



Sinergie
SIMA
Management
Conference



Grand challenges: companies and universities working for a better society

Extended Abstracts

University of Pisa - Sant'Anna School of Advanced Studies, Pisa

September 7-8, 2020

Electronic Conference Proceedings of Sinergie - Sima Management Conference
Grand challenges: companies and universities working for a better society Pisa, 7-8 September
2020
University of Pisa - Sant'Anna School of Advanced Studies, Pisa

ISBN 97888943937-6-7

Gli Electronic Conference Proceeding sono pubblicati *online* sul portale di Sinergie Italian Journal
of Management
<http://www.sijm.it>

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Via Interrato dell'Acqua Morta, 26
37129 Verona - Italy



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7-8 September 2020

Electronic Conference Proceedings

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a cura di

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Supply chains network during a global crisis: Covid-19 emerging challenges

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Objectives. *The COVID-19 outbreak emerged in China in November 2019 and spread rapidly to almost all over the globe. It presents several emerging challenges for the global economy. It is not the first time that a pandemic has been tackled, however, it is the first time that policymakers take impactful restrictive measures on the firms following a pandemic. The study posits that the supply chains are particularly exposed to the emerging challenges from restrictive measures and day-by-day changing laws in order to fight the spread of the virus.*

Currently, it is almost impossible to outline an accurate picture of the overall situation, not even through analyzing real-time data, integrated with the most important researches on the supply chain and crisis management. Even the whole scientific community is still in turmoil on these issues, trying to produce answers and hypotheses in order to support the entire population to find a potential exit - or coexistence - strategy with the outbreak.

Of course, the COVID-19 pandemic is negatively impacting the entire world economic system; it has a particular multifaceted effect on the majority part of supply chains. Since 2012, the World Economic Forum (2012), had identified a list of possible causes that would have could carried out significant changes on the Supply Chains. Among the possible causes they cited a pandemic, however it was unlikely to foresee a scenario such as today's.

So far, it is known that COVID-19 rapidly exceeded the economic effects of previous post-war scenarios and pandemics. Actually, most of the first forecasts provided by the experts showed that this pandemic is characterized by unexpected features, large incidence of unpredictable and uncontrollable elements (McKibbin and Roshen, 2020). While analyzing the typologies of crises, Baubion - OECD (2013) has pointed out that a pandemic would have the worst impact on the economy because:

- *it affects the entire globe without differences;*
- *it is temporally indefinite;*
- *the economic shock is undetermined in duration and intensity;*
- *it is an event that never occurred during the "modern history", from the post-war onwards.*

Thus, the pandemic represents a major challenge for both policymakers and businesses. Within supply chains, the most critical effects will potentially occur on SMEs, embedded in that supply chain affected by the current crisis. Actually, these are often the most vulnerable actor of the business landscape. These actors have low power to affect the policymaker choices and an endemic struggle with the liquidity management in the short term.

The high impact on global economic is due to the fact that the most affected countries by COVID-19 coincide with the most industrialized in the world (Baldwin and Di Mauro, 2020a). These are US, China, Japan, Germany, Britain, France, and Italy, among the first countries in the Johns Hopkins COVID-19 ranking (2020).

Indeed, to describe the ongoing scenario a useful metaphor from car competitions as to the entry of the "safety car". At that moment all the positions are "frozen", but the firms more ready and focused on the restart can take advantage by transforming a potential threat into an opportunity. In fact, every crisis should represent also the moment to seize new opportunities and work to configure new business models.

If during "peace time" the approach is focused towards management of "business as usual" issues, in times of extreme uncertainty it might be mandatory to adopt a new approach to decisions and management, therefore all the organizations shall be ready for a "real time" management (McKinsey, 2020a).

Drawing on Supply Chain Network theories (SCN), (Harland 1999, Huemer, 2002, Gadde et al., 2002), in order to describe how firms and supply chains reacted to the pandemic, the study adopts versatility, adaptability and flexibility concepts to describe firms ability to handle unexpected events (Huemer, 2006, Adekola and Clelland, 2020, McKinsey, 2020a). Hence, the article aims to shed light on how the Supply Chain Network approach supports or constrains firms during major crisis:

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RQ: How SCN approach might support firms to react to the emerging challenges brought after COVID-19 outbreak?

The study is focused on the effects on the global supply chains because their modern network configurations made those exposed to potential risks of disruptions. A globalized supply chain is more vulnerable to disruptions because of the ripple effect (also known as risk propagation) - the phenomenon that a sudden disruption at a few nodes in a SCN can spread to neighboring nodes, and eventually adversely impact other firms ((Dolgui et al., 2018; Scheibe and Blackhurst, 2017; Li et al., 2020), and consequentially on the broader social structure. In fact, it should be remembered that, according to the Confindustria Study Center (2020), more than a third of all employees in the country depend on manufacturing industries.

Methodology. *Since we are conducting this ongoing research, the phenomenon is still ongoing, the suitable method is qualitative research, through "multiple case studies" (Yin, 2014). In the past, qualitative research has been proven particularly useful in explore complex research contexts (Finlay et al., 2013). Moreover, qualitative research seems to be the most utilized on crisis research (e.g. Buchanan and Denyer, 2013; Linnenluecke, 2017) as case studies have been successfully applied to investigate several crises as well as the emergence of issues following a crisis (Williams and Shepherd, 2016).*

Even though the possibility to rely on-field research has been precluded because of the lockdown, interviews are planned in order to collect primary data by inviting 20 key actors operating in B2B context, involved in international supply networks.

Moreover, because of the sudden changes of business landscape, it was decided to analyze not only primary data but also secondary sources, such as managerial studies and reports, which allowed the researchers to make use of updated and available field-evidences.

The research provided also a review on the background literature (Huff, 2008, Cronin et al., 2008), which allowed us to identify and develop the theoretical framework (Coughlan et al., 2007) of network supply chain and risk. The literature was gathered through snowball sampling, then categorized and analyzed. This type of review is useful to summarize a huge volume of information on a specific field and to provide results in a clear and explicit way (Davoudi et al. 2016). The comparison of the results of the review with primary data and secondary sources has finally allowed us to formulate new constructs and interesting theoretical contribution to underpin emerging managerial suggestions.

Hence, the study aims to provide support to firms by suggesting new perspectives for managing supply chain emerging issues and future opportunities.

Findings. *Supply Chain Management (SCM) is defined as the integrated management of information and resources flows that range from the supply of raw materials to the delivery of finished product to the customers (Marcone, 2019).*

In order to manage supply chain, the original focus of Porter's Value Chain refers to the organizational process of the company in transforming raw materials or semi-finished products into products. Drawing on the Porter's model, production processes optimization and in-bound and out-bound logistics are key resources for value creation (Huemer, 2006).

Harland (1999) suggests integrating the SCM theory with the Supply Network, considering the firm as a link with a network of partners - upstream and downstream - of the supply chain. Here, the inter-organizational relationships between the actors, upstream and downstream of the firm's supply chain, generate dyadic interactions (Omta et al., 2001).

An important contribution to the Supply Network was developed from the IMP group's Industrial Network Approach (Industrial Marketing and Purchasing), which claims that SCM's perspective contributes substantially to understanding the efficiency of material flows, but does not consider that relationships are not independent and isolate, but embedded and intertwined (Gadde et al 2002). The concept of Supply Network clarifies how to develop business relationships with suppliers and combine these relationships in efficient supply chains (Huemer, 2002). From the Industrial Network approach, the SC is seen as an interconnected network of activities, resources and actors. The development and management of these relationships are a "complicated exercise" for all firms, regardless of their size or the industrial sectors in which they operate (Gregori et al., 2017; Håkansson and Ford, 2002; Gadde et al., 2012; La Rocca et al., 2013). Furthermore, the heterogeneity of the actors involved within the supply network means that they can perceive the network, its boundaries and the nature of the relationships in different ways. The indeterminate nature of networks is one of the intrinsic characteristics: the network and the relationships within the actors are developed towards heterogeneous goals. Therefore, no firm can be identified as the focal firm of the structure. The dynamism is conditioned by the continuous interactions and it enacts a process of mutual adaptation among firms. The awareness of the network context and horizon as well as the types of interdependencies, and its coordination and relative positioning, become firm's key processes in order to develop business relationships. However, the framework does not clarify what processes firms, within complex networks, should deploy in the presence of an emergency or how they can manage the risk of a major emergency such as that of a pandemic or how it can reconfigure itself, transform or destroy itself in these situation.

In fact, the supply chain network studies are mainly focused on "peace time", offering a conceptualization of supply chain structures, interdependencies among the actors, positioning and coordination (Huemer, 2002). These

studies are not well suited to describe the “crisis time” risks such as those of the Covid-19 outbreak. The study will provide new insight to this literature during “crisis time”.

However, while interactions with other firms facilitates access to resources (Pfeffer and Salancik, 1978), any interdependence increases the risks in turbulent conditions in which every company is more vulnerable (Sheffi and Rice Jr, 2005). The supply chain risks are of different nature and can be classified into operational and disruption risks (Ivanov, 2020, Tang, 2006, Tomlin, 2006, Craighead et al., 2007, Ivanov, 2018, Choi et al., 2019, Xu et al., 2020). Ivanov (2020) points out two main risk categories for supply chains in the presence of the pandemic:

- *Operational risk: relating to the performance of day-to-day operations and activities that is compromised and that therefore deadlines and agreements previously taken cannot be respected.*
- *Disruption risk: it is a profound impact on the entire global supply chain structure that compromises the success of the entire flow.*

A specific case of SC disruption risks is represented by the occurrence of natural catastrophic events, such as epidemics. The risks related to these events are characterized by three elements: 1. long-term persistence of the event and unpredictability about its progress, 2. simultaneous interruption of the SC (chain effect) and spread of the population infection (e.g. pandemic propagation), 3. simultaneous interruptions of supply, demand and logistics infrastructure, (Ivanov, 2020). This triad of elements can be fully seen in the current system crisis caused by the COVID-19 pandemic.

In the specific situation of the emergency of Covid-19 - at the time when the authors are working on the research - the following events occurred that influenced and made most of the business management processes unpredictable:

- *the choices of the policymaker (Cerved, 2020) on:*
 - *Duration of the lockdown*
 - *Incentives and aid to businesses*

In particular, the duration and persistence of the lockdown will be also a direct effect of the country's economic damage. This will be also influenced by how the governments will be able to react and manage the current pandemic crisis by safeguarding the economic continuity of the country's ecosystem while managing to save lives.

- *the unpredictability of the economic shock (analysed from Confindustria Study Center, 2020), it has two main areas of influence:*
 - *Demand: there has been a stop to the household consumption forced to stay at home, indefinitely interruption, to date to be determined, for the entire tourism sector, interruption or drastic reduction of import / export;*
 - *Supply: directly due to the closure of commercial activities to the customers, indirectly due to interruptions in supplies and discontinuity of production at a global level.*
- *crisis management in other countries connected to the global supply chain (Baldwin and Di Mauro 2020b).*

Therefore, to ensure continuity or manage the interruptions “imposed” by the policymaker, the study identifies the challenges that firms have to deal with in order to survive the emergency.

The study suggests that adopting a supply chain network perspective in pandemic times might lead to several advantages. These advantages can be referred to an increased adaptability, versatility and flexibility within the network thanks to a higher control of the supply chain structure and awareness of the interdependencies among the actors. These, in turn, support the actors in improving mutual adaptation and manage repositioning mechanisms within the network. Thus, having an SCN approach would allow the firms to increase their awareness of the other actors embedded in the supply network, thus allowing them to manage flexibility, adaptability and versatility in the case of a crisis.

The development of these practices constitutes a non-exhaustive response to the two main types of crisis that the supply chain might face: the operational crisis management for firms that are operating within supply chains that the policymaker decided to be “essential”; and the total disruption for those supply chains which the policymakers decided to block.

Research limits. *The limitations of this ongoing study are connected to the continuous changing scenario and to the potential impact of the policymaker's further decisions on lockdown to which the firms are subordinated. Furthermore, the limited data leads to the possibility of being able to develop further studies trajectories drawing on both qualitative methodology - thus longitudinal studies - and quantitative empirical studies - thus for assessing the response of a large and heterogeneous number of actors - for a more complete study of the dynamics that characterized supply chain management during the crisis. Certainly, it is also interesting to have a differentiated point of view between “essential” firms that have maintained continuity (for example, fundamental companies such as agri-food) and companies that have instead seen their activity blocked by government decisions (for example clothing, wood, furniture and furnishings sector, etc.).*

Practical implications. *The unexpected and complex consequences brought by Covid-19 outbreak - and further policymaker decisions - has forced firms and supply chains to adapt in order to continue their activities. The study observes different settings of firms: there are entire supply chains whose are forced to stop, some of those with high risk of running out of money; for the supply chains which continued to do business, there are several which needed to reorganize internal and external processes and other which has to rethink their sales organization; finally, there are some firms which has to rethink their whole strategy, identifying new buyers and new sales channels.*

Thus, the practical implications related to the emerging challenges brought from Covid-19 outbreak means that

firms have to manage the following challenges within the Supply Network:

- *Maintaining relationships with customers: all the firms are called to establish a direct channel with consumers and buyers in order to ensure business continuity. Choices in this field might lead to some further issues to manage, such as:*
 - a) *Sales intermediates and wholesaler: they might become useless and lose their position in the network.*
 - b) *New opportunities for the manufacturing company: they can develop a direct sales channel with their buyers.*
 - c) *The sales reps are no longer allowed to travel from customer to customers, but they have to manage customer relationships through digital tools and platforms. All business relationships were translated into digital channels. Here, the level of digitization of the firm at the time of the outbreak of the pandemic plays a crucial role to manage the crisis (Caiozzo and Guenzi, 2020).*
- *Policymakers' decisions: Since supply chains are now globally interweaved, the risks of interruption due to the different decisions of each countries' policymaker might cause the emerging need to rethink supply choices in terms of supplier and buyers, distribution and sales channels and logistics.*
- *Demand flattening: due to the forced block of consumption consequent to typical consumers behaviors in times of crisis, often termed as "wait and see" approach. Moreover, because almost all the population around the world is under lockdown into their homes, for these, it is almost impossible to go shopping unless they use e-commerce, where this is still functioning.*
- *Demand volatility: the external shock forces firms to manage the production and activities with an "accordion effect":*
 - a) *In crisis' times there are some goods whose demand is skyrocketing - the case of flour, yeast, DIY and home gym products is the best example. This shift asks companies to reorganize their configuration and their supply management and therefore the need to communicate quickly and effectively also with the supplier base (McKinsey 2020a);*
 - b) *However, there will be products that will be almost impossible to sell (products that require interaction, installation at the home or the buyer's premises, which take advantage of closed distribution channels due to regulations, etc.) and which therefore will have to be rescheduled in the procurement and production (McKinsey 2020a).*
- *Resource management: the pandemic is a great challenge for all the firms according to resource management. In terms of supply chain network, the emerging challenges can be addressed to the following issues:*
 - a) *People first: firms have to guarantee people safety and safeguarding by creating environments in compliance with hygiene standards (McKinsey 2020a).*
 - b) *Insurance: protect staff who go to workplaces with the necessary insurance coverages.*
 - c) *Training and coordination: the issuing of new laws requires to coordinate the entire workforce in short terms. The creation of interdisciplinary teams could be the turning point to define the best strategy to face the crisis and coordinate activities to manage crisis processes (Porsche Consulting 2020).*
 - d) *Re-organize: decide which people are to be kept working at the physical location and which ones can be shifted to smart-working mode, or - in the worst case - put into forced stop (Lay-off or paid leave or suspension of occasional work relationships or collaboration). To enhance smart working, firms have to facilitate that for all those functions that do not require specific presence in a physical location. The firms should provide all the technical and ICT devices to allow people work from their homes.*
 - e) *Technology: To ease smart working firms are called to provide digital tools and devices. Thus, not only VPN-server access and corporate e-mail plus laptop and smartphone; but it will be necessary to have already set all the project management tools in order to check the workflow processes (platforms such as Trello, Slack or Jira) and to ensure information sharing (Skype, MS Teams, Zoom, Telegram, Google G Suite for Business). Information sharing within the organization and between organizations will play a crucial role in managing and overcoming this crisis (Harari 2020).*
- *Cost management: the firms might face rising costs related to the pandemic and for being compliant with health care regulations. These costs will be of two major categories:*
 - a) *Direct costs: sanitization of environments, PSD (Personal safety devices), ICT devices (smartphones, laptops, printers, etc.) for workers in smart working.*
 - b) *Indirect costs: running a business with restrictions means, in the best scenario, a lower productivity and lower level of sales, with a less efficient use of commercial and production spaces in order to ensure social distance between people and consequent compliance with the regulations issued by the policymaker.*
- *Strategy in real time: Firms and entire supply chains have the need to review even the whole business strategy. Firms are required to adopt a real time management approach to cope with the unpredictability of the events. Thus, it is possible to identify three different horizons to reimagine business strategy (McKinsey 2020b):*
 - a) *Short/very short-term: manage cash for ensure business safety and adapt quickly to new emerging opportunities;*
 - b) *Mid-term: manage to ramp-up the business to achieve a "new normal" operations, here the coordination with the supply chain is crucial to define new interactions processes;*
 - c) *Long-term: begin to a "normal" approach and re-align "real time" operations to the firm's strategic vision.*

In these cases, financial and structural stress could be potential risks and failure scenarios. It could be appropriate to create a new system of indicators to monitor the evolution of events (McKinsey 2020b).

Originality of the study. The study analyzes the implications of the current Covid-19 Italian pandemic crisis and the immediate emergent challenges in supply chains management. The uniqueness of the study in addressing a new and still ongoing phenomenon makes the considerations outline in the article in continuous change, presumably there will be several changes with the continuous evolution of the pandemic. As a matter of fact, the research is carried out “inside the eye of a hurricane”, since at the time when the document is developed the lockdown has not yet been removed, it has not yet gone to “Fase 2” (the total lockdown in Italy is named “Fase 1”, the beginning of the re-opening is named “Fase 2”). and therefore, there is still apprehension and full uncertainty about the timing and methods that the government plans to deploy in order to encourage the restart of industrial and commercial activities.

The results of the study include a series of insights that contribute to the theory of supply chains network and in managing the effects of the pandemic. The study attempts to reach a conceptualization of the management challenges responses that can be deployed during a profound crisis such as that triggered by the current Covid-19 outbreak. These insights might become the principles to begin the study of the ex-post effects of this event into supply chains network. Furthermore, it could be useful to begin the understanding on how to manage the re-start of the business landscape and consequently analyze the response of firms to the whole phenomenon.

Furthermore, the research aims to contribute also to managerial literature, offering practical elements to manage supply chain crises, thus a set of operational implications that firms could follow to secure the continuity of their supply chain and therefore to face and live with potential future crises (which of course we hope will not occur).

Key words: Supply Chain; Covid-19; Epidemic outbreak; Risk management; Pandemic plan; Resilience

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