Breaking the reactionary cycle by investing in supply chain resilience

Received (in revised form): 10th February, 2023

BEN AYLOR
Managing Director and Senior Partner, Boston Consulting Group, USA

Ben Aylor is a core member of Boston Consulting Group’s Health Care and Operations practice areas and the global co-lead of BCG’s Operations Resilience topic. He is also BCG’s global topic leader on network strategy for pharmaceutical manufacturing and has extensive experience with both strategy and operations projects across industries, including corporate strategy, manufacturing network designs, enterprise and operations transformations, make/buy analyses and sourcing strategies. Ben’s current focus is on helping clients build their capabilities in new areas such as digital supply chain and resilience, and meet the challenges of major change efforts including post-merger integrations and broad transformations. Before joining the company, Ben worked at Arthur Andersen Business Consulting.

Boston Consulting Group, 655 15th St NW, Suite 1100, Washington, DC 20005, USA
Tel: +1 301-664-7564; E-mail: aylor.ben@bcg.com

DUSTIN BURKE
Managing Director and Senior Partner, Boston Consulting Group, USA

Dustin Burke is the Global Co-Leader of Boston Consulting Group’s Manufacturing and Supply Chain topic, part of BCG’s Operations practice. He is the Global Leader of Supply Chain AI, BCG’s digital supply chain accelerator, which includes data scientists, designers, technology experts and application developers. Dustin’s client work focuses on end-to-end supply chain transformations, digital supply chain, post-merger integration and distribution and logistics strategies for consumer and industrial goods companies. He also advises carriers, infrastructure providers and principal investors active in supply chain and logistics across transportation modes on operational and strategy topics. Dustin has written on advanced analytics and big data in supply chain and logistics, the impact of changing trade regimes on manufacturers in a range of industries, global trade flows, shifts in relevance for US ports and the growth agenda for freight railroads, among other topics. He is a TED presenter and has spoken at CSCMP among other conferences. Before joining BCG, Dustin held positions at MGM Resorts and Citigroup.

Boston Consulting Group, 300 N La Salle Street, 46th Floor, Chicago, IL 60654, USA
Tel: +1 312-474-5065; E-mail: burke.dustin@bcg.com

JEREMY KAY
Managing Director and Partner, Boston Consulting Group, USA

Jeremy Kay leads Boston Consulting Group’s Operations practice in the Great Lakes area and co-leads the operational resilience work globally. He has more than two decades of hands-on operations experience, specialising in supply chain, procurement and cost excellence topics. Jeremy has particular expertise in direct materials procurement within industrial goods. Throughout his career, Jeremy has helped his clients identify, design and/or execute programmes that created more than US$6bn of value. Jeremy primarily serves manufacturing clients across several industries, focusing on industrial goods and automotive. He has also led large-scale cost transformation and supply management strategy cases in the aerospace, defence, consumer goods and energy industries. Before consulting, Jeremy held positions as Purchasing Manager at Navistar, Commodity Manager at TRW Automotive and Commodity Manager at Federal-Mogul. He is a Certified Professional in Supply Management and member of the Institute for Supply Management.

Boston Consulting Group, 300 N Lasalle Street, 46th Floor, Chicago, IL 60654, USA
Tel: +1 630-338-7389; E-mail: kay.jeremy@bcg.com
Abstract
Eighty per cent of companies are unprepared to quickly address disruptions and their operations are not structured to absorb disruptions over the long term, according to a recent Boston Consulting Group (BCG) survey. These companies need to strengthen their resilience — the ability to quickly identify and assess risks, react fast and absorb the impacts of disruptions across the supply chain. Although the pandemic-induced supply chain challenges are easing, now is the time for supply chain leaders to reinforce their commitment to resilience. Each company should determine the optimal level of supply chain resilience in its specific circumstances and risk profile. This paper sets out a wide variety of actions to build resilience. Investments that allow companies to ‘absorb’ disruptions (for example, network design, multisourcing, product redesign and inventory) are costly to employ across the board, so a targeted approach is necessary to maximise return on investment. Investments to ‘recover’ from disruptions (monitoring and sensing, predictive modelling and crisis response) can be cost-effective and offer the promise of a first-mover advantage when crises occur. All companies need both absorb and recover capabilities. Our research finds, however, that few companies excel in all these dimensions, and the frontrunners are investing to increase their advantage. Companies can apply these capabilities to define a strong resilience strategy. Steps include gaining visibility into your extended supply chain, quantifying potential disruptions and the cost of actions to reduce the associated risks, and understanding your current level of resilience and how resilient you want to become. With this information, supply chain leaders can secure the investment they need.

Keywords
supply chain resilience, operational resilience, resilience strategy, building resilience, investing in resilience, absorbing disruptions, recovering from disruptions

INTRODUCTION
Supply chain professionals have always valued resilience. During the recent decades of relative stability, however, the business case for prioritising resilience investments over cost reduction was unclear. As a result, companies have often responded to disruptions with short-term solutions such as building inventory. They seldom made long-term structural changes to their supply chains, such as near-shoring or building more capacity, at least partly because such moves often cannot address immediate disruptions and have an unclear return on investment (ROI). Indeed, when a crisis ends or cost pressure escalates, companies often reduce their resilience investments. They rarely revisit which long-term investments are available and have a strong ROI by helping to avoid or recover from the next disruption.

This reactionary cycle played out on a grand scale during the COVID-19 crisis. Nearly all companies experienced disruptions and responded by increasing supply chain investments. For many, the clearest and easiest path forward was building inventories and taking other short-term actions to overcome the specific crisis. While having inventory can help to ensure supply when disruptions occur, it does not alone solve the long-term challenges of supply chain resilience.

Today, with the risk of a downturn looming, companies are under pressure to cut costs and improve working capital by reducing inventory; however, supply chain leaders should not abandon their efforts to promote resilience. Given the impacts of climate change and geopolitical instability, we believe that frequent
and unpredictable supply chain disruptions are the ‘new normal’. The challenge now is to increase resilience while also delivering on cost, working capital and service-level commitments and targets.

There is no single right answer for how to build resilience. To decide on the best avenues for their company to pursue, supply chain leaders need to assess investing in a set of capabilities to ‘absorb’ disruptions and ‘recover’ quickly. Although all companies need both absorb and recover capabilities, each company will have a different mix of capabilities. Some may need to emphasise the absorb capabilities, which are especially important when even advanced knowledge of a disruption is not sufficient to overcome it. This may occur, for example, regulated industries or highly customised manufacturing. Other companies choose to prioritise recovery, such as by becoming nimble to secure alternate supply if a disruption occurs. For these companies, cost-effective actions that promote rapid response are more important than making large structural supply chain changes given their risk profile.

Even the size and type of investments within each capability set (for example, near-shoring, dual-sourcing) will differ depending on the company, industry and which products or commodities they are buying and making. Some levers can be pulled at a low cost. Others, however, may require investment in new data and analytics capabilities and digital tools, as well as large structural supply chain moves.

This paper explores the capabilities required to absorb and recover from disruptions and discusses the status of implementation as revealed in a resilience capabilities benchmarking study conducted by Boston Consulting Group (BCG) and APQC. It also offers guidance on how companies can develop a resilience strategy tailored to their risk profile.

THE MANY WAYS TO BUILD RESILIENCE

We define resilience as the ability to quickly identify and assess risks, react fast and absorb the impacts of disruptions across the supply chain. There are many ways to build resilience, and the right strategy is highly dependent on each company’s circumstances (see Figure 1).

‘Absorb’ capabilities

‘Absorb’ moves reduce exposure to risks and ward off potential disruptions to operations over the long term. Without a sound strategy or business case, these moves can be costly to employ across the board, so a targeted approach is necessary to maximise ROI. When done right, such investments can even improve supply chain efficiency and reduce costs over the long term (such as through automation, near-shoring, better planning, more flexible product design and increased competition from dual sourcing).

There are four key aspects:

- Network design: Design your supply chain network to reduce single points of failure, increase supply redundancy and shorten the supply chain. For some companies, such moves help to counteract the rising cost of doing business in Asia stemming from higher wages, tariffs and ocean freight costs. For example, near-shoring (such as US companies moving production and/or suppliers to new locations in North or Central America) can reduce
the variable costs of production and transportation. Lower variable costs are not always possible, however, and even so, decisions to change a network’s structure must consider that large capital expenditures are often required;

- **Sourcing strategy**: To define an integrated sourcing strategy, start by understanding your suppliers’ lead times and disruption risks. Make sourcing decisions in conjunction with strategic choices for inventory buffers and supplier redundancy. Source critical materials from two or more suppliers to ensure that capacity is always available. This is especially important when the item purchased is subject to capacity constraints (for example, semiconductors) and/or difficult to substitute. Many companies are concerned that splitting volume among suppliers reduces scale benefits, can lead to higher prices and requires upfront investment in supplier qualification. In our experience, injecting competition can help offset those factors, and can even result in a net cost reduction;

- **Planning and inventory management**: As discussed, increasing inventory across the board improves resilience but is often a very costly solution. Even so, inventory buffers have an important role, particularly when strategically augmented for materials
that are especially critical and/or are not suitable for other risk mitigation strategies. Additionally, integrating resilience metrics and considerations into sales and operations planning (S&OP) processes ensures that long-term resilience is always top of mind for strategic planning decisions. This facilitates efforts to balance cost, risk and working capital;

- **Product and engineering flexibility:** Develop resilient products by building flexibility into the design specifications and using standardised or off-the-shelf components wherever possible. This facilitates substitutions and broadens access to a larger pool of capable suppliers or manufacturing locations. These actions can also help to reduce costs: first, the availability of substitutes increases competition, and second, using a design-for-value approach may lead to a less expensive design. The need for one-time upfront investments in engineering resources, testing and tooling, however, may have an impact on the business case. To mitigate the challenges of time-consuming and large-scale product redesigns, leading companies complement these efforts by developing a robust emergency design change process. This allows them to quickly evaluate and approve substitutions and deviations when faced with an imminent disruption.

- **Monitoring and sensing:** Monitor external events that may have an impact on operations across the supply chain and proactively send alerts of potential deviations and disruptions. It is important to monitor not just your own operations and direct suppliers, but also multiple tiers of the supply chain, all the way back to the raw material source. Many companies believe they are protected by having multiple Tier 1 suppliers for the same component. But there may be a single point of failure further down the supply chain, as was the case during the semiconductor crisis;

- **Predictive scenario modelling:** Use scenario planning to understand the impact of potential disruptions on the supply chain under various market and supply chain conditions. Employ digital twins (virtual representations of the supply chain) to see the impact of different actions and choose the best ones to address declining revenue and rising costs. It can be useful to also model the potential impact of ‘black swan’ and other large-scale events. This helps test the supply chain’s level of resilience under the most extreme conditions and may reveal additional vulnerabilities;

- **Crisis response:** Develop processes, a playbook and planning tools to help the organisation optimise decision making if a crisis occurs. Gain access to real-time data to enable rapid responses.

**‘Recover’ capabilities**

Building ‘recover’ capabilities, on the other hand, often requires much less upfront capital. It also offers the potential of a first-mover advantage in obtaining scarce materials or capacity during a disruption.

A rapid response involves the following:

- **Recover’ capabilities**

Building ‘recover’ capabilities, on the other hand, often requires much less upfront capital. It also offers the potential of a first-mover advantage in obtaining scarce materials or capacity during a disruption.

A rapid response involves the following:

**Few companies excel in all dimensions**

BCG and APQC recently surveyed 185 companies across five sectors — automotive, consumer packaged goods, health care, industrial goods and retail
— to gain insights into their performance across these dimensions. Only 10 per cent of companies participating in the survey have strong capabilities in both ‘absorb’ and ‘recover’. The lion’s share — 80 per cent — are unprepared to quickly address disruptions that may occur, and their operations are not structured to absorb disruptions over the long term (see Figure 2).

We expect the gap between the top 10 per cent and the bottom 80 per cent to widen further. The survey revealed that companies with already strong capabilities are planning to increase their level of investment in resilience, whereas those who are struggling plan to continue their current investment trajectory (see Figure 3).

BUILDING YOUR RESILIENCE STRATEGY

Moving your capabilities and level of resilience into the top right ‘thriving’ quadrant is a journey, which starts with a strong resilience strategy. In our experience, the following sequence of activities will help enable a coherent strategy with the greatest chance of success.

Establish visibility into your extended supply chain

Before developing a resilience strategy, companies first need to gain visibility into their supply chains and the potential risks of disruptions. This requires access to a large amount of data, some of which may be difficult to obtain. This includes:

FIGURE 2  Few companies are truly resilient and thriving
Sources: BCG and APQC survey. BCG analysis
• Internal data on your Tier 1 suppliers, including the supplier’s name, part, category and most importantly, the supplier’s manufacturing location. The manufacturing location may not always be readily available because you might only have the supplier’s headquarters address in your enterprise resource planning (ERP) system, for example. To acquire this information, you may need to examine shipping, receiving and customs documentation and/or directly request it from your suppliers;
• The bills of materials for all your company’s products (not applicable for retail or wholesale). These will allow you to map purchased items to the end product and determine the amount of revenue and margin associated with each component;
• Many companies stop with Tier 1 visibility, but significant risks and single points of failure may exist further upstream in the supply chain. To mitigate these, it is important to collect the above information from your Tier 1 suppliers in order to map the Tier 2 supply chain, and so forth, until you have a comprehensive view of your supply chain at multiple levels, ideally all the way back to the raw material source. Collecting this data can require considerable time and effort, and not all suppliers will share it with you. There are several third-party tools and data providers that can assist you in approximately mapping your Tier 2+ supply chain using their databases and artificial intelligence (AI) technology. Some of these platforms can also be used to exchange actual supply chain data with your suppliers, provide visual network maps and even alert you in real time to potential disruptions. This process will take time, regardless of whether you find the information yourself or rely on a third party. So, start with those suppliers and categories having the greatest potential impact on revenue if there is a disruption;
• Creating an initial network map, even if it only includes Tier 1 suppliers, is typically sufficient to begin the subsequent steps in strategy development. Over time, you can collect more data and refine your strategy. In the ideal future state, a world-class company will have real-time visibility into its entire supply chain, including
customers, with a clear understanding of inventory and production capacity.

### Quantify potential disruptions and the cost of the associated risks

Armed with data, companies now need to analyse it to assess the risks in their supply chain. Key performance indicators (KPIs) and other operational metrics will help identify potential points of failure at the part, supplier, location and product levels. These metrics will also help quantify how likely a potential exposure is and how long mitigation will take. Keep in mind that some risks are unpredictable. Such ‘black swan’ events (for example the Global Financial Crisis of 2008 or the Suez Canal blockage) can have serious impacts on supply chains. Scenario planning can help illuminate vulnerabilities and help you structure your supply chain to minimise the potential disruption arising from any event. The result of this exercise should be a quantified impact associated with each component you make or buy. In its simplest form, you may use the revenue associated with each part, with more advanced analytics also quantifying other implications, such as combinatorial effects on other products, business lines or company reputation.

### Understand your current level of resilience and how resilient you want to become

Start by developing a view of your resilience capabilities. A set of characteristics define best-in-class performance for each dimension of our resilience framework. Qualitatively score your company’s performance versus best-in-class in each dimension to understand which capabilities are your greatest weaknesses. Compare this with average maturity levels in your industry if benchmarks are available. By knowing where you stand, you can determine your ambition across each dimension and create a plan to develop capabilities over the long term.

### Prioritise which risks to address

Prioritise your risks based on the quantification of exposure discussed above plus estimates of the probability of occurrence and potential duration should a disruption occur. Give priority to addressing risks that have both high impact and high probability. Conversely, those having low impact and low probability should receive minimal attention.

### Determine appropriate levers for each prioritised risk

Starting with your highest-priority risks, identify one or more levers to increase resilience. For example, if you are concerned about a single-source supplier in a country where you may face trade restrictions, consider: 1) working with the supplier to relocate its production to another country; 2) finding an alternative source in a different country; 3) holding an additional strategic inventory buffer at the point of use; or 4) developing a real-time monitoring and sensing capability to provide early warning of potential disruptions. Use our framework to guide the consideration of potential options.

### Assess the full impact of addressing each risk

For each risk mitigation lever, quantify the one-time and recurring costs, capex and inventory required to use it. There
may be trade-offs among one-time costs, recurring costs and working capital that you will need to normalise using your company’s financial modelling guidance. This could entail, for example, applying weighted average cost of capital to inventory increases and calculating the net present value of recurring versus one-time costs.

Construct and present the business case
By comparing the risk-adjusted cost of disruption and the investment required to mitigate it, you can prepare a business case that will be relevant to a cross-functional set of business leaders. The costs of disruption can include lost sales, alternate sourcing choices and expedited freight, among others. It is important to link the estimated costs that might be incurred with specific costs of mitigation. For example, relying on a single freight lane may present a vulnerability that can be mitigated by using multiple carriers or modes. The cost of disruption would include expedited freight costs. You may find that capability-building investments (for example, real-time monitoring and sensing) have a poor return when applied to only one specific risk. To evaluate the return on these investments, aggregate risks across your entire supply chain and prepare a business case at a programme level.

Put enablers in place
Once you have a strategy and programme to start addressing risks, you now need to consider additional enablers of a sustainable resilience programme, including change management practices, a culture that supports a mindset of resilience, processes and operating tools, governance and talent. These enablers promote resilience by breaking down organisational silos, fostering cross-functional collaboration and accelerating decision making.

Many companies will need to foster a major shift in mindset — from purely focusing on short-term cost and profitability to taking a long-term perspective that is more holistic and risk-adjusted. The best companies integrate risk and resilience into their operating models, including the metrics they use to measure success and their organisation, governance and operating processes.

Apply new capabilities and digital tools
New capabilities and digital tools make it easier to pinpoint which investments in resilience can generate the most value. For instance, data and analytics can be utilised to make more precise cost-cutting and working capital decisions. Scenario modelling can help evaluate the effect of potential disruptions, and supply chain visibility upstream and downstream can provide early warnings of emerging risks.

When combined with business processes, advanced digital tools can augment human capabilities and unlock new sources of value. For example, an AI-powered platform can make real-time supply chain decisions autonomously, allowing for better management of market volatility.

What it takes to be a resilience leader
In our client engagements, we have observed the following practices to be particularly effective for securing investments, building resilience capabilities and mitigating risks:
• Conduct the exercise when no crisis is occurring: Identify the risks and ways to improve your buffer. Determine investments available to mitigate risks;
• Evaluate resilience investments rigorously: Consider resilience investments as investments, like you would capacity changes. Assess the probability-weighted ROI and the consequences of lacking specific resilience capabilities;
• Measure resilience: Building resilience is not a one-time event, so it is important to set targets and regularly measure and monitor performance; however, there is no universal set of metrics that will apply to every company. Based on your resilience strategy, determine a set of KPIs that will effectively measure your progress. For instance, if your company relies heavily on suppliers from high-risk countries, you might track the percentage of spending or revenue tied to these suppliers. If you are concerned about a single-source risk, you might track the percentage of spending or revenue without a second approved supplier;
• Set a ‘budget’: Quantifying the cost of not being resilient is challenging, so take a historical and forward-looking view of your risk exposure while creating your resilience strategy. Analyse the past costs of supply chain disruptions, including lost revenue and profit. Estimate the probability-adjusted impact of future disruptions based on your list of risks. With this information, you can calculate the cost of not improving resilience and determine the level of investment you are willing to make to reduce risk. It is not possible to eliminate risk entirely; as you get closer to zero risk, the cost of achieving an incremental improvement significantly increases. It is possible, however, to make a business case for investment in capabilities and structural changes as well as recurring costs for a resilience team and higher supplier prices. The same principles used to justify investments in equipment maintenance, capex and inventory can be applied to resilience;
• Use the capability: Capitalise on the benefits of your resilience investments when disruptions occur. If you can continue to supply products while your competitors cannot, do not just seek short-term gains. Quickly enter the market and strike deals to secure long-term market share. This allows you to turn resilience into a sustainable competitive advantage;
• Continuously scrutinise the investments: The options and ROI will shift in response to changes in the world (for example, manufacturing costs), the industry (for example, the number of external manufacturing partners) and technology (such as forecasting).

DO NOT PUT RESILIENCE ON THE BACK BURNER
The recovery from the pandemic-induced supply chain crisis combined with a softening economy could lead many companies to shift their focus from supply chain resilience to cutting costs and working capital. We have seen this before in the aftermath of previous crises. The right investments in supply chain resilience can generate substantial value, however, which is especially important in helping a company withstand an economic downturn and maintain a competitive advantage.

Supply chain leaders need to build a coherent strategy specific to their company and its specific risks. They should also consider how they can most
effectively apply new capabilities and digital tools to identify challenges and select solutions. Then, they need to construct a business case with a clear ROI for investments in resilience. By building the right strategy, backed with a positive return to secure funding, leaders can position their companies to thrive during the inevitable crises that lie ahead.