. – North America rates showed a different trend compared to the other two. They reached the highest peak in May 2021, with \$8,70 per kg (in May 2020 they recorded the highest rate of \$7,73 per kg). After a strong increase in Q1 2021 they are now experiencing a decline and are equal to \$7,90 per kg (compared to \$3,44 per kg in 2019).

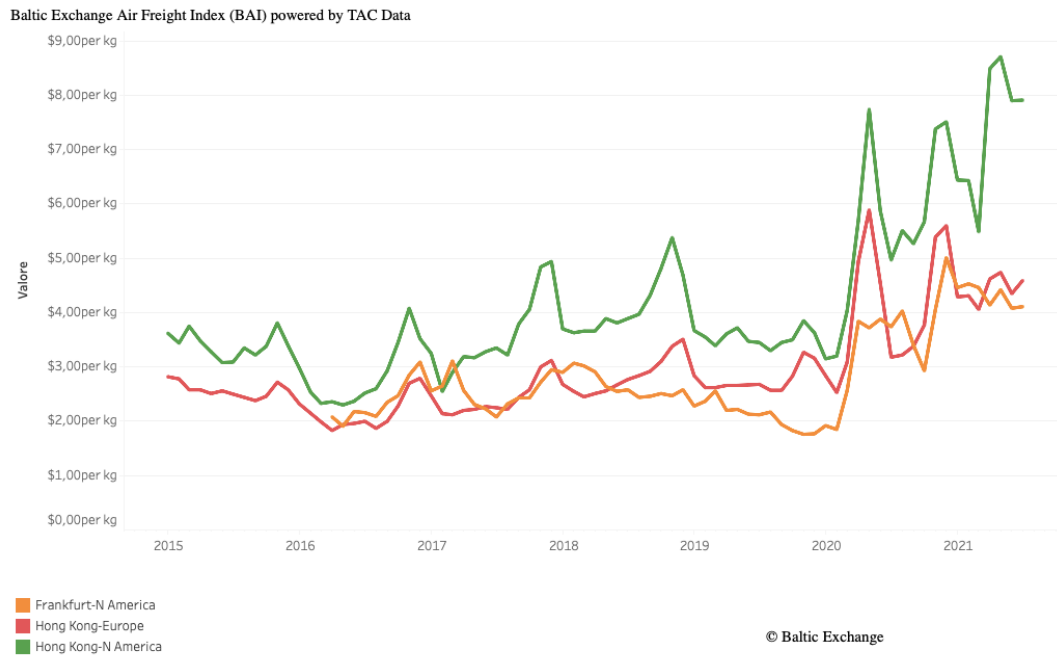


Figure 51. International Air Freights trends (source: TAC index)

As an attempt to increase the capacity and maintain rates at fair levels, airlines found some temporary solutions. Some firms withdrew large-capacity aircrafts and transformed them into all-cargo airplanes; some modified the internal layout (by removing seats) for the transport of goods; others directly placed small cargo on passenger seats, such as PPE and other appliances. With these short-term but somehow effective solutions, air freights started to calibrate and decrease to more acceptable levels. However, they still remain volatile and unstable, forcing companies to rely on SPOT rates.

Thanks to the development of vaccines and to stricter and more effective protocols, air transport has started to improve in 2021. Nevertheless, the situation does not allow for a return to normal yet, since cross borders movements are still problematic (due to new variants and national regulations) and not all routes have resumed working with the same regularity and frequency as in the past. It is a sector that is still struggling to recover, with some airlines that collapsed and declared bankruptcy since they were no longer able to pay for their debts.

All the problems and the related consequences of high rates and delays in air transport are directly transferred to companies, which had found in air transportation a viable alternative to sea shipping, given all complications and delays with maritime transport and ocean freights. If firms manage to secure a place for their cargo, they must be able to tolerate and afford such

high tariffs, which do not always guarantee efficient services and on time delivery due to recurrent delays and to the instability of the general situation.

3.5 Raw materials

The issues related to air and maritime transport, and especially the shortage of containers to transport goods, caused further complications to manufacturing companies. As a matter of fact, logistics factors are one of the three main causes of raw materials shortages and their consequent rise in prices. In the first half of the year 2021, transport costs have become higher than the raw material value itself, and companies have been obliged to pay up to \$9.000 to procure the needed resource, a huge amount if compared with \$2.000 of November 2020. Such exponential increase in ocean freights (refer to par. 3.3 Maritime Transport) and the consequent rise in raw materials prices are having a great impact on businesses' operations, not to mention the consequences rising from recurrent delays in the delivery time, that affect both the production processes and the customer relations. The Baltic Dry Index, which shows freight trends for moving major raw materials by sea (such as iron ore, coal and cereals), records an increase of 690% since May 2020⁷⁵, arriving at a peak of more than 3.000 (level reached only in 2010).

⁷⁵ Anima Confindustria. *Boom dei noli marittimi: aumentano i costi delle materie prime e i ritardi nelle consegne*, 5 Luglio 2021 (www.ingenio-web.it/31332-boom-dei-noli-marittimi-aumentano-i-costi-delle-materie-prime-e-i-ritardi-nelle-consegne)



Figure 52. Baltic Dry Index (source: Trading Economics)

Besides logistics factors, there are other elements causing shortages of raw materials and their high prices. During the first months of the pandemic, prices of major commodities experienced a decrease of 20-30%, mainly due to companies' closure and cancelled orders in response to national lockdowns. In addition, due to closures and to the weak demand, extraction and production of raw material slowed down as well. Chinese companies, which restored their production earlier than European ones, took advantage of this favorable situation and stockpiled most of the resources available. When European businesses were able to reopen and restore their activities, the huge demand for raw materials both for production and to replenish stocks (also caused by empty warehouses that needed to be filled) led to a strong increase in their prices and to their complete unavailability in a short time. This situation causes problems especially for Italian companies, that rely heavily on imports of resources and does not have the same purchasing power as China or the US to procure the materials needed at whichever price.

The third reason of the increase in raw materials prices is mainly related to financial factors. In the last few months, raw materials have become an interesting investment. They are priced

in US \$, which is currently a weak currency, therefore they are more convenient for those who purchase them in € or other currencies.⁷⁶

All these factors led to the exponential increase in the price of most raw materials. According to Confapi data, steel experienced an increase of 70% at the end of 2020, and in 2021 it reached €1.000 ca. per metric tonne, compared to nearly €400 in the previous year.



Figure 53. Steel price 2021 (source: Bloomberg)

According to Trading Economics, Aluminum reached its record level since 2018 and arrived at 2618 USD/T in August 2021, marking an increase of 26% compared to pre-crisis levels.

⁷⁶ Corriere della Sera. *Allarme materie prime: le regioni non dette*, 7 Giugno 2021



Figure 54. Aluminum price trends (source: Trading Economics)

Plastic materials are suffering from the same price escalation, especially ethylene, polypropylene and PVC, which have experienced an increase of 58%, 34% and 42% respectively.⁷⁷

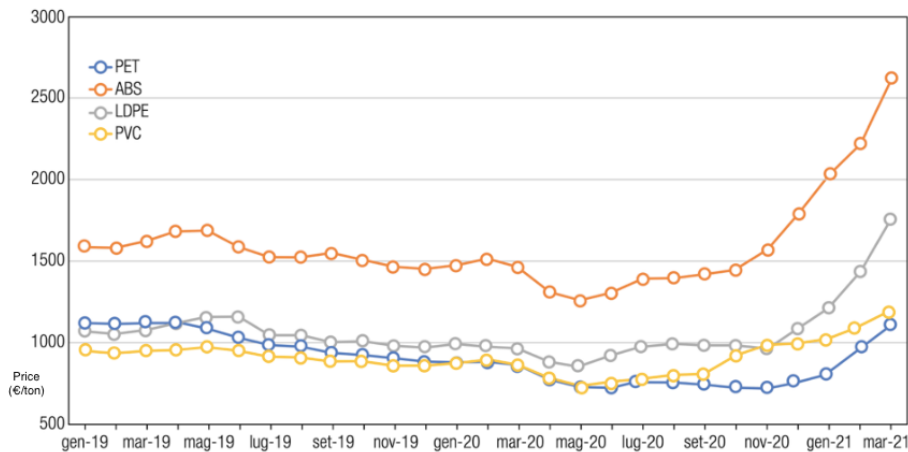


Figure 55. Plastic materials prices (source: REM Ecologia)

⁷⁷ REM Ecologia. *Le materie prime sono diventate costosissime e introvabili. I prezzi delle materie prime sono saliti alle stelle e le attività produttive rischiano di fermarsi*, 30 Giugno 2021 (www.remecologia.it/news/le-materie-primе-sono-diventate-introvabili-ecco-i-motivi)

Apart from these commodities which are essential for manufacturing companies, there are concerns also for other resources which in the last few years have become crucial for the green and digital transition. These include copper, rare-earth elements (REE), lithium, cobalt, silicon, nickel and tin. Due to investments in new technologies and to the energetic transition, their demand will keep rising, but their supply is still limited and will not be able to cover such necessity. Copper price already increased 115%, tin and lithium price recorded +130% and rare earths an overall +447%.⁷⁸



Figure 56. Copper price trend (source: Bloomberg)

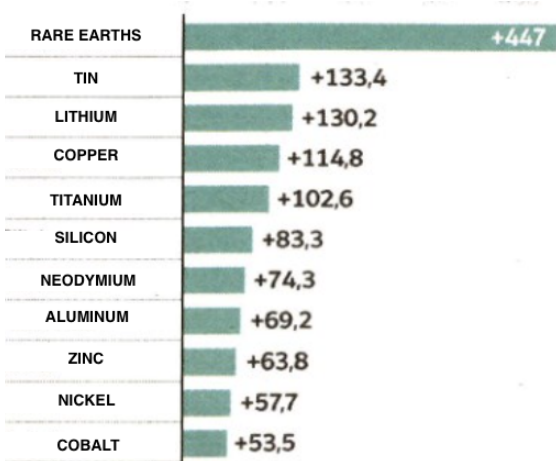


Figure 57. Raw materials annual increase % (source: Corriere della Sera)

⁷⁸ Corriere della Sera, Allarme materie prime: le regioni non dette, 7 Giugno 2021

China is now in an advantaged position, since its territory allows the extraction of copper, lithium and REE. Moreover, as a manufacturing giant, it is able to purchase nickel and cobalt from other countries (such as Philippines and Indonesia) and then transform them locally. In a globalized and interconnected world, Europe has a great dependence on Chinese suppliers for these commodities (98% of dependence for REE), and this difficult situation is putting a strain on European and Italian companies, which have no alternative but to purchase from China the available raw materials at disproportionate prices, assuming they can find them.

The constant increase in raw material prices and all the additional costs and problems related to maritime and air transport have become a big burden that Italian companies need to consider and handle in order to prevent damaging their operations and business.

Next chapter will exhibit a practical simulation of how such additional prices could burden on companies balances and income and consequently harm their performances.

CHAPTER 4. THE IMPACT OF COVID ON COMPANIES' PERFORMANCE

4.1. The effects on companies' operations

In recent years, companies developed and followed an organizational logic characterized by lean management and manufacturing, which comprises methods aimed at minimizing waste and guaranteeing the efficiency of industrial production processes. It is mainly based on just-in-time manufacturing, whose goal is to minimize inventory and reduce times both within the production system and from suppliers and to customers along all the nodes of the supply chain.⁷⁹ By manufacturing products only on customer's necessity and avoiding that the production exceeds the actual demand, companies have been able to maintain their cash-flow at fair levels and consequently guarantee financial stability over time.

This logic has proved to be remarkably successful for most companies; however, with the outbreak of COVID-19, firms encountered several difficulties in managing their daily operations, and this is also due to these new manufacturing methods. During the first phase, characterized by infection peaks and repeated lockdowns, a lot of companies had no choice but to close and interrupt their production, thus disrupting the normal production cycle of the products and the correct functioning of supply chains. Now, one question arises spontaneously: which are the main problems companies needed to deal with from both an economic and financial point of view?

First of all, fixed costs need to be considered. They refer to all the indirect expenses that do not depend on the amount of goods produced and sold by the company, and comprehend rents, insurances, loan payments and employee salaries. Such costs must be paid regardless of the actual production, and created problems for companies, which were not able, at least at the beginning, to cover such high expenses since these could not be absorbed by sales and revenues. However, when the economy started to recover and companies restored their

⁷⁹ Elaboration from Wikipedia

production, part of this issue has been managed by governments and organizations by the use of social safety nets, especially concerning fixed costs for salaries.

Another difficulty arises in managing contracts, both with suppliers and with customers. Due to lockdowns and companies' closures, and problems related to delays in the delivery of raw materials and finished products, firms had to deal with missed deadlines and all the problems that go with it. From the supply side, delaying the delivery of raw materials and components means slowing and deferring the production, thus resulting in late distribution of products. From the demand side, if customers do not get their goods on time, or do not receive them at all, they will not pay for them. This is a problem for manufacturing companies that operate with trade receivables because, if the receivable is not paid at maturity, it does not become an inflow and creates liquidity problems for firms that planned to pay their expenses with it (for example trades payables to their suppliers).

As a result of production stops and drops in demand, companies' turnover and revenues decreased. In order to pay for the indirect expenses and not to drain all the assets, firms started cutting costs and thus reduce their investments and purchases. This entails also the procurement of stock of raw materials and components which are essential for the production, that were not considered a priority given such low demand. When the economy started to recover and production returned to normal levels, new difficulties emerged for those entities that chose to follow the JIT logic⁸⁰. Companies that did not rely on lean manufacturing and kept some inventories were able to restore their production earlier than others, because they managed to keep up with the increasing demand by producing products with the components already available inhouse. Those which did not retain stock or finished them in a short period of time encountered significant problems with the procurement of resources and semi-finished products, since they have become really scarce and difficult to find in the short-term, as previously discussed in chapter 3. Even those who managed to acquire it, had to cope with longer and delayed lead times caused by transport issues, especially regarding maritime

⁸⁰ Just-in-time manufacturing

transport (ref. chapter 3), and to consequent higher prices both to secure the delivery (due to higher container costs) and to purchase the resources themselves.

It is clear that China is one of the most important exporters of resources and that most companies, especially Italian ones, rely on Chinese suppliers for the procurement of critical materials and components which are hardly found elsewhere at the same price and availability. However, if in the past companies were able to maintain low costs in their economic cycle by purchasing at low price from China, they are now having a hard time, because the natural cycle of supply chains failed to function correctly, and companies cannot afford to act liked they used to in the past and in other periods of crisis. This is due to the fact that COVID-19 has been an unpredictable global event, which has significantly affected nearly all countries and whose effects on the economy are not likely to be limited to the short term. In past periods of crisis, firms managed to buffer the unavailability of a supplier by purchasing from other sources, by looking for nearer companies that provide materials in shorter time or relying on the supplier's partners in the same country (for example China) to get the resources at the same price, especially if it regards goods that are available only in a region due to its specialization. With the outbreak of this pandemic, companies were no longer able to do so, because COVID-19, with all its specificities of a global and unpredictable event, could not be limited to a single area and consequently affected all the entities taking part in international relations, causing ripple effects that could not be managed using temporary alternatives.

4.2 Economic cycle and financial cycle

In order to understand all the problems and risks resulted from the pandemic that companies need to cope with, it is important to take a step back and consider the differences between the economic and the financial cycles.

Company production cycle

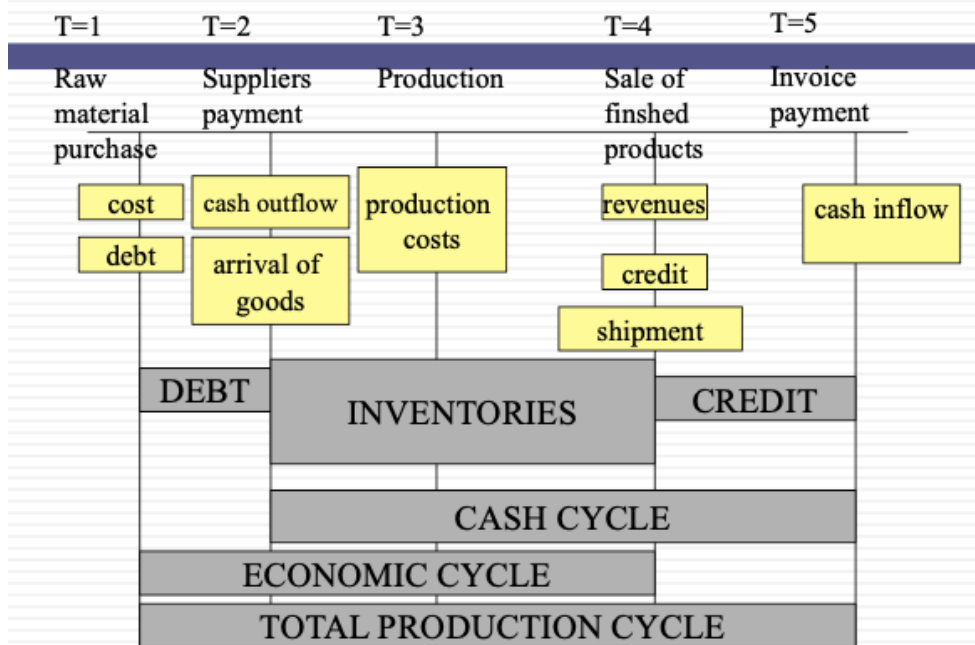


Figure 58. Company production cycle (source: author notes)

The overall production cycle of a company comprehends the economic cycle, that starts with the purchase of raw material and ends with the sale of the finished product, and the cash cycle, which begins with the payment to supplier and finishes with the customer's payment of the invoice. The main difference between economic and cash cycle is:

- The economic cycle refers to cost and revenue, and these two elements do not necessarily refer to an outflow or inflow of cash if they are not linked to an immediate payment.
- The cash or monetary cycle refers to the cash inflows and outflows and concern mainly the liquidity of a company.

This difference is due to the combination of three elements: debt, inventories, and credit. Debt refers to the delay of payment that the company can get from supplier, and it marks the difference between the starting point of the economic and cash cycle (the longer is the delay, the later starts the cash cycle). Inventories concerns the number of days there is stock inside the company. This affects the length of the cycles, since as long as the products stay inhouse,

they cannot be sold and consequently do not generate nor revenues or cash inflows. Credit refers to the delays of payment the company grants to its customers.⁸¹

For these reasons, profit does not have a direct correlation with cash inflow, and the same thing happens for costs, that do not always mean cash outflows. It is important to mark this distinction in order to understand the real performance of a company, because even if a firm makes profit and claims to have good economic performance, it may not be able to pay for its debts or expenses because it has liquidity problems.

Taking into consideration the monetary cycle, the three components (debt, inventories, credit) are fundamental for the management of current operations. This is because the difference between these variables (whose formula is $credit + inventories - debt$) makes the working capital, which is the amount of money the company needs in order to run its day-by-day business. Even if credits and inventories refer to positive assets, in the working capital they work the opposite way. In other terms, credits or trade receivables are revenues not collected, and inventories are products which are purchased but not sold, therefore they absorb liquidity because they prevent a cash inflow and cause a dilation of the working capital. Following the same logic, debts to supplier or trade payables avoid a cash outflow and generate liquidity in the company (because it does not have to pay), thus leading to a reduction of the working capital. Hence, the working capital acts like a “sponge”, if it has a contraction, it generates liquidity, while if it expands, it absorbs monetary resources. This means that if companies manage to maintain their working capital negative, they are able to self-finance their current operations thanks to the liquidity already inside the company, without having to rely on external entities for financing.

This aspect is very important to analyse because it is at the basis of liquidity problems and prevent firms from a financial equilibrium in the short-term. However, it is not always simple to manage the working capital in the best way for the company, since such dimensions depend

⁸¹ Elaboration of author notes of International Finance and Banking based on the book *International Finance and banking in Asia* (BERTINETTI G., International Finance and banking in Asia, McGraw-Hill Education 2017)

also on external factors which are out of its control (companies are not always able to choose when to pay their suppliers, and the same happens with customers). It is clear, however, that inventories are the most difficult element to manage, because companies need to find a balance between low stock levels to decrease costs and contract the working capital, but right quantity of resources to secure production in case of disruption. This has been one of the major problems encountered by firms with the outbreak of the pandemic, especially for those following the just-in-time and lean manufacturing logic. Nevertheless, it is worth mentioning all the potential problems from both an economic and financial point of view.

Concerning the economic cycle, the relevant dimensions are costs and revenues. Due to COVID and all the related consequences, companies experienced a sharp decrease in their turnover, mainly because of interruptions and delays in the production, and this resulted in lower revenues. In order to find a balance with decreased profit, companies need to be able to cut costs, in order to prevent losses and bankruptcy. As mentioned at the beginning of the chapter, costs comprises both fixed and variable costs. Variable expenses are related to the production, and due to disruptions in manufacturing, some of them directly decreased. However, this decline is not enough to balance such low revenues. Therefore, companies should find a solution to reduce their purchases and their expenses, for example avoiding unnecessary purchases of equipment or non-critical components, or by using the social safety nets provided by governments and institutions to cover those fixed costs that cannot be avoided and employing temporary measures to avoid additional costs such as teleworking. In a period of recession caused by the propagation of the disease and the continuous uncertainties related to the recovery, companies should rethink their structure and adapt it to the new situation, maybe making it simpler and more flexible. Sometimes downsizing does not necessarily entails less profit. Considering variable costs instead, such as transport costs and cost of raw materials, they can strongly affect the performance and equilibrium of the company (as shown in next paragraph) and need to be managed correctly.

On the other side, looking at the financial cycle, companies need to consider the problems that can originate from the three main dimensions: debt, inventories, credit. Since they are related to day-to-day operations, at first companies may encounter more problems of this nature that need to be managed in the short term. Concerning inventories, companies may find difficulties in replenish the stock due to lack of resources available or longer delivery times,

as explained above. Due to such problems and to delays in the production of finished products, firms need to manage their trade receivables which are likely to be extended to customers, since the distribution of the final product is deferred. In the worst case, it can happen that the customer has become insolvent or declared bankruptcy, therefore such credit will not become an inflow and turns into a loss. Such issue creates a further problem in the relationship with suppliers and in the management of debts and trade payables, since if the company does not get money from its client, it is not able to pay for its debt. Moreover, not all suppliers are willing to extend the delay in payment, on the contrary they are more likely to ask for an anticipated payment to secure the purchase of raw material and components, which have become very difficult to find and to deliver to the final destination. An additional issue arises if companies planned to replace outdated machinery and equipment. Firms should reduce if not avoid new investments, because like for costs, they should minimize purchases and cash outflows not to expand the working capital. It is clear that these difficulties are hard to manage simultaneously and could have significant negative effects on the companies' performance.

Those explained above are some of the problems caused by the pandemic, or at least exacerbated by it, that companies are facing and need to cope with. Some of them come naturally with operational risks that firms decide to accept, some are unpredictable and very difficult to control in the short term. It is worth considering that even those risks and problems that in normal situations could be managed taking dedicated measures (such as credit risks due to customers' insolvency, loss of critical supplier, capacity problems due to low inventory etc.), in these particular circumstances take a different connotation and severity. As with one company, COVID-19 created the same disruptions to all other entities as well. Since it is a global event, its effects and consequences propagated to all organizations involved in international supply chains, causing ripple effects on all partners and entities related to them. This is mainly due to globalisation, or at least to the internationalisation of economic activities, and to the overdependence on other countries for the functioning of one's own business. Because of its specificity and large-scale, companies cannot afford to consider such risks and problems as temporary and isolated but need to manage them in a specific and comprehensive way.

4.3 Case simulation

In order to better understand these general assumptions, it is necessary to develop a brief case simulation. These simple calculations provide a practical insight of the effects of the pandemic on companies' performance.

It is developed into different steps, and each step adds a major degree of impact. The main aspects that will be considered are transport costs, cost of raw material, debt towards suppliers (trade payables), final price and credit towards customers.

4.3.1 Premise

Assume that it is a manufacturing company with stable economic performance, with constant turnover from one year to the other and stable cash inflows and outflows. This implies there is no growth.

Consider the following performance at T0 (the last annual report):

Asset & Liability			
Trade receiv.*	100	Trade payables*	60
Inventories*	50	CTL	5
PCA	200	NFP	85
		Equity	200
	350		350

Figure 59. Asset & Liability statement T0 (source: author notes)

Profit & Loss	
Revenues	400
Δinventories	40
Costs	-360
V.A.	80
Workers	-50
EBITDA	30
Ammortizations	-10
EBIT	20
Interests	-8
Before tax Profit	12
Taxes	-6
Net profit	6

Figure 60. Profit & Loss statement T0 (source: author notes)

The current working capital is equal to 90, given by the difference between trade receivables + inventories – trade payables (100+50-60).

The interest rate is at 10% and the tax rate is equal to 50% of gross profit (there is no VAT).

The contractual conditions are:

- Customers will pay after 90 days from the purchase
- Suppliers will receive payment after 60 days from the sale

The increase in inventory is considered 50%, and there are no new investments nor disinvestments in permanent assets.

The simulation in T1 considers the following 6 months.

Next figure will summarize the steps developed in the simulation, taking into consideration two different scenarios related to the incidence of transport costs on the overall trade costs of the company:

	SCENARIO 1 5% incidence of transport costs	SCENARIO 2 30% incidence of transport costs
STEP 1: increase in transport costs	increase in transport costs with 5% incidence on overall trade costs	increase in transport costs with 30% incidence on overall trade costs
STEP 2: increase in raw material price	- increase in transport costs with 5% incidence on overall trade costs - increase in raw material price	- increase in transport costs with 30% incidence on overall trade costs - increase in raw material price
STEP 3: debt towards suppliers reduced to 30 days	- increase in transport costs with 5% incidence on overall trade costs - increase in raw material price - payments towards suppliers reduced to 30 days compared to 60 days of T0	- increase in transport costs with 30% incidence on overall trade costs - increase in raw material price - payments towards suppliers reduced to 30 days compared to 60 days of T0
STEP 4: increase in final price to customers	- increase in transport costs with 5% incidence on overall trade costs - increase in raw material price - payments towards suppliers reduced to 30 days compared to 60 days of T0 - 40% increase in final price to customers	- increase in transport costs with 30% incidence on overall trade costs - increase in raw material price - payments towards suppliers reduced to 30 days compared to 60 days of T0 - 60% increase in final price to customers
STEP 5: credit towards customers reduced to 30 days	- increase in transport costs with 5% incidence on overall trade costs - increase in raw material price - payments towards suppliers reduced to 30 days compared to 60 days of T0 - 40% increase in final price to customers - credit towards customers reduced to 30 days instead of 90 days of T0	- increase in transport costs with 30% incidence on overall trade costs - increase in raw material price - payments towards suppliers reduced to 30 days compared to 60 days of T0 - 60% increase in final price to customers - credit towards customers reduced to 30 days instead of 90 days of T0

Figure 61. Case simulation steps (source: author notes)

4.3.2 Step 1

The first step focuses on transport costs. The calculation starts from the evidence given by figure 32 (ref. Chapter 3) on the incidence that transport costs have on trade costs. Two scenarios are analysed in order to include a wide range of companies and possibilities.

The highest rate of incidence is at 30% (as shown in figure 32, for the manufacturing sector), the lowest is set at a general rate of 5%.

With both scenarios in mind, it is now time to estimate the increase in transport costs. To simplify the simulation, the calculation is based only on the price of containers.

Taking for example the rates regarding China-North Europe route, the current price of container is nearly 3/4 times higher than the previous year, namely from around \$4,901 at December 2020 to \$13,188 of July 2021⁸².

The calculation is developed as follows:

Scenario 1: rate of incidence at 5%

- Total costs at T0: 360
- Transport costs (5%): 18
- Increase in transport costs (3 times higher): $18 \times 3 = 54$
- Total costs at T1: $(360 + 54) / 2 = 207$

Considering the revenues stable and the inventories increase at 50%, the draft of the Profit & Loss statement expected on June 30th is the following:

Profit & Loss Expected June 30th	
Revenues	200
Δinventories	25
Costs	-207
V.A.	18
Workers	-25
EBITDA	-7
Ammortizations	-5
EBIT	-12

Figure 62. STEP 1: Profit & Loss statement T1 scenario 1 (source: author notes)

In order to understand the cash outflows and inflows of the company in the following 6 months, it is necessary to draw up a budget, which is essential to complete the Profit & Loss and also the Asset & Liability statements.

⁸² Source: FBX Freightos Baltic Index

The budget is calculated taking into consideration the real cash inflows and outflows of the company. Revenues are collected after 90 days, while payments are done after 60 days.

	Jan.	Feb.	March	April	May	June	TOT.
Revenues current year				33,33	33,33	33,33	100,00
Revenues previous year	33,00	33,00	34,00				100,00
Cash Inflows From Current Operations	33,00	33,00	34,00	33,33	33,33	33,33	200,00
Payment suppliers current year			- 34,50	- 34,50	- 34,50	- 34,50	- 138,00
Payment suppliers past year	- 30,00	- 30,00					- 60,00
Personnel expenses	- 3,85	- 3,85	- 3,85	- 3,85	- 3,85	- 3,85	- 23,08
Cash outflows From Current Operations	- 33,85	- 33,85	- 38,35	- 38,35	- 38,35	- 38,35	- 221,08
CFICO	- 0,85	- 0,85	- 4,35	- 5,01	- 5,01	- 5,01	- 21,08
Capex							-
FCFO	- 0,85	- 0,85	- 4,35	- 5,01	- 5,01	- 5,01	- 21,08
Taxes (ex TCL)					- 5,00		- 5,00
Taxes (advance)					- 2,35		- 2,35
FCFO after Tax	- 0,85	- 0,85	- 4,35	- 5,01	- 12,36	- 5,01	- 28,43
Dividends							-
Equity issue							-
Debt issue							-
Debt repayment							-
CFFF	-	-	-	-	-	-	-
Total Cash Flow (FCFO after tax + CFFF)	- 0,85	- 0,85	- 4,35	- 5,01	- 12,36	- 5,01	- 28,43
Starting NFP	- 85,00	- 85,85	- 86,69	- 91,04	- 96,05	- 108,42	- 118,19
Terminal NFP	- 85,85	- 86,69	- 91,04	- 96,05	- 108,42	- 113,43	- 118,19
Interests						- 4,76	

Figure 63. STEP 1: Budget scenario 1 (source: author notes)

From the budget, it is clear that the company is not in the position to finance its activities by itself and has to rely on external credit (such as banks) to keep the equilibrium, since the final Net Financial Position is equal to -118,19.

Thanks to the budget, it is possible to complete the economic and financial statements of the company to analyse its performance.

Profit & Loss Expected June 30th	
Revenues	200
Δinventories	25
Costs	-207
V.A.	18
Workers	-25
EBITDA	-7
Ammortizations	-5
EBIT	-12
Interests	-4,76
Before tax Profit	-16,76
Taxes	0,00
Net profit	-16,76

Figure 64. STEP 1: Final Profit & Loss statement T1 scenario 1 (source: author notes)

Since there is no profit, there are no taxes to pay over it. As shown in the P&L statement, the final performance is negative, with a loss of 16,76.

The Asset & Liability statement is the following:

Asset & Liability Expected June 30th			
Trade receiv.*	100,00	Trade Payables*	69,00
Inventories*	75,00	Workers*	1,92
PCA	195,00	CTL	-2,35
		NFP	118,19
		Equity	200,00
		Net profit	-16,76
	370,00		370,00

Figure 65. STEP 1: Final Asset & Liability statement T1 scenario 2 (source: author notes)

From this simple calculation, it can be noted that the company finds itself in difficulty, and it is not able to bear this increase in costs, even if limited, with its own means and without increased revenues (that can be both derived from new sales and from higher selling price).

Therefore, it is clear that the situation will be even worse for the second scenario, since transport costs have 30% incidence on total costs.

Scenario 2: rate of incidence at 30%

- Total costs at T0: 360

- Transport costs (30%): 108
- Increase in transport costs (3 times higher): $108 \times 3 = 324$
- Total costs at T1: $(360 + 324) / 2 = 342$

The simulation develops like for the first scenario:

Profit & Loss Expected June 30th	
Revenues	200
Δinventories	25
Costs	-342
V.A.	-117
Workers	-25
EBITDA	-142
Ammortizations	-5
EBIT	-147

Figure 66. STEP 1: Profit & Loss statement T1 scenario 2 (source: author notes)

Even without considering the expenses related to interests and taxes, the figure shows a bad economic performance, mainly given by the high increase in costs, which are little less than 2 times higher than revenues.

The budget calculation is:

	Jan.	Feb.	March	April	May	June	TOT.
Revenues current year				33,33	33,33	33,33	100,00
Revenues previous year	33,00	33,00	34,00				100,00
Cash Inflows From Current Operations	33,00	33,00	34,00	33,33	33,33	33,33	200,00
Payment suppliers current year			- 57,00	- 57,00	- 57,00	- 57,00	- 228,00
Payment suppliers past year	- 30,00	- 30,00					- 60,00
Personnel expenses	- 3,85	- 3,85	- 3,85	- 3,85	- 3,85	- 3,85	- 23,08
Cash outflows From Current Operations	- 33,85	- 33,85	- 60,85	- 60,85	- 60,85	- 60,85	- 311,08
CFICO	- 0,85	- 0,85	- 26,85	- 27,51	- 27,51	- 27,51	- 111,08
Capex							-
FCFO	- 0,85	- 0,85	- 26,85	- 27,51	- 27,51	- 27,51	- 111,08
Taxes (ex TCL)					- 5,00		- 5,00
Taxes (advance)					- 2,35		- 2,35
FCFO after Tax	- 0,85	- 0,85	- 26,85	- 27,51	- 34,86	- 27,51	- 118,43
Dividends							-
Equity issue							-
Debt issue							-
Debt repayment							-
CFFF	-	-	-	-	-	-	-
Total Cash Flow (FCFO after tax + CFFF)	- 0,85	- 0,85	- 26,85	- 27,51	- 34,86	- 27,51	- 118,43
Starting NFP	- 85,00	- 85,85	- 86,69	- 113,54	- 141,05	- 175,92	
Terminal NFP	- 85,85	- 86,69	- 113,54	- 141,05	- 175,92	- 203,43	- 209,80
Interests						- 6,37	

Figure 67. STEP 1: Budget scenario 2 (source: author notes)

As for the costs, the terminal net financial position has almost doubled in negative, marking a higher need for external money to finance the company's business.

The final statements are:

Profit & Loss Expected June 30th	
Revenues	200
Δinventories	25
Costs	-342
V.A.	-117
Workers	-25
EBITDA	-142
Ammortizations	-5
EBIT	-147
Interests	-6,37
Before tax Profit	-153,37
Taxes	0,00
Net profit	-153,37

Asset & Liability Expected June 30th			
Trade receiv.*	100,00	Trade Payables*	114,00
Inventories*	75,00	Workers*	1,92
PCA	195,00	CTL	-2,35
		NFP	209,80
		Equity	200,00
		Net profit	-153,37
	370,00		370,00

Figure 68.1 – 68.2. STEP 1: Final Profit & Loss and Asset & Liability statement T1 scenario 2 (source: author notes)

For those companies to which transport costs have a high impact on their overall costs, this is an unbearable situation, considering that the time period of the calculation is of just 6 months. Therefore, they should find an immediate solution to deal with this problem.

4.3.3 Step 2

As it was explained in chapter 3, COVID-19 pandemic has brought up several consequences that companies had to face simultaneously. In this step, in addition to transport costs, the increase in price of raw materials is taken into consideration. These resources are crucial for the core activities of the company, and if their procurement undergoes changes, these will strongly affect the company's performance.

It has been assumed that the cost of raw material has an impact of 15% on the overall costs of the company. The increase in price is calculated taking as a model the fluctuation in steel price, which is more than doubled from one year to another (ref. Chapter 3). Starting from both scenarios of step 1, the simulation is the following:

Scenario 1

- Total cost at T0: 360
- Raw material cost (15%): 54
- Increase in raw material price (2 times higher): $54 * 2 = 108$
- Total costs at T1 (considering both transport costs and raw material costs):
 $(360 + 108 + 54) / 2 = 261$

The expected starting Profit & Loss statement is:

Profit & Loss Expected June 30th	
Revenues	200
Δinventories	25
Costs	-261
V.A.	-36
Workers	-25
EBITDA	-61
Ammortizations	-5
EBIT	-66

Figure 69. STEP 2: Profit & Loss statement T1 scenario 1 (source: author notes)

It already underlines a high difference in comparison with the same scenario in the first step, from an EBIT of -12 to this of -66. Just adding the cost-plus of raw materials, the performance is more than five times worse.

The cash budget is the following:

	Jan.	Feb.	March	April	May	June	TOT.
Revenues current year				33,33	33,33	33,33	100,00
Revenues previous year	33,00	33,00	34,00				100,00
Cash Inflows From Current Operations	33,00	33,00	34,00	33,33	33,33	33,33	200,00
Payment suppliers current year			- 43,50	- 43,50	- 43,50	- 43,50	- 174,00
Payment suppliers past year	- 30,00	- 30,00					- 60,00
Personnel expenses	- 3,85	- 3,85	- 3,85	- 3,85	- 3,85	- 3,85	- 23,08
Cash outflows From Current Operations	- 33,85	- 33,85	- 47,35	- 47,35	- 47,35	- 47,35	- 257,08
CFfCO	- 0,85	- 0,85	- 13,35	- 14,01	- 14,01	- 14,01	- 57,08
Capex							-
FCFO	- 0,85	- 0,85	- 13,35	- 14,01	- 14,01	- 14,01	- 57,08
Taxes (ex TCL)					- 5,00		- 5,00
Taxes (advance)					- 2,35		- 2,35
FCFO after Tax	- 0,85	- 0,85	- 13,35	- 14,01	- 21,36	- 14,01	- 64,43
Dividends							-
Equity issue							-
Debt issue							-
Debt repayment							-
CFFF	-	-	-	-	-	-	-
Total Cash Flow (FCFO after tax + CFFF)	- 0,85	- 0,85	- 13,35	- 14,01	- 21,36	- 14,01	- 64,43
Starting NFP	- 85,00	- 85,85	- 86,69	100,04	- 114,05	- 135,42	
Terminal NFP	- 85,85	- 86,69	- 100,04	- 114,05	- 135,42	- 149,43	- 154,83
Interests						- 5,40	

Figure 70. STEP 2: Budget scenario 1 (source: author notes)

The final statements obviously mark a negative performance, showing a higher loss to bear and greater need for external entities to finance its activities. This situation will prevent the company from being healthy and resilient in the long term.

Profit & Loss Expected June 30th	
Revenues	200
Δinventories	25
Costs	-261
V.A.	-36
Workers	-25
EBITDA	-61
Ammortizations	-5
EBIT	-66
Interests	-5,40
Before tax Profit	-71,40
Taxes	0,00
Net profit	-71,40

Asset & Liability Expected June 30th			
Trade receiv.*	100,00	Trade Payables*	87,00
Inventories*	75,00	Workers*	1,92
PCA	195,00	CTL	-2,35
		NFP	154,83
		Equity	200,00
		Net profit	-71,40
	370,00		370,00

Figure 71.1 - 71.2. STEP 2: Final Profit & Loss and Asset & Liability statement T1 scenario 1 (source: author notes)

Scenario 2

- Total cost at T0: 360
- Raw material cost (15%): 54
- Increase in raw material price (2 times higher): $54 * 2 = 108$
- Total costs at T1 (considering both transport costs and raw material costs):
 $(360 + 108 + 324) / 2 = 396$

Next figures will show a worse situation, given that in addition to the increase in raw material price, there is the incidence of 30% of transport costs on the overall costs of the company.

Profit & Loss Expected June 30th	
Revenues	200
Δinventories	25
Costs	-396
V.A.	-171
Workers	-25
EBITDA	-196
Ammortizations	-5
EBIT	-201

Figure 72. STEP 2: Profit & Loss statement T1 scenario 2 (source: author notes)

	Jan.	Feb.	March	April	May	June	TOT.
Revenues current year				33,33	33,33	33,33	100,00
Revenues previous year	33,00	33,00	34,00				100,00
Cash Inflows From Current Operations	33,00	33,00	34,00	33,33	33,33	33,33	200,00
Payment suppliers current year			- 66,00	- 66,00	- 66,00	- 66,00	- 264,00
Payment suppliers past year	- 30,00	- 30,00					- 60,00
Personnel expenses	- 3,85	- 3,85	- 3,85	- 3,85	- 3,85	- 3,85	- 23,08
Cash outflows From Current Operations	- 33,85	- 33,85	- 69,85	- 69,85	- 69,85	- 69,85	- 347,08
CFfCO	- 0,85	- 0,85	- 35,85	- 36,51	- 36,51	- 36,51	- 147,08
Capex							-
FCFO	- 0,85	- 0,85	- 35,85	- 36,51	- 36,51	- 36,51	- 147,08
Taxes (ex TCL)					- 5,00		- 5,00
Taxes (advance)					- 2,35		- 2,35
FCFO after Tax	- 0,85	- 0,85	- 35,85	- 36,51	- 43,86	- 36,51	- 154,43
Dividends							-
Equity issue							-
Debt issue							-
Debt repayment							-
CFFF	-	-	-	-	-	-	-
Total Cash Flow (FCFO after tax + CFFF)	- 0,85	- 0,85	- 35,85	- 36,51	- 43,86	- 36,51	- 154,43
Starting NFP	- 85,00	- 85,85	- 86,69	122,54	- 159,05	- 202,92	
Terminal NFP	- 85,85	- 86,69	- 122,54	- 159,05	- 202,92	- 239,43	- 246,44
Interests						- 7,01	

Figure 73. STEP 2: Budget scenario 2 (source: author notes)

Profit & Loss Expected June 30th	
Revenues	200
Δinventories	25
Costs	-396
V.A.	-171
Workers	-25
EBITDA	-196
Ammortizations	-5
EBIT	-201
Interests	-7,01
Before tax Profit	-208,01
Taxes	0,00
Net profit	-208,01

Asset & Liability Expected June 30th			
Trade receiv.*	100,00	Trade Payables*	132,00
Inventories*	75,00	Workers*	1,92
PCA	195,00	CTL	-2,35
		NFP	246,44
		Equity	200,00
		Net profit	-208,01
	370,00		370,00

Figure 74.1-74.2. STEP 2: Final Profit & Loss and Asset & Liability statement T1 scenario 2 (source: author notes)

4.3.4 Step 3

Now the simulation takes a step further. Even if it may not be common nor ordinary, increase in costs and price of resources can happen, sometimes even abruptly as it was explained in the previous chapter, and companies should be ready to deal with this event. However, these

changes do not come alone, instead they bring with them several consequences, and one of them is the instability of the relationships with other entities along the supply chain, namely suppliers and customers.

Taking step 2 as an example, the increase in price of raw materials is mainly due to their unavailability and to the consequent high demand for them. Those suppliers which are able to procure and sell these resources have a strong competitive power over manufacturing companies, because they are aware of the fact that some of them are willing to pay any price and accept whichever condition to procure them. The firm in question is one of them. Its Chinese supplier of steel has decided to guarantee the supply of the product on time only if the company paid off the debt only after one month from the sale. Therefore, the voice *trade payables* from 60 days would become 30 days. Earlier in the chapter it was explained how important was to keep the debt towards suppliers longer, because it could give the company the possibility to finance its activities with own resources, without having to rely on external entities. In the following scenarios, what happens in the opposite situation is presented.

Scenario 1

It remains the same as STEP 2 (increase in raw material and transport costs with 5% incidence), the only thing that changes is the starting point of the *payment towards suppliers for the current year*, that from 60 days is reduced to 30 days.

	Jan.	Feb.	March	April	May	June	TOT.
Revenues current year				33,33	33,33	33,33	100,00
Revenues previous year	33,00	33,00	34,00				100,00
Cash Inflows From Current Operations	33,00	33,00	34,00	33,33	33,33	33,33	200,00
Payment suppliers current year		- 43,50	- 43,50	- 43,50	- 43,50	- 43,50	- 217,50
Payment suppliers past year	- 30,00	- 30,00					- 60,00
Personnel expenses	- 3,85	- 3,85	- 3,85	- 3,85	- 3,85	- 3,85	- 23,08
Cash outflows From Current Operations	- 33,85	- 77,35	- 47,35	- 47,35	- 47,35	- 47,35	- 300,58
CFfCO	- 0,85	- 44,35	- 13,35	- 14,01	- 14,01	- 14,01	- 100,58
Capex							-
FCFO	- 0,85	- 44,35	- 13,35	- 14,01	- 14,01	- 14,01	- 100,58
Taxes (ex TCL)					- 5,00		- 5,00
Taxes (advance)					- 2,35		- 2,35
FCFO after Tax	- 0,85	- 44,35	- 13,35	- 14,01	- 21,36	- 14,01	- 107,93
Dividends							-
Equity issue							-
Debt issue							-
Debt repayment							-
CFFF	-	-	-	-	-	-	-
Total Cash Flow (FCFO after tax + CFFF)	- 0,85	- 44,35	- 13,35	- 14,01	- 21,36	- 14,01	- 107,93
Starting NFP	- 85,00	- 85,85	- 130,19	143,54	- 157,55	- 178,92	
Terminal NFP	- 85,85	- 130,19	- 143,54	- 157,55	- 178,92	- 192,93	- 199,89
Interests						- 6,96	

Figure 75. STEP 3: Budget scenario 1 (source: author notes)

The final Profit & Loss and Asset & Liability statements are the following:

Profit & Loss Expected June 30th	
Revenues	200
Δinventories	25
Costs	-261
V.A.	-36
Workers	-25
EBITDA	-61
Ammortizations	-5
EBIT	-66
Interests	-6,96
Before tax Profit	-72,96
Taxes	0,00
Net profit	-72,96

Asset & Liability Expected June 30th			
Trade receiv.*	100,00	Trade Payables*	43,50
Inventories*	75,00	Workers*	1,92
PCA	195,00	CTL	-2,35
		NFP	199,89
		Equity	200,00
		Net profit	-72,96
	370,00		370,00

Figure 76.1-76.2. STEP 3: Final Profit & Loss and Asset & Liability statement T1 scenario 1 (source: author notes)

The current working capital is equal to 129,58. This means that instead of providing money to finance the company's activities, it is absorbing liquidity, and this will have bad consequences for the firm's financial equilibrium, both in the short and in the long term.

Scenario 2

In the second scenario (increase in raw material and transport costs with 30% incidence) happens the same thing, only on a larger scale.

	Jan.	Feb.	March	April	May	June	TOT.
Revenues current year				33,33	33,33	33,33	100,00
Revenues previous year	33,00	33,00	34,00				100,00
Cash Inflows From Current Operations	33,00	33,00	34,00	33,33	33,33	33,33	200,00
Payment suppliers current year		- 66,00	- 66,00	- 66,00	- 66,00	- 66,00	- 330,00
Payment suppliers past year	- 30,00	- 30,00					- 60,00
Personnel expenses	- 3,85	- 3,85	- 3,85	- 3,85	- 3,85	- 3,85	- 23,08
Cash outflows From Current Operations	- 33,85	- 99,85	- 69,85	- 69,85	- 69,85	- 69,85	- 413,08
CFICO	- 0,85	- 66,85	- 35,85	- 36,51	- 36,51	- 36,51	- 213,08
Capex							-
FCFO	- 0,85	- 66,85	- 35,85	- 36,51	- 36,51	- 36,51	- 213,08
Taxes (ex TCL)					- 5,00		- 5,00
Taxes (advance)					- 2,35		- 2,35
FCFO after Tax	- 0,85	- 66,85	- 35,85	- 36,51	- 43,86	- 36,51	- 220,43
Dividends							-
Equity issue							-
Debt issue							-
Debt repayment							-
CFFF	-	-	-	-	-	-	-
Total Cash Flow (FCFO after tax + CFFF)	- 0,85	- 66,85	- 35,85	- 36,51	- 43,86	- 36,51	- 220,43
Starting NFP	- 85,00	- 85,85	- 152,69	188,54	- 225,05	- 268,92	
Terminal NFP	- 85,85	- 152,69	- 188,54	- 225,05	- 268,92	- 305,43	- 314,80
Interests						- 9,37	

Figure 77. STEP 3: Budget scenario 2 (source: author notes)

Profit & Loss Expected June 30th	
Revenues	200
Δinventories	25
Costs	-396
V.A.	-171
Workers	-25
EBITDA	-196
Ammortizations	-5
EBIT	-201
Interests	-9,37
Before tax Profit	-210,37
Taxes	0,00
Net profit	-210,37

Asset & Liability Expected June 30th			
Trade receiv.*	100,00	Trade Payables*	66,00
Inventories*	75,00	Workers*	1,92
PCA	195,00	CTL	-2,35
		NFP	314,80
		Equity	200,00
		Net profit	-210,37
	370,00		370,00

Figure 78.1-78.2. STEP 3: Final Profit & Loss and Asset & Liability statement T1 scenario 2 (source: author notes)

The current working capital is 107,08. It is a little less than that of scenario 1 only because the cost to pay is higher. The loss, instead, is always greater.

4.3.5 Step 4

These two final steps will try to provide a sort of solution in order to buffer, at least temporary, this unbearable situation. Step 4 will concentrate on the increase in the final price of the product. As it comes naturally with the increase in costs, companies often transfer such costs on the selling price in order to gain some margin or at least have no profit nor loss (to reach the breakeven point). Both scenarios see a percentage increase in the final price, but with different scales. In the first one, there is a 40% increase in price compared with 5% incidence of transport costs; in the second one the rise is of 60%, with 30% incidence of transport costs. Even if the proportion is not completely correct, it reflects a more realistic hypothesis, since companies usually cannot afford to double the selling price to their customers, or they run the risk of losing them. The 40% increase obviously shows the best scenario; however, it is not easily feasible anyway.

To simplify the calculation, the increased revenues are given only by the increase in price, without considering any change in the amount of goods sold.

Scenario 1

Increase in selling price of 40%:

- Revenues at T0: 400
- Increase in price (40%): 160
- Revenues at T1: $(400+160)/2= 280$

Profit & Loss Expected June 30th	
Revenues	280
Δinventories	25
Costs	-261
V.A.	44
Workers	-25
EBITDA	19
Ammortizations	-5
EBIT	14

Figure 79. STEP 4: Profit & Loss statement T1 scenario 1 (source: author notes)

The starting Profit & Loss statement on June 30th shows a positive EBIT of 14, compared to -12 of the same scenario in the first step.

The budget is the following:

	Jan.	Feb.	March	April	May	June	TOT.
Revenues current year				46,67	46,67	46,67	140,00
Revenues previous year	33,00	33,00	34,00				100,00
Cash Inflows From Current Operations	33,00	33,00	34,00	46,67	46,67	46,67	240,00
Payment suppliers current year		- 43,50	- 43,50	- 43,50	- 43,50	- 43,50	- 217,50
Payment suppliers past year	- 30,00	- 30,00					- 60,00
Personnel expenses	- 3,85	- 3,85	- 3,85	- 3,85	- 3,85	- 3,85	- 23,08
Cash outflows From Current Operations	- 33,85	- 77,35	- 47,35	- 47,35	- 47,35	- 47,35	- 300,58
CFFCO	- 0,85	- 44,35	- 13,35	- 0,68	- 0,68	- 0,68	- 60,58
Capex							-
FCFO	- 0,85	- 44,35	- 13,35	- 0,68	- 0,68	- 0,68	- 60,58
Taxes (ex TCL)					- 5,00		- 5,00
Taxes (advance)					- 2,35		- 2,35
FCFO after Tax	- 0,85	- 44,35	- 13,35	- 0,68	- 8,03	- 0,68	- 67,93
Dividends							-
Equity issue							-
Debt issue							-
Debt repayment							-
CFFF	-	-	-	-	-	-	-
Total Cash Flow (FCFO after tax + CFFF)	- 0,85	- 44,35	- 13,35	- 0,68	- 8,03	- 0,68	- 67,93
Starting NFP	- 85,00	- 85,85	- 130,19	143,54	- 144,22	- 152,25	
Terminal NFP	- 85,85	- 130,19	- 143,54	- 144,22	- 152,25	- 152,93	- 159,31
Interests						- 6,39	

Figure 80. STEP 4: Budget scenario 1 (source: author notes)

The final statements are the following:

Profit & Loss Expected June 30th	
Revenues	280
Δinventories	25
Costs	-261
V.A.	44
Workers	-25
EBITDA	19
Ammortizations	-5
EBIT	14
Interests	-6,39
Before tax Profit	7,61
Taxes	-3,81
Net profit	3,81

Asset & Liability Expected June 30th			
Trade receiv.*	140,00	Trade Payables*	43,50
Inventories*	75,00	Workers*	1,92
PCA	195,00	CTL	1,46
		NFP	159,31
		Equity	200,00
		Net profit	3,81
	410,00		410,00

Figure 81.1-81.2. STEP 4: Final Profit & Loss and Asset & Liability statement T1 scenario 1 (source: author notes)

For the first time in this simulation, the Profit & Loss statement shows a little profit for the company, marking a positive performance, or at least not negative. The Asset & Liability statement, however, underlines an inflated working capital, namely of 169,58, since higher revenues do not directly imply higher cash inflows.

Scenario 2

Increase in selling price of 60%, due to 30% incidence of transport costs on overall trade costs:

- Revenues at T0: 400
- Increase in price (60%): 240
- Revenues at T1: $(400+240)/2= 320$

Profit & Loss Expected June 30th	
Revenues	320
Δinventories	25
Costs	-396
V.A.	-51
Workers	-25
EBITDA	-76
Ammortizations	-5
EBIT	-81

Figure 82. STEP 4: Profit & Loss statement T1 scenario 2 (source: author notes)

Since costs are still higher than revenues, the EBIT remains negative.

The budget and the final statements develop as follows:

	Jan.	Feb.	March	April	May	June	TOT.
Revenues current year				53,33	53,33	53,33	160,00
Revenues previous year	33,00	33,00	34,00				100,00
Cash Inflows From Current Operations	33,00	33,00	34,00	53,33	53,33	53,33	260,00
Payment suppliers current year		- 66,00	- 66,00	- 66,00	- 66,00	- 66,00	- 330,00
Payment suppliers past year	- 30,00	- 30,00					- 60,00
Personnel expenses	- 3,85	- 3,85	- 3,85	- 3,85	- 3,85	- 3,85	- 23,08
Cash outflows From Current Operations	- 33,85	- 99,85	- 69,85	- 69,85	- 69,85	- 69,85	- 413,08
CFfCO	- 0,85	- 66,85	- 35,85	- 16,51	- 16,51	- 16,51	- 153,08
Capex							-
FCFO	- 0,85	- 66,85	- 35,85	- 16,51	- 16,51	- 16,51	- 153,08
Taxes (ex TCL)					- 5,00		- 5,00
Taxes (advance)					- 2,35		- 2,35
FCFO after Tax	- 0,85	- 66,85	- 35,85	- 16,51	- 23,86	- 16,51	- 160,43
Dividends							-
Equity issue							-
Debt issue							-
Debt repayment							-
CFFF	-	-	-	-	-	-	-
Total Cash Flow (FCFO after tax + CFFF)	- 0,85	- 66,85	- 35,85	- 16,51	- 23,86	- 16,51	- 160,43
Starting NFP	- 85,00	- 85,85	- 152,69	188,54	- 205,05	- 228,92	
Terminal NFP	- 85,85	- 152,69	- 188,54	- 205,05	- 228,92	- 245,43	- 253,94
Interests						- 8,51	

Figure 83. STEP 4: Budget scenario 2 (source: author notes)

Profit & Loss Expected June 30th		Asset & Liability Expected June 30th			
Revenues	320	Trade receiv.*	160,00	Trade Payables*	66,00
Δinventories	25	Inventories*	75,00	Workers*	1,92
Costs	-396	PCA	195,00	CTL	-2,35
V.A.	-51			NFP	253,94
Workers	-25			Equity	200,00
EBITDA	-76			Net profit	-89,51
Ammortizations	-5				
EBIT	-81				
Interests	-8,51				
Before tax Profit	-89,51				
Taxes	0,00				
Net profit	-89,51				
			430,00		430,00

Figure 84.1-84.2. STEP 4: Final Profit & Loss and Asset & Liability statement T1 scenario 2 (source: author notes)

The Profit & Loss statement shows a negative performance, but much better than the one presented in the third step. The current working capital is more or less the same as the first scenario (167,08).

With this hypothesis of solution, it is clear that an increase in price is not enough to cover such high costs, and it is to be considered that it has been calculated as immediate increase. In other words, the rise in price is estimated as if it started from January 1 of the current year, even if it is not a very realistic situation. This is because few companies are able to provide a different quotation for every order they get, and to make it enter into force immediately. A lot of companies are able to increase the price only after some months (4/6) because in the current year they have to process order placed years before, whose price has already been fixed and cannot be modified. Furthermore, some companies, whilst they could have the possibility to add a percentage to their selling price, do not retain enough competitive power over customers to do so.

In the next paragraph, the final step attempts to provide an additional solution for the company.

4.3.6 Step 5

Since the increase in costs caused complications and instability in the relationship with suppliers, this step tries to buffer this problem working on the relationship with customers. In other terms, the credit towards client will not last 90 days as previously fixed, instead it will be reduced to 30 days, like for the debt towards suppliers. As for the other steps, both scenarios are analysed.

Scenario 1

	Jan.	Feb.	March	April	May	June	TOT.
Revenues current year		46,67	46,67	46,67	46,67	46,67	233,33
Revenues previous year	33,00	33,00	34,00				100,00
Cash Inflows From Current Operations	33,00	79,67	80,67	46,67	46,67	46,67	333,33
Payment suppliers current year		- 43,50	- 43,50	- 43,50	- 43,50	- 43,50	- 217,50
Payment suppliers past year	- 30,00	- 30,00					- 60,00
Personnel expenses	- 3,85	- 3,85	- 3,85	- 3,85	- 3,85	- 3,85	- 23,08
Cash outflows From Current Operations	- 33,85	- 77,35	- 47,35	- 47,35	- 47,35	- 47,35	- 300,58
CFFCO	- 0,85	2,32	33,32	- 0,68	- 0,68	- 0,68	32,76
Capex							-
FCFO	- 0,85	2,32	33,32	- 0,68	- 0,68	- 0,68	32,76
Taxes (ex TCL)					- 5,00		- 5,00
Taxes (advance)					- 2,35		- 2,35
FCFO after Tax	- 0,85	2,32	33,32	- 0,68	- 8,03	- 0,68	25,40
Dividends							-
Equity issue							-
Debt issue							-
Debt repayment							-
CFFF	-	-	-	-	-	-	-
Total Cash Flow (FCFO after tax + CFFF)	- 0,85	2,32	33,32	- 0,68	- 8,03	- 0,68	25,40
Starting NFP	- 85,00	- 85,85	- 83,53	50,21	- 50,88	- 58,92	
Terminal NFP	- 85,85	- 83,53	- 50,21	- 50,88	- 58,92	- 59,60	- 62,98
Interests						- 3,39	

Figure 85. STEP 5: Budget scenario 1 (source: author notes)

Compared to Scenario 1 step 4, the Net Financial Position shows a better performance (from -159,31 to -62,98), showing a lower need of external financing.

The final statements are the following:

Profit & Loss Expected June 30th	
Revenues	280
Δinventories	25
Costs	-261
V.A.	44
Workers	-25
EBITDA	19
Ammortizations	-5
EBIT	14
Interests	-3,39
Before tax Profit	10,61
Taxes	-5,31
Net profit	5,31

Asset & Liability Expected June 30th			
Trade receiv.*	46,67	Trade Payables*	43,50
Inventories*	75,00	Workers*	1,92
PCA	195,00	CTL	2,96
		NFP	62,98
		Equity	200,00
		Net profit	5,31
	316,67		316,67

Figure 86.1-86.2. STEP 5: Final Profit & Loss and Asset & Liability statement T1 scenario 1 (source: author notes)

The P&L statement shows a profit of 5,31, while the working capital is reduced to 76,24, marking an improvement of the performance.

Scenario 2

	Jan.	Feb.	March	April	May	June	TOT.
Revenues current year		53,33	53,33	53,33	53,33	53,33	266,67
Revenues previous year	33,00	33,00	34,00				100,00
Cash Infows From Current Operations	33,00	86,33	87,33	53,33	53,33	53,33	366,67
Payment suppliers current year		- 66,00	- 66,00	- 66,00	- 66,00	- 66,00	- 330,00
Payment suppliers past year	- 30,00	- 30,00					- 60,00
Personnel expenses	- 3,85	- 3,85	- 3,85	- 3,85	- 3,85	- 3,85	- 23,08
Cash outflows From Current Operations	- 33,85	- 99,85	- 69,85	- 69,85	- 69,85	- 69,85	- 413,08
CFfCO	- 0,85	- 13,51	17,49	- 16,51	- 16,51	- 16,51	- 46,41
Capex							-
FCFO	- 0,85	- 13,51	17,49	- 16,51	- 16,51	- 16,51	- 46,41
Taxes (ex TCL)					- 5,00		- 5,00
Taxes (advance)					- 2,35		- 2,35
FCFO after Tax	- 0,85	- 13,51	17,49	- 16,51	- 23,86	- 16,51	- 53,76
Dividends							-
Equity issue							-
Debt issue							-
Debt repayment							-
CFFF	-	-	-	-	-	-	-
Total Cash Flow (FCFO after tax + CFFF)	- 0,85	- 13,51	17,49	- 16,51	- 23,86	- 16,51	- 53,76
Starting NFP	- 85,00	- 85,85	- 99,36	81,87	- 98,38	- 122,25	
Terminal NFP	- 85,85	- 99,36	- 81,87	- 98,38	- 122,25	- 138,76	- 143,84
Interests						- 5,08	

Figure 87. STEP 5: Budget scenario 2 (source: author notes)

Profit & Loss Expected June 30th	
Revenues	320
Δinventories	25
Costs	-396
V.A.	-51
Workers	-25
EBITDA	-76
Ammortizations	-5
EBIT	-81
Interests	-5,08
Before tax Profit	-86,08
Taxes	0,00
Net profit	-86,08

Asset & Liability Expected June 30th			
Trade receiv.*	53,33	Trade Payables*	66,00
Inventories*	75,00	Workers*	1,92
PCA	195,00	CTL	-2,35
		NFP	143,84
		Equity	200,00
		Net profit	-86,08
	323,33		323,33

Figure 88.1-88.2. STEP 5: Final Profit & Loss and Asset & Liability statement T1 scenario 2 (source: author notes)

Even with the reduced credit towards customers, the situation remains still negative for the company in case of 30% incidence of transport costs on overall costs. The working capital, however, shows a better performance (60,41) thanks to the reduced trade receivables.

Next figure summarizes the most relevant results of this simulation:

	SCENARIOS	EBIT	NET PROFIT	NFP (NET FINANCIAL POSITION)
STEP 1: increase in transport costs	1 (5% incidence of transport costs)	-12	-16,76	118,19
	2 (30% incidence of transport costs)	-147	-153,37	209,80
STEP 2: increase in raw material price	1 (5% incidence of transport costs)	-66	-71,40	154,83
	2 (30% incidence of transport costs)	-201	-208,01	246,44
STEP 3: debt towards suppliers reduced to 30 days	1 (5% incidence of transport costs)	-66	-72,96	199,89
	2 (30% incidence of transport costs)	-201	-210,37	314,80
STEP 4: increase in final price to customers	1 (5% incidence of transport costs)	14	3,81	159,31
	2 (30% incidence of transport costs)	-81	-89,51	253,94
STEP 5: credit towards customers reduced to 30 days	1 (5% incidence of transport costs)	14	5,31	62,98
	2 (30% incidence of transport costs)	-81	-86,08	143,84

Figure 89. Case simulation final results (source: author notes)

The simulation developed in this chapter provides only a general hypothesis and does not necessarily reflect real situations. However, it is useful in order to understand the dynamics of supply chains during the last period, and to provide food for thought for companies that want to keep their realities sound and resilient and prevent them from major and irreparable disruptions.

From this last chapter it has emerged that it is not enough to find and implement temporary solutions as an attempt to face up to the problems and disruptions brought about by this pandemic because, even though they may be effective in the short term, they do not guarantee stability and resilience in the long run.

All types of risks, especially those with high and unpredictable impact like epidemic risks, should always be monitored and controlled by companies, which should have a carefully developed risk management plan with efficient mitigation measures to manage and reduce such risks and their impact. This is even more important for companies involved in international supply chains and with overseas partners (especially Chinese companies) on which they rely for the procurement of the resources necessary for their sustenance. These companies are far more exposed to such kinds of risks, and the COVID-19 pandemic should be taken as a model for creating integrated and comprehensive risk management plans to face up to any kind of potential disruption in the most efficient way and ensure long-term resilience.

CONCLUSION

The recent COVID-19 pandemic has definitely upset international trade and the intricate relations between companies. As it was explained in the first chapter, international bonds between Italian and Chinese organizations have experienced continuous development, making China one of the most important sources of wealth for our country. Indeed, it is now the second importing country for Italy. Nevertheless, their relationship has always been unbalanced, since their trade flows show a ratio of 3 to 1, meaning that Italian imports from China are three times higher than its exports. This factor is worth considering because it underlines the low competitive power of Italian companies compared to Chinese ones, and the consequent high dependence on them, especially regarding the procurement of raw materials and semi-finished products essential for the core activities and production. The pandemic has not significantly changed the trade structure between these two countries, since their trade flows kept rising, but it created some problems in the management of their relationships mainly due to economic disruptions, problems that have not been considered important until recently. Such issues and the consequent disruptions are related to the development of international supply chains and are the result of the growing globalization and internationalization of economic activities.

As a matter of fact, the evolution of international supply chains and the overdependence on other countries for the procurement of resources and the export of goods have brought companies to be exposed to greater risks, some of which have emerged with the outbreak of the pandemic. Therefore, in order to understand which kinds of threats affect companies engaged in international supply chains, the second chapter introduced the concept of risk management and tried to provide an overview of the most relevant risks, taking into consideration both common and uncommon ones, and more importantly their probability and impact. This was necessary to recognize the importance of supply chain risk management and of the creation of supply chain risk management plans, especially when it comes to realities that rely on overseas partners like Italy. Such plans, if carefully developed, are fundamental to detect and manage the most important risks, even those with low probability and high impact, and provide companies with the guidelines to mitigate their effects and prevent major disruptions. This is the reason why the second chapter has been conceived.

Moving from theory to practice, the third section presented the actual risks that COVID-19 has caused to supply chains. The study was carried out focusing on logistics and transport, which are the most severely affected sectors, and taking into consideration three main elements: maritime transport, air transport and cost of raw material. The chapter tried to offer a comprehensive and detailed insight into the real effects of the pandemic on companies, and of all the consequences that followed. Organizations were not ready to tackle these unexpected problems in such a short time, neither did they know where to start, given the uniqueness and unpredictability of this global event.

The analysis that has been carried out in the third chapter provided the basis for the last section. The increase in the cost of transports and raw materials have been used as primary data to develop a case simulation aimed at assessing the economic and financial impact of COVID-19 on companies' performance. The simulation has been divided into 5 steps, each comprising a different and major degree of impact, and has analysed two different scenarios based on the incidence of transport costs on the overall trade costs of the company. The first three steps had the objective of assessing the real impact both from an economic and a financial point of view. This comprehended both the study of the expected Profit and Loss and Asset and Liability statements, and also the drafting of the expected cash budget, in order to understand the real cash inflows and outflows of the company in the following six months. As an attempt to reflect real situations, it did not only consider the increase in costs, but it has also taken into account the relationship with external partners (in this case suppliers), whose characteristics have a great influence on the company's cashflows, and whose changes can significantly affect its final performance.

This simulation, even if simplistic, has offered an insight into the major effects of the pandemic on the company, and of the bad performance that has come with it. Steps 4 and 5 tried to provide a temporary solution to such problems, both working on the increase of the final price to customers and on the changes in trade relations with them, as a possible attempt to buffer the high costs that the firm has to bear. The simulation, however, has clarified the ineffectiveness of such measures, because they do not only prevent the company from being stable and resilient in the long term, but they neither provide the resources needed to survive in the short term. Therefore, it has underlined the importance and necessity of supply chain risk management plans, because it is only with a correct and integrated analysis of potential

risks that companies are able to implement specific measures to solve these problems and to prevent major disruptions, thus maintaining their stability.

Appendix

Appendix 1: Sample Risks by Category

Source: Supply Chain Risk Leadership Council

External, End to End Supply Chain Risks

Natural Disasters

- Epidemics

- Earthquakes

- Tsunamis

- Volcanoes

- Weather disasters (hurricanes, tornados, storms, blizzards, floods, droughts)

Accidents

- Fires

- Explosions

- Structural failures

- Hazardous spills

Sabotage, Terrorism, Crime, and War

- Computer attacks

- Product tampering

- Intellectual theft

- Physical theft

- Bombings

- Biological and chemical weapons

- Blockades

Government Compliance and Political Uncertainty

- Taxes, customs, and other regulations

- Compliance issues

 - Regulatory financial reporting (e.g., Sarbanes-Oxley)

 - Operations

 - Logistics / Trade

 - Regulatory Approvals - Marketing Approvals

 - Public Health

 - Environmental

 - Trade restrictions (e.g., Buy American Act)

 - Regulatory Audit history

- Currency fluctuations

- Political unrest

- Boycotts

Labor Unavailability and Shortage of Skills

- Availability
- Quality
- Cost
- Unrest
- Strikes and slowdowns

Industry-wide (i.e., Market) Challenges

- Capacity constraints
- Unstable prices
- Lack of competition
- Entry barriers
- Capital requirements
- Specific assets
- Design patents
- Process patents
- Shrinking industry
- Low supplier profitability
- Certification
- Cost trends
- Recessions/Inflation

Lawsuits

- Environmental
- Health and safety
- Intellectual property

Technological Trends

- Emerging technologies (pace/direction)
- Obsolescence
- Other technological uncertainty

Supplier Risks: External, contract manufacturers, or internal business unit

Physical and Regulatory Risks

- Key Suppliers Located in High Risk Areas
- Material Unavailability/Poor Planning
 - Raw materials
 - Other materials
- Legal Noncompliance / Ethical practices
 - Labor practices
 - Safety practices & performance
 - Environmental practices
 - History & outcomes of lawsuits
 - Tax practices
- Regulatory Noncompliance
 - Customs/trade

- Security clearance requirements
- History & outcomes of regulatory audits
- Regulatory certification requirements (e.g., Food & Drug Administration, Federal Aviation Administration)
- Critical disclosure – International Traffic & Arms Regulations

Production Problems

Capacity

- Too little, too much, or diminishing
- Order and shipping times
- Out of stock (i.e., no/low inventory)
- Performance history, equipment age & downtime (manufacturing & testing equipment)
- Repair cycle time

Inflexible Production Capabilities (Long setup times)

Technological Inadequacies or Failures

- Incompatible information systems
- Slow adoption of new technology

Poor Quality

- Defects / contamination in manufactured product
- Mislabeling of items
- Lack of training or knowledge

Lead Times

- Backlogs
- Unresponsive
- Unreliable
- Variable

Financial losses and premiums

Degree of Competition/Profitability

- Downstream integration or too much competition
- Little/no competition - sole source
- Mergers & Acquisitions

Financial Viability

- Inability to sustain in a downturn
- Bankruptcy
- Withdrawal from the market

Management Risks

Inadequate Risk Management Planning

- Lack of business continuity plans
- Lack of requirements for supplier's supplier business continuity plans

Management Quality

- High turnover
- Dishonesty
- Poor labor relations

- Poor metric scorecards
- Substituting inferior or illegal materials/parts
 - Failing to perform required treatments/tests
 - Submitting inaccurate/false invoices
- Lack of Continuous Improvement
 - Unwillingness
 - Cost escalation
 - Opaque processes
 - Opportunistic behavior
 - Inflation of purchase costs
- Dependence on One or a Few Customer(s)
- Poor Communication
 - Internal
 - External
 - Transparency of data & operations
- Upstream (i.e., subcontractors and their subcontractors) Supply Risks
 - Any of the above external/supplier risks
 - Lack of visibility into subcontractors
 - No or poor relationships with subcontractors
 - Diminishing sources of supply
 - Transition "costs" for new suppliers
- Distribution Risks/Disruptions: Inbound or Outbound
 - Infrastructure Unavailability
 - Roads
 - Rails
 - Ports
 - Air capacity/availability
 - Assets - Lack of Capacity or Accidents
 - Containers
 - Trucks
 - Rail cars
 - Ships
 - Airplanes
 - Labor Unrest/Unavailability
 - Truck drivers
 - Rail operators
 - Longshoremen
 - Pilots
 - Cargo Damage/Theft/Tampering
 - Physical damage
 - Theft and other security problems
 - Tracking the damage

- Environmental controls (e.g., temperature, humidity)
- Warehouse Inadequacies
 - Lack of capacity
 - Inaccessibility
 - Damage
 - Environmental controls (e.g., temperature, humidity)
 - Lack of security
- IT System Inadequacies/Failures
- Long, Multi-Party Supply Pipelines
 - Increased chance of all problems above
 - Longer lead time
- Internal, Enterprise Risks
 - Operational risk
 - Loss of Inventory (damage, obsolescence)
 - Equipment loss, mechanical failures
 - Process Issues
 - Process reliability
 - Process robustness
 - Lead time variability
 - Inflexible Production Capabilities (long set up times, etc)
 - Capacity
 - Too little, too much, or diminishing
 - Order and shipping times
 - Out of stock (i.e., no/low inventory)
 - Performance history, equipment age & downtime (manufacturing & testing equipment)
 - Repair cycle time
 - Poor Quality
 - Defects in manufactured product
 - Failure to maintain equipment
 - Lack of training or knowledge
 - Environmental performance to permits / other
 - Government Compliance and Political Uncertainty
 - Taxes, customs, and other regulations
 - Currency fluctuations
 - Political unrest
 - Boycotts
 - Demand Variability/Volatility
 - Drawdown of the stockpile
 - Exceeding maintenance replacement rate
 - Shelf life expiration
 - Surges exceed production, repair, or distribution
 - Shortfalls

Personnel Availability/Skills Shortfalls

- Sufficient number
- Sufficient knowledge, skills, experience
- Union contract expiry
- High turnover rate

Design Uncertainty

- Changes to requirements
- Lack of technical detail
- Lack of verification of product
- Changes to product configuration
- Poor specifications
- Reliability estimates of components
- Access to technical data
- Failure to meet design milestones
- Design for supply chain (e.g., obsolescence, standardization, and commonality)

Planning Failures

- Forecast reliability/schedule availability
- Planning data accuracy
- Global visibility of plans & inventory positions
- Competition/bid process
- Acquisition strategy
- Manufacturability of a design
- Program maturity
- Subcontracting agreements

Financial Uncertainty/Losses

- Funding availability
- Workscope/plan creep
- Knowledge of supplier costs
- Strategic risk

Facility Unavailability/Unreliability/ Capacity

- Facility breakdown
- Mechanical failures
- Sites located in high risk areas
- Adequate capacity

Testing Unavailability / Inferiority / Capacity

- Unreliable test equipment
- Operational test qualifications
- Operational test schedule
- Integration testing
- Transition from first test to mass production

Enterprise Underperformance/Lack of Value

- Customer satisfaction/loyalty

- Liability
- Cost/profit
- Customer demand
- Uniqueness
- Substitutability
- Systems integration
- Other application/product value

Supplier Relationship Management (SRM) Use

- Contract/supplier management availability and expertise
- In-house SRM expertise
- Lack of internal and external communication/coordination
- Supplier development and continuous improvement
- Supplier communications - (EDI web, real time demand, plans, forecasts, technology roadmaps)

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论新型冠状病毒肺炎对全球供应链的影响

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