

IMPACT PATHWAY

Research opportunities for a more resilient post-COVID-19 supply chain – closing the gap between research findings and industry practice

Post-COVID-19
supply chain

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Abstract

Purpose – The COVID-19 crisis has caused major supply chain disruptions, and these can be traced back to basic supply chain risks that have previously been well identified in literature. The purpose of this paper is to suggest a pathway for closing the gap between supply chain resilience research and efforts in industry to develop a more resilient supply chain.

Design/methodology/approach – Based upon virtual roundtables with supply chain executives, supplemented with interviews and publicly available datapoints about COVID-19 impact on the supply chain, we explore challenges in industry and suggest opportunity areas where research can support efforts in industry to improve supply chain resilience.

Findings – During the COVID-19 crisis, participating supply chain executives are experiencing textbook supply, demand and control risks in the supply chain. They also observe a lack of preparedness, shortcomings of current response plans and the need for greater supply chain resilience. Focus areas in improving resilience mirror generic recommendations from literature and provide a rich opportunity to reduce the gap between research findings and efforts in industry.

Research limitations/implications – More empirical, event-based and less conceptual research into supply chain resilience has been called for several times during the last two decades. COVID-19 provides a very rich opportunity for researchers to conduct the type of research that has been called for. This research may contribute to the structurally de-risking of supply chains. Areas of research opportunity include decision models for supply chain design that avoid overfocusing on costs only, and that consider the value of flexibility, short response times and multiple sources as well as methods for enriching supplier segmentation and evaluation models to reduce a focus on savings and payment terms only.

Practical implications – Key levers for de-risking the supply chain include the need to balance global sourcing with nearshore and local sourcing, the adoption of multiple sources and a greater utilization of information technology to drive more complete and immediate information availability. Perhaps most importantly, talent management in supply chain management needs to promote a focus not just on costs, but also on resilience as well as on learning from current events to improve decision-making.

Social implications – There is a great opportunity for supply chain managers to grow their contribution to society beyond risk response into the proactive reduction of risks for the future. Researchers can serve society by informing this progress with impactful research.

Originality/value – This article offers initial empirical exploration of supply chain risks experienced in the context of COVID-19 and approaches considered in industry to improve supply chain resilience. Opportunities for empirical, event-based and less conceptual research that has been called for years, are identified. This research can help close the gap between supply chain resilience research and efforts in industry to improve supply chain resilience. Hopefully the research opportunities identified can inspire the flurry of research that can be expected in response to the multiple special issues planned by journals in our field.

Keywords Supply chain risk, Supply chain resilience, COVID-19

Paper type Research paper



1. Introduction

A survey published on March 28 by the Chartered Institute of Procurement and Supply found that 86% of supply chains are impacted by the COVID-19 pandemic [1], and the Institute for Supply Management found that between early March and late March, the number of companies experiencing supply chain impact rose from 80 to 95% [2]. According to Walmart, multiple industries and categories (ranging from hand sanitizer and toilet paper to hair products) have been facing massive panic buying due to the COVID-19 pandemic [3], and the world's largest 1,000 companies had over 12,000 factories, warehouses and operations in quarantined regions in early March (Linton and Vakil, 2020, p. I). This has led to calls in the popular management press for the development of more resilient supply chains (Linton and Vakil, 2020, p. I) and the development of supply chain recovery scenarios and approaches (Simchi-Levi, 2020). Amongst the approaches suggested in popular management press for improving resilience and developing a recovery plan are collaborating with suppliers (Linton and Vakil, 2020, p. II) and accelerating technology implementation (Van Hoek and Lacity, 2020).

Existing supply chain resilience literature would categorize panic buying as a demand risk, and the closure of supplying factories and warehouses as a typical supply risk (Christopher and Peck, 2004; Vanpoucke and Ellis, 2019). Unfortunately, existing supply chain resilience research may not have contributed to its fullest potential to an understanding of supply chain risks in industry. A survey with over 700 respondents conducted by Bassware found that 60% of responding procurement managers experience a lack of transparency in their supply chain [4]. Beroe, a procurement market intelligence service, published survey data based upon 450 companies from around the world on March 22 [5], indicating that only 49% of respondents had rolled out business continuity plans for the COVID-19 crisis and that only 57% of respondents have identified critical supplies and suppliers. Perhaps most interesting, 64% of respondents indicated that they anticipate a return to business as usual within 3–6 months. ISM also found that 44% of respondents to its survey did not have plans in place to cope with supply disruptions from China [6]. These findings imply that while we are witnessing textbook supply and demand risk scenarios, and while the popular management press is calling for resilience and recovery scenario development, many companies do not have a plan for resilience and recovery and most companies are hoping for things to just go back to normal in short notice. This suggests that there is a gap between the understanding of supply chain risks in literature and that in the industry.

There have been consistent calls for more empirical and event-based research on supply chain risk and resilience in literature. As early as in 2007, for example, Kahn and Burnes (2007) called for more integrated research into supply chain risk management approaches and tactics for improving supply chain resilience. Sohdi *et al.* (2012) called for more empirical and event-based research. And as recent as earlier this year, Scholten *et al.* (2020) offered, in this journal, an editorial reflection about how publications on supply chain resilience often have a limited empirical base and that a considerable part of literature is conceptual in nature. Fortunately, there have been several calls for special issues on COVID-19 and the supply chain, including in JOM, DSI, SCMIJ and IJPR, and as a result, we may anticipate a rich stream of research in the coming period. Clearly now is a good time to address the calls for more empirical and event-based research that is less conceptual in nature. On top of that, a really good impact pathway for this research is the opportunity to begin to close the gap between the understanding of the subject in literature and the understanding of the subject in industry. This may support progress toward achieving greater supply chain resilience and supply chain recovery.

The purpose of this impact pathway paper is to not only further inspire research but also to initiate empirical exploration of supply chain events surrounding COVID-19. By initiating empirical exploration, we will be able to identify opportunities for impactful and relevant empirical and event-based research that may help close the gap between supply chain resilience research and practice in industry. In order to achieve this supply, chain executives

were interviewed, public sources reporting on COVID-19 supply chain developments were studied and we participated in several virtual and online roundtables with executives and open forums on the topic. While this does not represent a full systematic literature review or a full empirical study, it does enable very timely identification of an impact pathway for the research called for by many journals.

The next section will further consider example supply chain risk drivers identified in literature in order to ground our exploration a bit further in existing research findings. After an overview of the method adopted for the empirical exploration, the next section shares empirical findings on the risk drivers identified in literature. This, in turn, provides the basis for identifying opportunities for research that can help inform industry efforts to build a more resilient supply chain.

2. Literature has identified demand and supply risk factors going back at least six decades

The roots of supply chain resilience can be traced back in literature to the late 1950s. The bullwhip effect, first introduced by Forrester (1958, 1961), is a foundational theory for the operations and supply chain management discipline, and it directly relates to demand risks and how those can cause disruption throughout the supply chain. Beyond the need to manage the risk of demand signal amplification throughout the supply chain that Forrester's work introduces, Christopher and Peck (2004) and Mena *et al.* (2018) are amongst the authors that list out a broader number of categories of supply chain risks, including supply, demand and control risks. Pettit *et al.* (2010) build upon this work by listing common risk consequences of common supply chain management decisions. These include the risk increases resulting from the globalizing supply chains, focusing on supplier reduction for greater procurement negotiation leverage and establishing specialized factories for greater economies of scale. In a recent JSCM webinar on COVID-19 and supply chain, Ellram [7] builds upon these findings by stating that a lot of the resilience challenges have arisen from a cost obsession and short-term cost focus in supply chain management. She indicates that the move to low-cost country sourcing has led to long pipelines and limited local backup supply. Finally, Ellram claims that the fixation on financial statements has led to extended payment terms and inventory being moved to the balance sheets of suppliers, while lean techniques may have been applied to widely, reducing agility in the supply chain.

The globalization of the supply chain can indeed achieve a cost of goods sold benefit through economies of scale and the location of production in regions with factor cost benefits. Globalization, however, also lengthens the logistics pipeline, and this introduces the risk of delivery delays and a dependency on remote sources (Harrison *et al.*, 2014). A reduction of the number of suppliers can create leverage in negotiating payment terms and prices, but it also increases the dependency on those suppliers for continued supply. Dependency and supply risk is one of the two axes in the most well-known supplier segmentation from Kraljic (1983). In this segmentation, it is advised that for critical bottleneck supplies, companies focus on ensuring supplies rather than on cost savings, and for more strategic supplies, companies should adopt a more collaborative approach. Further, supply chain techniques that are suggested in literature to combat supply chain risks include active information sharing throughout the supply chain (Wagner and Bode, 2008). Technologies such as RFID and blockchain can accelerate information sharing and improve visibility into inventory positions and logistics flows (Pettit *et al.*, 2019; van Hoek, 2019). This is particularly the case if the information exchange can shift from partial and sequential (one tier at the time) to more fully and instant (van Hoek *et al.*, 2019). Supply chain techniques suggested to combat dependency on a few global suppliers and specialized factories include the use of flexible suppliers (Tang, 2006), ensuring redundant suppliers (Chopra and Sodhi, 2004), inventory buffers and backup sources (Vanpoucke and Ellis, 2019; Kahn and Burnes, 2007), multiple sources and the

sharing of risks between supply chain participants and plants (Manuj and Mentzer, 2008). Figure 1 lists the techniques suggested in literature against the risk factors involved in COVID-19, as identified in the introduction section.

3. Method

While impact pathway papers are not intended to be full empirical studies, we do aim to initiate empirical exploration in this paper. The exploration can inform the identification of research opportunities that can help close the gap between research and industry practice and that can impact managerial actions to improve supply chain resilience. There are three components to our exploration: (1) a review of public newsfeed, (2) participation in online seminars and roundtables and (3) interviews with supply chain executives. Given that our objective is to identify research opportunities and not so much to reach definitive conclusions, this empirical exploration can serve its purpose. Additionally, the COVID-19 pandemic is a new phenomenon and supply chains are very much in flux still, so an initial broad exploration seems fitting. It also offers some initial empirical data, which in and of itself is part of the contribution of this paper.

To ground our discussions with executives in an initial understanding of the impact of COVID-19 on supply chains, we studied various daily and weekly supply chain newsfeeds,

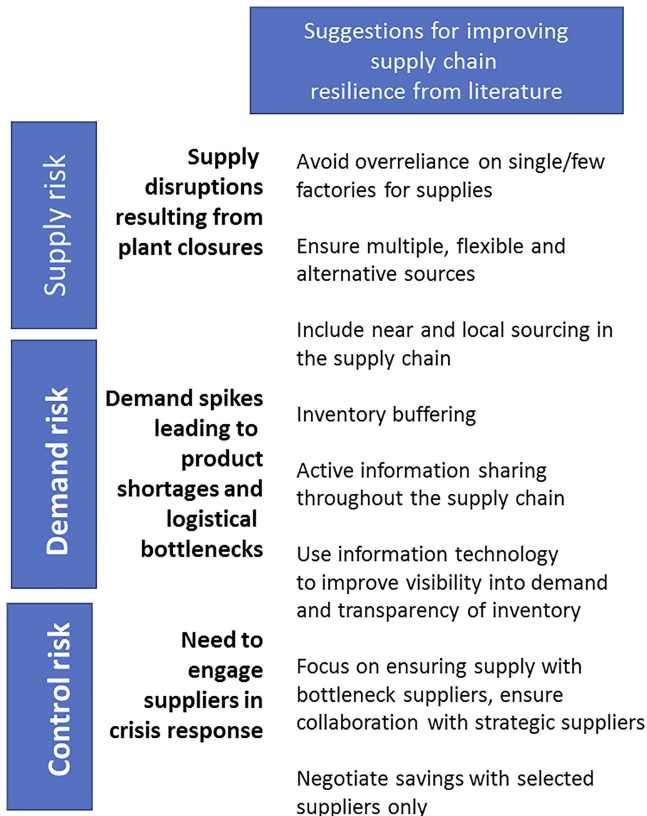


Figure 1. COVID-19 supply chain risks and selected approaches to improving resilience literature

including Supply Chain Dive, Procurement Dive, the CSCMP SmartBrief, SupplyChainBrain, this week in procurement digital newsletter from Ardent Partners and the daily update on the impact of COVID-19 on global supply chains available from riskmethod.com. These sources provide a sense for industry challenges and action areas. Additionally, these sources provided some of the industry datapoints used in the introduction section of this paper.

As a second step, participation in online roundtables, open forums and webinars offered the opportunity to learn from and discuss with executives and thought leaders the challenges, approaches and practices considered for improving supply chain resilience in the context of COVID-19. Similar to a focus group or workshop that might be typically used in early stages of empirical exploration, these sessions helped map out areas worthy of further and deeper exploration in one-on-one interviews with supply chain executives. The events participated in include:

- (1) A webinar from CAPS Research on March 26; <https://www.capsresearch.org/coronavirus/>,
- (2) A virtual open forum discussion, An action agenda for effective post-COVID-19 supply chains, hosted by the *Journal of Supply Chain Management* on April 14; <https://www.youtube.com/watch?v=Jgoe6iCYLF4&t=5s>,
- (3) A webinar hosted by CSCMP on April 24 on the impact of COVID-19 on US trucking market;
- (4) An online roundtable hosted by Reuters on April 24 on implications of COVID-19 on inventory planning, sourcing and procurement,
- (5) A webinar hosted by Ardent Partners on April 28 on “CPO strategies: Paving the way to recovery”; www.virtual.CPOrising.com.

As a third step, interviews were conducted over videoconference with executives from a range of industries including transportation, retail, equipment manufacturing, fast-moving consumer goods, food manufacturing, durable consumer products manufacturing, apparel, technology and software services. These interviews were semi-structured and included high-level questions as well as questions about supply chain resilience topics and focus suggested in literature. Table 1 lists example interview questions. Interviews were held between April 6 and April 25, 2020. The interviews were recorded so that they could be transcribed, coded and revisited during the development of the paper. Quotes from the interviews will be used in the following sections to help illustrate findings and areas of research opportunity identified.

- (1) Is your supply chain impacted by COVID-19? If so how?
- (2) What challenges did and does your supply chain face more specifically? (if needed, inquire about demand, supply and control risks)
- (3) How is your company responding to these risks?
- (4) Did you company have a contingency plan in place that could be deployed?
- (5) Are you considering adjusting the supply base?
- (6) If so, in which way are you doing this? (if needed, inquire about multiple sourcing, local and nearshoring)
- (7) Is your company increasing inventories and reducing a focus on lean in favor of agility?
- (8) Is your company engaging with suppliers to address supply issues?
- (9) If so in what way? (if needed, inquire about extending payment terms, negotiating discounts, joint mitigation efforts)
- (10) Is your company considering technologies to address supply chain challenges? (if needed, inquire about blockchain and digitization)
- (11) Is your company planning changes to its supply chain for after the COVID-19 pandemic? If so, what are they?

Table 1.
Interview questions

These quotes and drafted versions of this manuscript were shared with interviewed executives to ensure correct citation and that the interpretation and analysis of findings fit with the discussion during the interview and the perspective of the interviewed manager. Sharing the citations and drafted findings with participating supply chain executives provided a useful feedback loop that further informed some dialogue and analysis. It also enabled validation and development of the research opportunities identified by contributing supply chain executives.

4. Supply chain risks experienced during the COVID-19 crisis offer textbook examples of supply chain risks

Figure 2 summarizes risks and challenges reported by participating executives in the central column and resilience-improving efforts being pursued and reported in the far-right column. Comparing risks reported and resilience actions pursued in industry with those identified and suggested in literature (relisted from Figure 1 in the far-left column) indicates that there is a lot of consistency and overlap between the insights from literature and perspectives in industry.

4.1 Supply risks

Several different forms of supply disruptions and extended delivery times were reported by participating supply chain executives;

Due to plant closures our lead times extended from days to weeks and from weeks to months with certain products. Until a full reopening the clock may keep running on us and we will not be able to do much about the fact that all our factories are impacted. Account manager of a technology manufacturer.

Some of these were not instant due to the delay of long shipping pipelines;

I have 3 more weeks of inventory on the sea between China and the US but after that we will start running out of inventory quickly and we risk not being able to fulfil demand. Supply chain director of durable manufactured product.

While this delay may appear a short-term benefit of the globalized supply chain, obviously there will also be a delay in shipping once supply ramps back up, creating a longer lasting aftereffect;

Factories are back open in China but it will take them a while to reach full productivity again, partially because their supply lines were also disrupted and have to start back up before assembly can ramp up. This will likely take several weeks. Account manager of a technology manufacturer.

The implication of this is that without changes to the supply chain design, the supply disruptions from COVID-19 will have extended effects, past the closures and quarantining. During this period, there may be logistical bottlenecks:

We can rush some shipments with airfreight but that is more expensive, while there is a reduction in global traffic volumes, the reopening of plants will lead to a rush for transportation capacity and a search for speed. Supply chain manager of a consumer products company.

Perhaps most importantly, several participating supply chain executives shared that they experienced insufficient preparedness for the supply disruptions and a lack of applicability of existing contingency plans to the COVID-19 pandemic:

We have never been through this level of complexity and no historical data is relevant at this point. We were not as prepared to be able to manage supply as you would have hoped we would be. Supply chain VP of a consumer products company.

Supply risk	Suggestions for improving supply chain resilience from literature	Selected risks reported by participating supply chain executives	Resilience efforts targeted and pursued by participating supply chain executives
<p>Supply disruptions resulting from plant closures</p>	<p>Avoid overreliance on single/few factories for supplies</p> <p>Ensure multiple, flexible and alternative sources</p> <p>Include near and local sourcing in the supply chain</p> <p>Inventory buffering</p> <p>Active information sharing throughout the supply chain</p> <p>Use information technology to improve visibility into demand and transparency of inventory</p>	<ol style="list-style-type: none"> 1) Shortage of supply and extended leadtimes 2) Slow ramp up after factories reopen 3) Logistical bottlenecks as a result of rush supplies 4) Lack of preparedness to respond to disruptions and limited applicability of existing plans 	<p>Rebalance supply-lines to include more local and nearshore suppliers and plants</p> <p>Reduce reliance on single plants and single locations</p> <p>Accept inventory level increases for the sake of agility</p>
<p>Demand spikes leading to product shortages and logistical bottlenecks</p>	<p>Inventory buffering</p> <p>Active information sharing throughout the supply chain</p> <p>Use information technology to improve visibility into demand and transparency of inventory</p>	<ol style="list-style-type: none"> 5) Shortterm peaks in certain categories 6) Reductions in demand in other categories 7) Shortterm peak in transportation demand followed by surplus capacity in transportation 8) Need to speed up online and IT capabilities 	<p>Accelerate digitization initiatives for greater visibility</p> <p>Introduce new types of automation</p> <p>Adopt a relationship approach to help suppliers and grow relationship capital for the long run</p>
<p>Need to engage suppliers in crisis response</p>	<p>Focus on ensuring supply with bottleneck suppliers, ensure collaboration with strategic suppliers</p> <p>Negotiate savings with selected suppliers only</p>	<ol style="list-style-type: none"> 9) Need to focus on ensuring supplies and getting priority with disrupted suppliers 10) Seeking inventory and improved terms with suppliers as part of coping with (financial) pressure on the company 	<p>Focus on critical supplies and resist the temptation to opportunistically benefit from softness in the supply market.</p> <p>Only seek savings and payment support from selected suppliers</p>

Figure 2. COVID-19 supply chain risks reported by participating executives and responses they are pursuing

The shocks we are experiencing are different from disruptions and crises in the past, we are executing a similar playbook but much faster and it does not apply to every issue we are dealing with. Supply chain manager of a transportation service company.

We did not see this coming. CPO of a financial services company.

4.2 Demand risks

Participating supply chain executives report a more varied demand situation from that often reported. While there are spikes in demand in certain products, others face a fast reduction. Some of these reductions are near instant, while some are slower;

While demand for food and beverage and essentials grew by 50% in the month of March, demand for apparel and accessories was down by 20% Supply chain VP of US retailer Target.

Demand in automotive is slowly coming to a halt, first it was limited retail activity, now it is reduced mobility. And this is working its way across the supply lines of these manufacturers, Procurement director of manufacturer.

The transportation industry is experiencing several consequences of these demand fluctuations. While initially there was a surge in demand for capacity, with the reduction in economic activity, the demand started slowing down:

The need for rush shipments and the spike in demand led to a large surge in demand and shortage in capacity. After a shortterm peak we are now seeing a lot more capacity, customers are not able to meet transportation volumes contracted and rates are declining. We are focusing on keeping all drivers working 80% and not have some work 100% while others go out of business, Executive, transportation brokerage company.

Freightwaves [8], a transportation market intelligence firm, confirmed this pattern. It reported that in the first half of March, there a large spike in outbound transportation demand, and in the week of March 28, this started leveling down as demand peaks started leveling off.

Some changes in demand drive shifts in channels and delivery modes, and these stimulate a greater focus on digitization and visibility;

We are experiencing a huge shift towards digital and delivery services, we will need greater visibility across the enterprise to enterprise spectrum, Supply chain VP Target.

E commerce is exploding for us, Supply chain director of consumer products company.

4.3 Control risk

When it comes to control risks with suppliers and supply lines, different tendencies are reported by participating supply chain executives. On the one hand, there is a focus on seeking priority (over competition) and collaboration when it comes to scarce supplies, and on the other hand, there is a tendency to pass some of the financial pressure caused by COVID-19 on to the suppliers;

We were able to leverage a supplier relationship to get rush delivery of PPE, some of which we were even able to donate to a local hospital, Procurement director of manufacturing company.

Because we are experiencing a drop in demand and are forecasting a 25% revenue decrease for the year, we are protecting our cash and inventory position. We are asking suppliers to support us in this process, Supply chain director of consumer products company.

We are renegotiating with suppliers, some inventory we are not taking on because the demand is not there anymore, Supply chain manager retailer.

Some CFO's have unilaterally pushed out payment terms with suppliers, procurement will need to communicate this and suppliers are facing many competing requests for support so supplier relationships are very paramount, in particular with your important suppliers CPO of financial services company.

This last quote does illustrate that while a focus on relationships with suppliers is key, there is a risk of companies opportunistically and unilaterally pushing payment terms and conditions. This is an action that may put those very relationships at risk.

4.4 Resilience improving efforts and focus areas

In response to supply, demand and control risks identified by the participating supply chain executives, several efforts to improve resilience are being focused on, as shown in the far-right column of [Figure 2](#).

A large area of focus is on resilience-improving actions in response to the supply-side risks. The CIPS survey referenced at the start of the introduction section found that 58% of survey respondents intend to mitigate risk by moving away from single sourcing, while 47% are considering holding more inventory in the future. Flynn in the JSCM open forum (referenced in footnote 6) advised:

Know your suppliers and where your dependencies are, reshore some manufacturing and reinvest in manufacturing capacity.

Participating supply chain executives do report high levels of daily focus on ensuring supply continuity as well as actions to rebalance supply lines. Some of this focus is on ensuring supply, and some of it is also to benefit from variations in market capacity short-term and in anticipation of mid-term shortages. And the focus is not limited to material and product supplies, it includes efforts around transportation and logistics;

We have very active daily management in place of our supply chain during shut-downs and restarts. We are screening inventory positions, moving products and orders between suppliers in order to keep product flowing. There is also some new capacity that became available in steel manufacturing as the automotive industry reduced production volumes. We are taking advantage of this and are trying to lock in new prices and capacity because when the automotive industry comes back it may be with force and a large backlog of demand so it is key to prepare for that competition now and balance out supply. Procurement director of a manufacturing company.

We need to look at alternative sources and locations, even if this means paying for securing capacity, including airfreight and transportation capacity. Operations director of Alpargatas, a footwear company from Spain.

Interestingly enough, the tariffs on product from China may have driven a degree of readiness that otherwise may not have been in place;

When the tariffs kicked in, we accelerated supply base diversification by reducing the reliance on Chinese sources. We included suppliers in India and Malaysia for example. When China went into shut down because of COVID-19, we were able to shift orders from Chinese suppliers to those new suppliers in India and Malaysia. By the time India and Malaysia went into shutdowns Chinese suppliers were back up and running so we could shift orders back to China. This gave us a huge dividend on our diversification efforts. Procurement director, manufacturing company.

While these quotes may imply lots of short-term adjustments, some companies have been working on the rebalancing of supply lines to reduce the reliance on single global sources by including additional local and nearshore suppliers and plants in their supply chain. Nike has been well underway with this approach. In the past, Nike may have been a poster child for sourcing from a limited number of lower-cost global locations to reduce cost of goods sold and create leverage in controlling supplier relationships. Increasingly, Nike is including nearshore

factories and suppliers (for example, in Turkey for the EU market, and in Latin America, for the US market) and even in-market sourcing into its supply chain. This has enabled the company to be able to respond to consumer demand faster, produce more frequent new product introductions and ship those into regional markets faster. It also reduced the company's dependency on a few global factories and suppliers. The benefit of this nuanced sourcing approach is also that the company remains flexible in sourcing as the crisis moved around the world; when China factories shut down, European factories were still open, and when European factories shut down, American factories were still open and Chinese factories were reopening.

Turning to demand risks, Nike has also created an opportunity to change product lines and product mix frequently. While its suppliers produce orders with great productivity and efficiency, they are also able to shift between product type and range, from one order to the next. This enables Nike to shift capacity in response to demand fluctuations, expected or not, and grow the agility of its supply chain. While participating supply chain executives do report some investment in additional inventory, agility does not have to come at an inventory cost, nor does a focus on lean mean a focus on cutting inventories for that sake of cost reduction;

Investing in inventory may only kick the bucket down the road. When one of our main suppliers was hit by a tornado last year we were able to move orders to another supplier in another region. Whereas dual and multiple sourcing gives you flexibility, a month of extra inventory would have only given you a month delay of the effect. Lean is also not about reducing inventory. Inventory reduction rather is a result of lean process optimization. Procurement director of a manufacturing company.

While we are managing our inventory we are also looking at postponement to improve agility, without needing all the inventory. Operations director, Alpargatas.

Efforts of participating supply chain executives to reduce supply risks are supported by accelerated digitization projects and even the initiation of new projects:

A lot of our digitization projects are in accelerated mode due to the rapid move towards e commerce and we are also looking at new projects such as contactless self check out. Supply chain manager, retail company.

We are introducing robots that can walk through our plants to scan temperatures of employees. These robots are also able to track changes in temperature of employees from one day to the next, analytics manager of a food producer.

Clearly we need to step up our investment in technology and logistics control towers to get better information and transparency across the supply chain and our supply basis, so that we can respond better to demand fluctuations. Operations director, Alpargatas.

Nike is deploying RFID in its supply chain to track demand and product availability throughout the supply chain in closer to real time, and this empowers faster response to shifts in demand and reducing the risk of overordering in response to shortages. Newer technology such as blockchain can also be used to drive more instant and full information dissemination in the supply chain, replacing traditional partial and sequential dissemination (van Hoek, 2019). In shipping, for example, Maersk uses blockchain to get shipment documents out to future shipping destinations upon departure of a shipment, not upon arrival of the shipment, and these documents are shared instantly with all downstream steps and players in the supply chain.

Turning to control risks in supplier relationships, participating supply chain executives offer a dual perspective. On the one hand, they are managing bottlenecks with suppliers carefully and they are using relationship-centric approaches with important suppliers, as is recommended in literature. On the other hand, there are negotiations underway for discounts and extended payment conditions with selected suppliers;

We are renegotiating with suppliers and cancelling some orders due to a change in demand. There are opportunities to seek additional discounts and extend payments terms and improvement payment conditions. We need to capture this. Procurement manager service company.

While there is softness in the market we are taking a relationship approach. Instead of cutting prices unilaterally we are ensuring we pay a fair price, even if not the lowest possible. It is our hope that this will help our suppliers and also pay off for us in the long run when the market turns again in favor of transportation providers. Manager, logistics service provider.

We dusted off supplier relationship management tools such as supplier scorecarding to evaluate the strength and importance of relationships, to identify where to invest and where to turn for additional support with scarce supplies. Procurement director, manufacturing company.

These perspectives from participating supply chain executives reflect not only a nuanced approach as recommended in literature. They also indicate that there is some effort to revisit and improve supplier relationship management capabilities in order to improve supply chain resilience. This provides input into the identification of research pathways in the next section.

5 Research pathways

The perspectives and actions from participating supply chain executives reflect a fair amount of consistency between generic recommendations for improving supply chain resilience in literature and the specific supply chain approaches these executives are taking in the context of COVID-19 events. This implies that there is very concrete and sizable opportunity for researchers to begin to bridge the gap with industry practice by engaging in targeted research opportunities on supply chain resilience in the context of COVID-19. This research can impact supply chain decision-making and redesign underway more concretely than perhaps earlier generic and more conceptual research on supply chain resilience has done. Participating supply chain executives did indicate that they found their level of preparedness insufficient and that their existing plans and playbooks were not fully applicable. As a result, closing the gap between research findings and industrial practice may not only reduce the need for supply chain managers to learn lessons already captured in research, it can also make a contribution to the structural de-risking of supply chains.

Figure 3 lists (in the far-right column) research avenues that can specifically address COVID-19 supply chain risks and supply chain resilience efforts in industry identified in the prior sections. To support efforts aimed at balancing global sourcing with nearshore, local sourcing and additional flexible sources, research can assist by developing decision models for supply chain design that are not too limited to cost focus but also factor in response times and flexibility considerations. This can be an enhanced version of total cost of ownership (TCO) concept. In TCO, all indirect costs associated with a purchase are considered, not just the product purchase price. For the balancing of sources and supplies, total supply chain capability can be considered, including lead times, flexibility in shifting product and locations and other factors to establish a level of resilience that is needed, at resulting costs. Essentially, this shifts decision-making toward a wider appreciation and consideration of supply chain capability. Just like delivery services such as two-day delivery or home delivery are becoming an expectation in the consumer market, so are levels of resilience in B2B markets.

Newer technologies can enable more autonomous supply chains where control towers can leverage new levels of visibility to manage for demand and supply risks. Research can support this by developing improved decision-making frameworks to evaluate and consider these technologies. Today, there is a tendency for considering the technology as just that, technology. This introduces the risk of “a solution looking for a problem.” Additionally, newer technologies are sometimes presented as transformational. However, in the Nike example, we saw the adoption of RFID, a much less-new technology. Blockchain is not adopted as a standalone technology at Maersk; it taps into and complements existing



Figure 3. Research opportunity and pathways in the context of COVID-19 supply chain risks

technologies already in place. The implication is that there is an opportunity to approach technologies for how they complement existing technologies, and to evaluate existing technologies for their potential contribution to supply chain problems, just as much as newer technologies. All this calls for research to help develop more nuanced and detailed decision frameworks.

To move toward a segmented, non-opportunistic approach to seeking supplier support in times of disruption, not only can existing supplier segmentations and supplier relationship efforts be enhanced. There is also an opportunity to enhance research into supplier relationships beyond the basics. Supplier-enabled innovation, for example, is widely targeted in procurement, but its application is less common (Van Hoek *et al.*, 2020). Factoring de-risking into supply base design more structurally and balancing a focus on cost competitive supply with responsiveness and resilience will change decision-making in procurement. Yet the focus on moving beyond efficiency and cost has remained a harder case to make for supply chain managers. Research into supplier selection and evaluation models can help. Research into how procurement and supply chain, as business partners, can drive more comprehensive and structural incorporation of risk factors into decision-making by the partners in the business they support may be even more relevant.

Finally, the role of the supply chain manager deserves further research focus. Not only is there little research on how supply chain managers can cope with risks more proactively, there is also little research on how to manage supply chain teams in times of crises. Today, supply chain managers find themselves targeting not just performance, cost and customer service, but also community support and disaster relief. This may need to be factored into talent management and talent development in supply chain more widely and consistently. Not returning to business as usual after COVID-19 is not only an opportunity to avoid needing to relearn risk management lessons again in the future. It is also an opportunity for supply chain managers to move beyond risk mitigation into creating a more sustainably de-risked supply chain. This can advance the contribution of supply chain managers in the company and perhaps society, from problem solvers that get the supply chain back up and running to preventing supply chain disruptions for the good of business and society.

6. Conclusion

The many journals in our field that have released call for research on COVID-19 and supply chain management have helped create a possible high impact pathway for research on supply chain resilience. We hope that this paper can further inspire the research called for. More importantly, we hope that this paper can assist efforts to focus on opportunities to close the gap between supply chain resilience research and industry practice. More targeted, less conceptual and more empirical research into events surrounding COVID-19 can help managers resolve supply chain risk challenges and can help reduce the risk of needing to further relearn lessons already learned in research when the next crisis comes around. Contributing to sustainable de-risking of the supply chain is an impact pathway for researchers that leads to the opportunity to support building a better world.

Notes

1. https://www.supplychainmovement.com/coronavirus-impact-felt-by-86-of-supply-chains/?utm_source=Supply+Chain+Movement+News&utm_campaign=f6d443e0df-Nieuwsbrief+EU+29+March+2020&utm_medium=email&utm_term=0_6d917e91b2-f6d443e0df-377252953
2. <https://www.instituteforsupplymanagement.org/news/NewsRoomDetail.cfm?ItemNumber=31175&SSO=1>

3. <https://www.cnn.com/2020/04/11/business/panic-buying-walmart-hair-color-coronavirus/index.html>
4. <https://www.supplychaindive.com/news/procurement-leaders-transparency-risk/571847/>
5. <https://www.beroeinc.com/blog/beroe-live-survey-global-bcp-coronavirus/>
6. https://www.capsresearch.org/media/2922/2020-03-26_covid-19_webinar.pdf
7. <https://www.journalofsupplychainmanagement.com/new-blog/2020/4/14/virtual-open-forum-discussion-an-action-agenda-for-effective-post-covid-19-supply-chains> available at: <https://www.youtube.com/watch?v=Jgoe6iCYLF4&t=5s>
8. <https://www.freightwaves.com/news/volumes-still-robust-but-may-have-peaked>

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