FAST
FORWARD

Rethinking supply chain resilience for a post-COVID-19 world

Introduction

The COVID-19 pandemic is the stress test that caught most organizations by surprise, and which offered very little time to prepare. Organizations have had to contend with sharp spikes and declines in consumer demand, production downtime, and supply and transport delays. Highlighting the impact of this volatility on supply chain risk, Mike Jackson, executive director at the Original Equipment Suppliers Association (OESA), says, *"Supply chain risks have spiked on a number of fronts, fueled by workforce constraints, input shortages and liquidity issues, due to the slashing of production volumes and future forecasts."*[1] The crisis has exposed the underlying complexities and vulnerabilities of global supply chains and illustrated the importance of a well-functioning supply chain.

How prepared would organizations be if this sort of global crisis were to occur again? What are the critical elements in building supply chain resilience so that organizations are prepared for such a scenario and how can companies put them in place? To find answers to these questions, we surveyed 1,000 organizations from the consumer products, retail, discrete manufacturing and life sciences sectors. We also conducted a range of in-depth interviews with senior supply chain executives.

Our research paints a worrying picture when it comes to supply chain resilience. Across sectors, supply chains have struggled to cope with the fallout of the crisis: close to seven out of 10 organizations have taken more than three months to restore operations. Moreover, when we looked at the capabilities that organizations will need to have to better handle a future crisis, we found that a very small minority are taking all the necessary actions to be crisis resilient. To understand the current state of play, and how to build the resilience needed to cope with future shocks, this research focuses on the following key themes:

1. The extent to which the crisis has forced organizations to question long established supply chain practices
2. Assessing organizations' readiness in withstanding future disruptions
3. Laying the groundwork for future-proofing supply chains.

The COVID-19 crisis has been a moment of truth for organizations

Organizations have struggled to cope with supply chain disruptions caused by the crisis

The COVID-19 crisis has raised serious questions on the resilience of global supply chains. More than 80% of organizations in our research report being negatively impacted by the crisis and a vast majority have struggled with significant challenges across all aspects of their operations (see Figure 1). These include shortage of critical parts/materials (74%), delayed shipments and longer lead times (74%), difficulties in adjusting production capacity in response to fluctuating demand (69%), and difficulties in planning amidst high levels of volatility in customer demand (68%). Organizations in all sectors covered in our research – retail, consumer products, discrete manufacturing, and life sciences – reported similar challenges across their supply chains.

Figure 1. Organizations faced significant challenges across the supply chain in the wake of the crisis
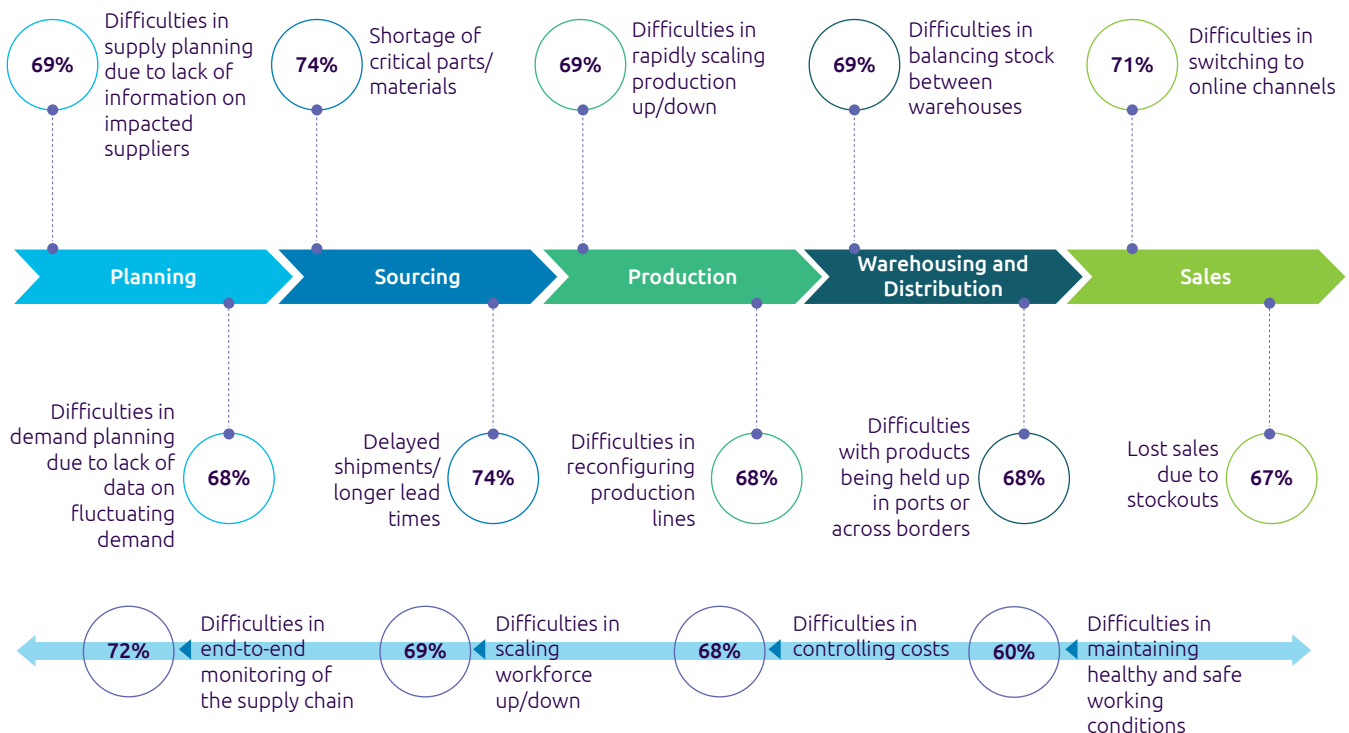
Percentage of organizations that faced significant challenges in each area
Source: Capgemini Research Institute, Supply Chain Survey, August–September 2020, N=1,000 organizations.
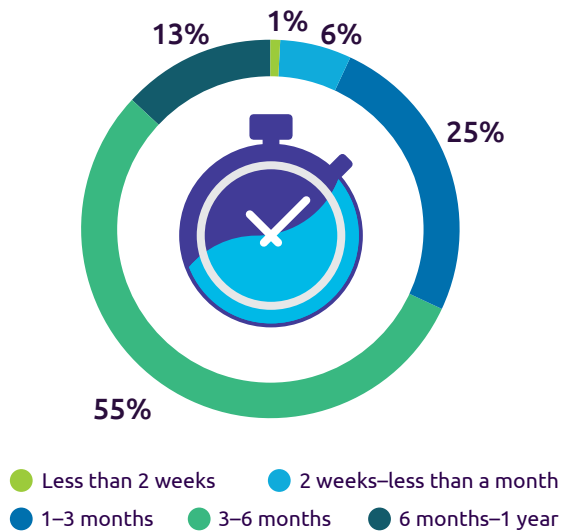
Close to seven out of 10 organizations have taken more than three months to recover from disruptions

Our research also found that organizations have struggled to respond rapidly to disruptions and to restore operations to a steady state (for instance, restoring inventory levels and the availability of manufacturing and logistics capacity), which further highlights the lack of resilience in supply chains today. As many as 55% of organizations have taken three to six months to recover from supply chain disruptions, while 13% expect to take six to 12 months to do so (see Figure 2). The life sciences sector however, emerges as an outlier. While the majority of organizations in other sectors have taken
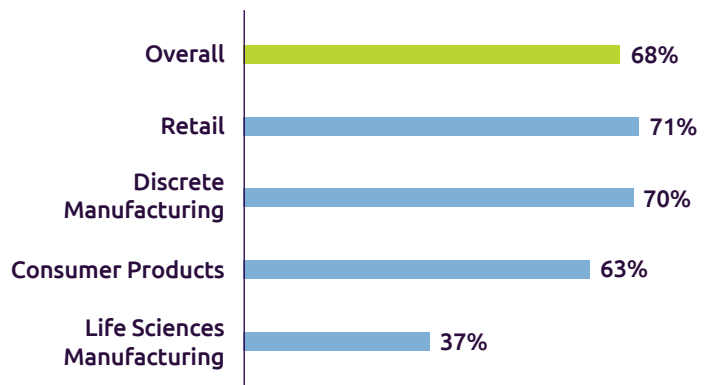
more than three months to recover from disruptions, this proportion is much lower among life sciences organizations at 37%. This can be explained in part by the significantly lower negative impact that the sector's organizations experienced during the crisis. Only 30% of life sciences organizations in our survey reported a negative business impact due to the crisis, compared to over 80% of organizations in other sectors (retail, consumer products, discrete manufacturing). In addition, life sciences organizations have demonstrated greater agility in responding to disruptions, which further explains the higher resilience shown by the sector. For instance, 39% of life sciences organizations in our survey report that their supply chains are agile enough to support new business models, compared to 27% overall.

Figure 2. Organizations have struggled to recover from supply chain disruptions

Please select the time that it took or might take for your supply chain to recover from the disruptions caused by the COVID-19 crisis

1% — Less than 2 weeks
6% — 2 weeks–less than a month
25% — 1–3 months
55% — 3–6 months
13% — 6 months–1 year

Legend:
- Less than 2 weeks
- 2 weeks–less than a month
- 1–3 months
- 3–6 months
- 6 months–1 year

% of organizations that have taken more than three months to recover from the crisis

Overall	68%
Retail	71%
Discrete Manufacturing	70%
Consumer Products	63%
Life Sciences Manufacturing	37%

Source: Capgemini Research Institute, Supply Chain Survey, August–September 2020, N=807 organizations that faced a negative business impact due to the crisis.

68%

Organizations that have taken more than three months to recover from supply chain disruptions caused by COVID-19
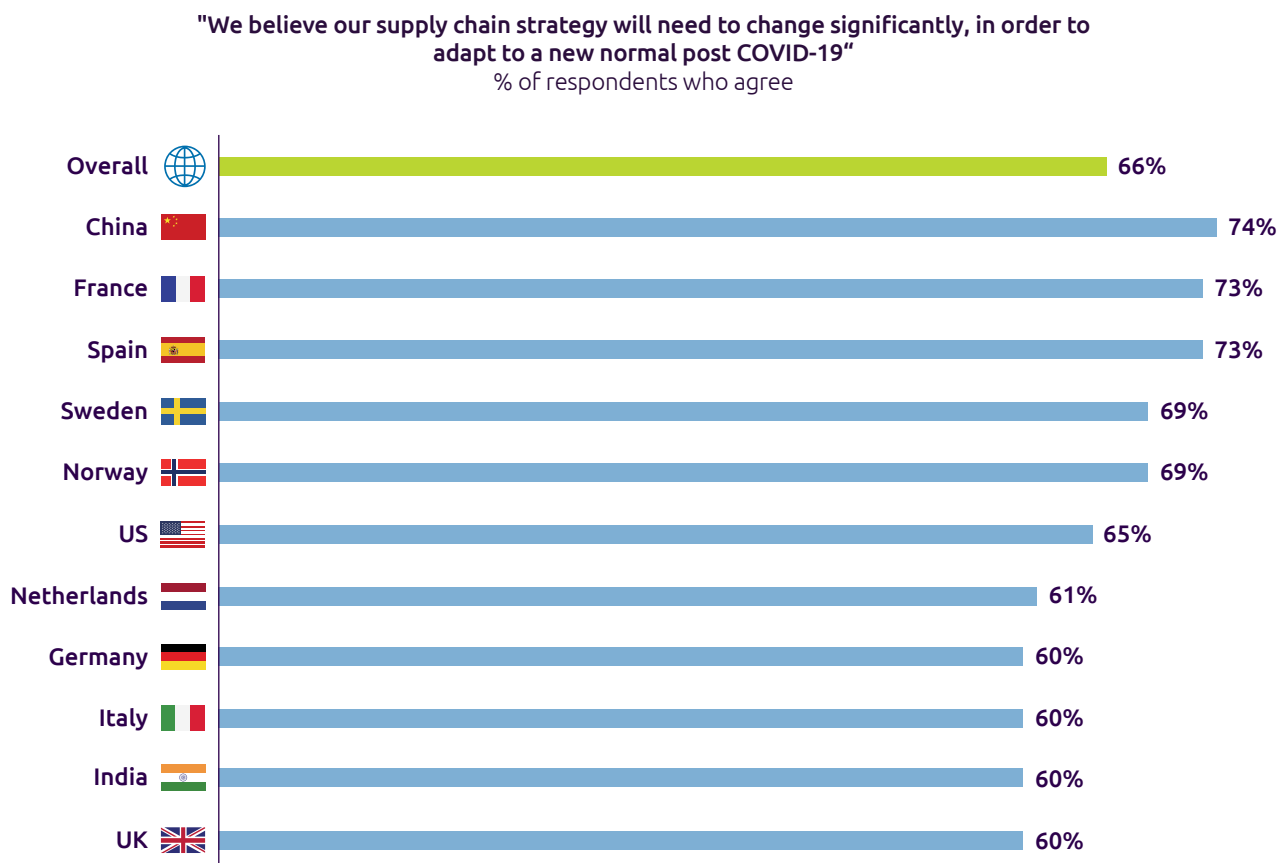
The crisis has forced organizations to question long-established supply chain practices

Most organizations see the need for a significant shift in their supply chain strategies in response to the crisis

Our research reveals a growing consensus among organizations on the need for a radical shift in supply chain strategies in response to the crisis. Two-thirds (66%) of

organizations believe that their supply chain strategy will need to change significantly in order to adapt to the new normal (see Figure 3). Stressing the need for such a shift, Parmeshwaran Iyer, global vice president for supply chain management at German consumer goods manufacturer Beiersdorf, says, *"Will supply chains go back to status quo after all this is over? The answer is no. The question that a lot of people have to ask in boardrooms is what kind of a resilience strategy do you have in place to overcome these impacts or anticipate these impacts far in advance? What kind of resilience are you building into your system strategically and can your businesses afford to have that amount of redundancy built into the system?"*

Figure 3. Two-thirds of organizations see the need for a significant shift in their supply chain strategies post-COVID

"We believe our supply chain strategy will need to change significantly, in order to adapt to a new normal post COVID-19"
% of respondents who agree

Country	%
Overall	66%
China	74%
France	73%
Spain	73%
Sweden	69%
Norway	69%
US	65%
Netherlands	61%
Germany	60%
Italy	60%
India	60%
UK	60%

Source: Capgemini Research Institute, Supply Chain Survey, August–September 2020, N=1,000 organizations.

The crisis is prompting organizations to rethink just-in-time sourcing and manufacturing

The need to build supply chain resilience is also prompting organizations to reduce their reliance on just-in-time manufacturing processes. Our research found that the proportion of organizations focusing on just-in-time sourcing and manufacturing is expected to reduce from 39% pre-COVID to 29% in the next three years. However, cost remains a dominant concern overall and organizations are willing to consider alternatives to just-in-time manufacturing if the costs of doing so are not significantly higher (see Figure 4).

Highlighting the need for a rethink of just-in-time strategies that have been the mainstay in many organizations, Beata Javorcik, chief economist, European Bank for Reconstruction and Development, says, *"The current events will force businesses to rethink their global value chains. These chains were shaped to maximize efficiency and profits. And while just-in-time manufacturing may be the optimal way of producing many complex products, the COVID-19 outbreak has exposed disadvantages associated with a system that requires all of its part to work like clockwork."*[2]

Figure 4. Organizations are more willing to consider alternatives to just-in-manufacturing in the wake of the crisis

Please indicate the proportion of the following strategies that your organization has adopted/will adopt for its product portfolio

We will shift from just-in-time sourcing and manufacturing wherever additional costs are not significantly higher — Pre-COVID 30%, Post-COVID 37%

We are actively building redundancy even if it means significantly higher costs — Pre-COVID 31%, Post-COVID 34%

We will focus on just-in-time sourcing and manufacturing — Pre-COVID 39%, Post-COVID 29%

● Pre-COVID ● Post-COVID (in the next 3 years)

Source: Capgemini Research Institute, Supply Chain Survey, August–September 2020, N=1,000 organizations.

Over two-thirds (68%) of organizations say that COVID-19 has forced them to adapt their business models

There is growing awareness among organizations that supply chains need to be more flexible and agile: 68% say that the crisis has forced them to adapt their business models. With the collapse of traditional business channels, businesses around the world had to react quickly and launch new initiatives to reach their customers.

Some large, traditional organizations chose the direct-to-consumer route to address the shift in demand. For example:

• PepsiCo launched two direct-to-consumer websites – PantryShop.com and snacks.com – to meet customer demand. The websites, built from ground-up in less than

a month, offer consumers direct access to some of Pepsi's top-selling SKUs.[3]

• Kraft Heinz launched their first ever direct-to-consumer ecommerce website in the UK – HeinztoHome. Jojo de Noronha, president of Kraft Heinz Northern Europe, said, *"While we continue to work day and night to get our most-loved Heinz varieties on shelf, we hope this new initiative will help those who cannot otherwise access our products."*[4]

Organizations have also pivoted towards service-oriented business models to create new revenue sources while continuing to serve customers remotely during the crisis. For example:

• US-based industrial manufacturing firm Munters, which offers energy-efficient air treatment systems, accelerated its shift from selling products towards "servitization" (i.e., a service-oriented business model). It did this by launching

remote maintenance services to ensure equipment uptime during the crisis.[5] *"Reducing our reliance on on-site visits will not only allow us to improve efficiency but being able to perform a remote resolution or diagnosis is a critical step in our journey to servitization,"* says Roel Rentmeesters, director of global customer service at Munters.[6]

- Cisco is evaluating its entire product portfolio as it accelerates its shift towards an as-a-service consumption model in the wake of the crisis. Speaking on the shift, Chuck Robbins, chairman and CEO at Cisco Systems, says, *"If the past year has taught us anything, it's the need to always be nimble. I believe that the changes we make to our business now will put us in a position of strength as we focus on the future."*[7]

Supply chain resilience

A **"resilient supply chain"** has the following features:
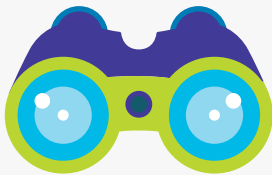
Visibility
across the entire supply network

Agility
speed at which the supply network can respond to shifts in the environment, such as scaling production up/down, reconfiguring plants and logistics networks, opening new demand channels (e.g., shifting from a brick and mortar model to ecommerce)

Diversification
of supplier-base, production footprint and transportation partners
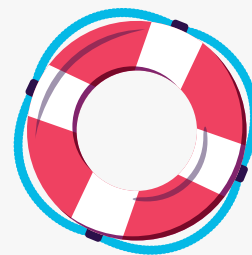
Contingency planning
the ability to anticipate and respond to disruptions

Organizations are ramping up investment in resilience

Perhaps not surprisingly, many organizations (62%) say increasing supply chain resilience is a key priority for their supply chain organization, post COVID-19. Furthermore, as Figure 5 shows, 57% also said they plan to increase investment in building supply chain resilience.

Figure 5. Building supply chain resilience is a key priority for organizations in the wake of the COVID-19 crisis
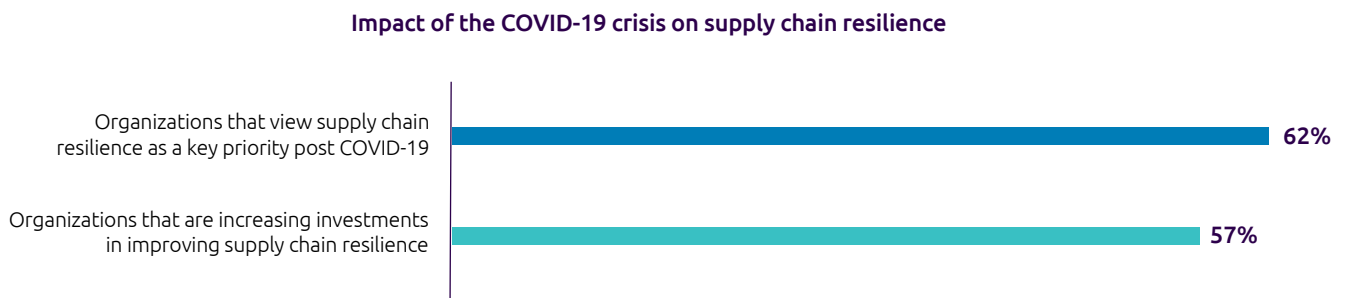
Impact of the COVID-19 crisis on supply chain resilience

Organizations that view supply chain resilience as a key priority post COVID-19	**62%**
Organizations that are increasing investments in improving supply chain resilience	**57%**

Source: Capgemini Research Institute, Supply Chain Survey, August–September 2020, N=1,000 organizations.

57%
Organizations that are increasing their investments in improving supply chain resilience
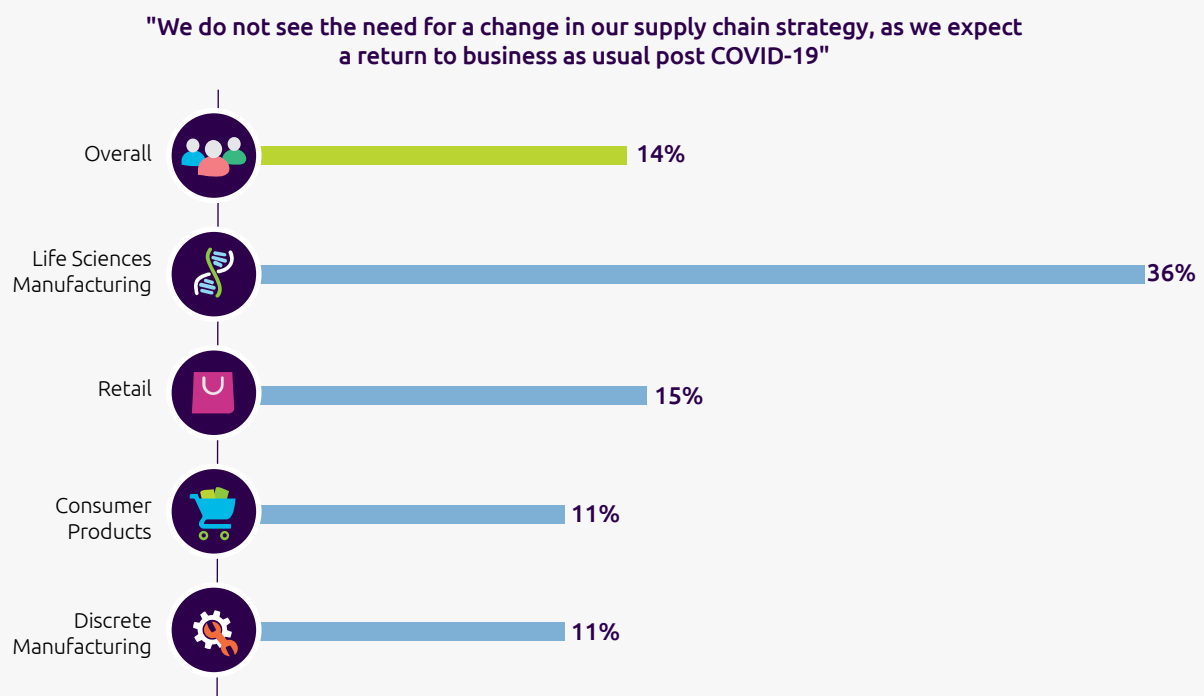
Only a small minority of organizations expect a return to business-as-usual and see no need for a change in supply chain strategy as a result of the crisis

While the majority of organizations recognize the need for a significant shift in their supply chain strategies due to the COVID-19 crisis, our research shows that 14% of organizations expect a return to business as usual (see Figure 6) and do not expect any changes in their pre-COVID supply chain strategy. The proportion is higher in the life sciences sector, which has seen a significantly lower negative business impact due to the crisis compared to other sectors. In addition, organizations in the sector report higher levels of agility – a key aspect of resilience – which further explains why they see less need for radical changes in their existing supply chain strategy.

Figure 6. More than a third of organizations in the life sciences sector do not see the need for a shift in supply chain strategy due to COVID

"We do not see the need for a change in our supply chain strategy, as we expect a return to business as usual post COVID-19"

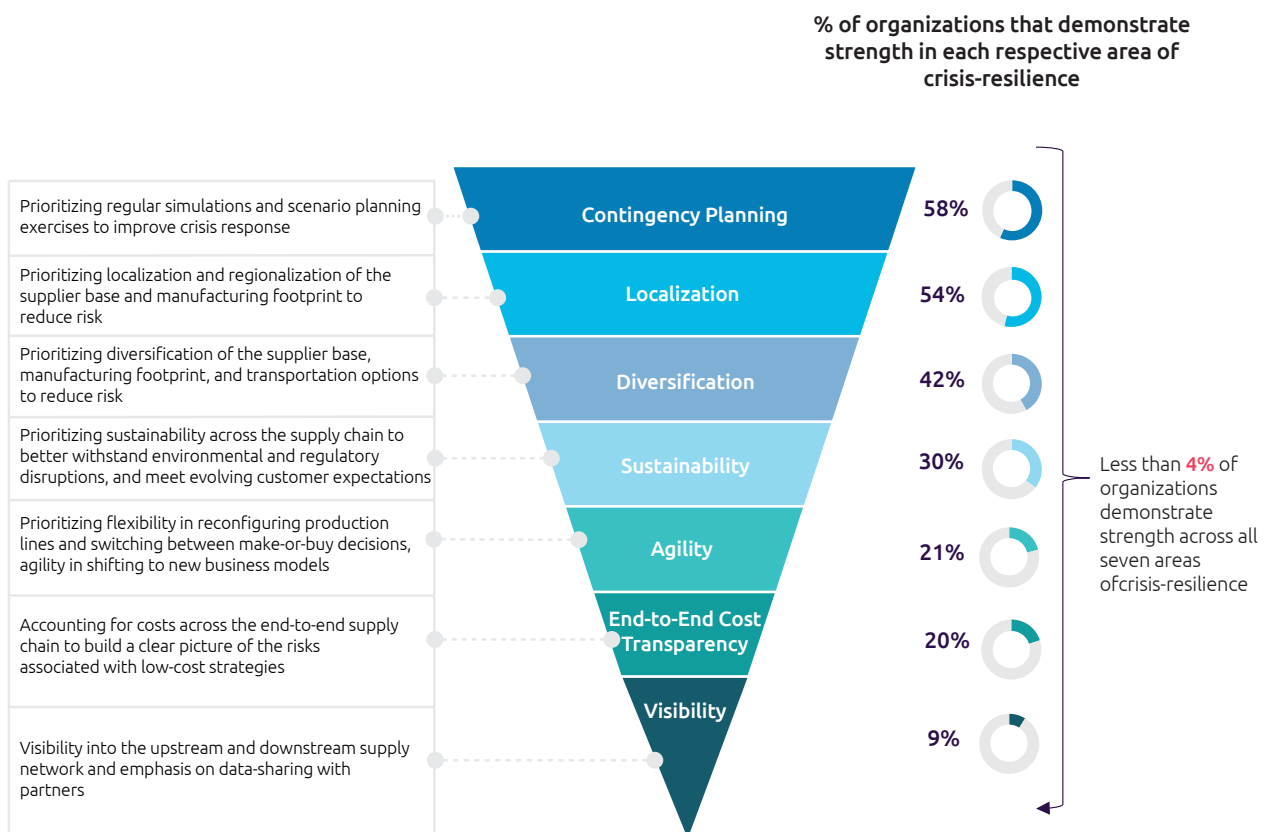| Sector	Percentage
Overall	14%
Life Sciences Manufacturing	36%
Retail	15%
Consumer Products	11%
Discrete Manufacturing	11%

Source: Capgemini Research Institute, Supply Chain Survey, August–September 2020, N=1,000 organizations.

Few organizations are prepared for another disruption in the next three years

In this section, we look at the actions that organizations are taking to adjust their supply chains in response to the crisis. We also assess whether these actions are sufficient in helping organizations build supply chains that can better withstand future disruptions, should one occur in the next three years.

Our assessment looks at seven core aspects of a crisis-resilient supply chain and covers both planned actions and the current state of organizational preparedness in each of these aspects (Figure 7).

Figure 7. The ability to withstand disruptions rests on building a range of capabilities

% of organizations that demonstrate strength in each respective area of crisis-resilience

Capability	Description	%
Contingency Planning	Prioritizing regular simulations and scenario planning exercises to improve crisis response	58%
Localization	Prioritizing localization and regionalization of the supplier base and manufacturing footprint to reduce risk	54%
Diversification	Prioritizing diversification of the supplier base, manufacturing footprint, and transportation options to reduce risk	42%
Sustainability	Prioritizing sustainability across the supply chain to better withstand environmental and regulatory disruptions, and meet evolving customer expectations	30%
Agility	Prioritizing flexibility in reconfiguring production lines and switching between make-or-buy decisions, agility in shifting to new business models	21%
End-to-End Cost Transparency	Accounting for costs across the end-to-end supply chain to build a clear picture of the risks associated with low-cost strategies	20%
Visibility	Visibility into the upstream and downstream supply network and emphasis on data-sharing with partners	9%

Less than **4%** of organizations demonstrate strength across all seven areas of crisis-resilience

*Organizations that demonstrate strength in an area are those that score above a threshold value in that area (the threshold value is defined as the median score for 1,000 organizations). Scores are assigned based on an organization's current level of preparedness as well as future plans. Crisis-resilient organizations score above the threshold value in all seven areas. These form less than 4% of our overall sample.

Source: Capgemini Research Institute analysis.

84%

Organizations that view "increasing crisis-preparedness using simulations" as a key priority post the crisis

Based on our assessment, we find that only a very small minority (less than 4%) of organizations demonstrate strengths across all seven areas of crisis-resilience. These are organizations that have either already built capabilities in these areas or are taking active steps towards doing so. We also find that while a significant proportion of organizations are taking the necessary measures to build capabilities around contingency planning, localization, and diversification, only a small proportion have the necessary levels of supply chain agility, cost transparency, and visibility. The gaps in agility, for instance, could be attributed to the fact that organizations often view their supply chain as a cost center rather than a source of competitive advantage. The current approach therefore leaves most organizations vulnerable to future disruptions.

We now look at each area of crisis resilience to understand organizations' plans and preparedness in more detail.

1. Organizations recognize the need to boost capabilities in contingency planning

The COVID crisis has brought home the need for quicker response times in the event of a crisis. The ability to run simulations and test scenarios in advance allows organizations to respond more rapidly to a crisis. Our research shows that improving crisis-preparedness using simulations is a key focus area for organizations. As many as 84% of organizations view this as a priority post-COVID compared to 62% before the crisis.

However, the majority of organizations have not built the required capabilities to simulate their supply chains

The ability to create a digital map of their supply chain using digital twins, combined with the ability to use advanced analytics and run simulations allows organizations to understand and manage their risks better. Through scenario planning, organizations can predict the impact of disruptions in one part of the supply chain on the rest of the organization and can take corrective actions. For example, Philip Morris International (PMI) developed a digital twin of its entire global manufacturing footprint. It allows the company to assess the impact of changes in regulation, changes in product portfolio, or even business disruption on a monthly basis versus only on a yearly basis. *"With the introduction of the smoke-free product category in PMI's portfolio, our business ecosystem is changing drastically. There are so many non-standard complexities and new constraints across our value chain that traditional tools and techniques could no longer support us in setting up our roadmap,"* said Alexandros Skandalakis, director of manufacturing capacity and footprint at PMI. *"[with this solution we could] extend the number of variables that could impact decisions, such as sourcing options, capacities and capabilities, inter-trading-zone product duties, inter-plant product transfer prices, and distribution costs. We reduced spread sheet simulations by 90% and decreased the time required for scenario evaluation from weeks to hours."[8]*

However, we found that only 16% of organizations are using a digital twin to conduct regular scenario planning exercises while another 26% are using it on an ad-hoc basis (see Figure 8).

Adoption of digital twins for scenario planning

16%   37%

26%

21%

● We have not invested in a digital twin solution and have no plans to do so

● We plan to invest in a digital twin solution in the short to medium term

● We have invested in a digital twin solution, and are using it to conduct scenario planning exercises on an ad-hoc basis

● We have invested in a digital twin solution, and are using it to conduct scenario planning exercises on a regular basis

Source: Capgemini Research Institute, Supply Chain Survey, August–September 2020, N=1,000 organizations.

2. Localization and regionalization are gaining traction

Our research shows increased interest among organizations in localization and regionalization. As many as 65% of organizations are actively investing in localizing or regionalizing their supplier and manufacturing base in order to reduce risk and to be closer to their customers (see Figure 9). *"The COVID crisis has made it very clear that a local-to-local approach makes more sense than ever. This is something that was already in our plan, but we clearly need to speed it up. We need to produce closer to our market. We still have quite a significant part of our business that is sourced from other continents because of the specialization of our plants, imbalances in industrial capacity, and strategic sourcing. But, at the end of the day, this optimization really puts our supply chain at risk when we are far from our sales,"* says a supply chain executive at a leading tyre manufacturer.

Our research shows that the trend towards nearshoring production is highest in the consumer products sector and lowest in the retail sector. As many as 72% of consumer products organizations are actively investing in localizing and regionalizing their manufacturing base compared to 58% of organizations in the retail sector.

Figure 9.   Organizations are actively investing in localizing and regionalizing their supplier base and manufacturing footprint

How has the COVID-19 crisis influenced your organization's sourcing and manufacturing strategy?

We are actively investing in regionalizing and localizing our manufacturing base (i.e. nearshoring production) **65%**

We are actively investing in regionalizing and localizing our supplier base **65%**
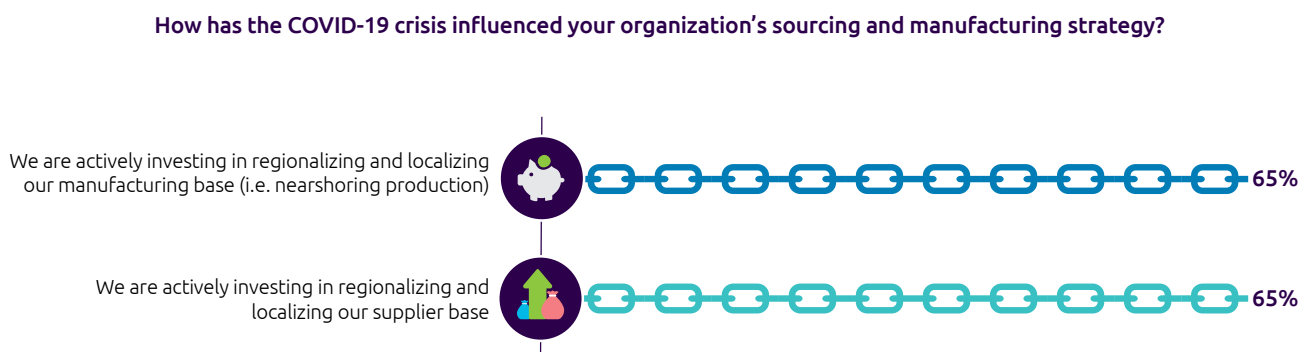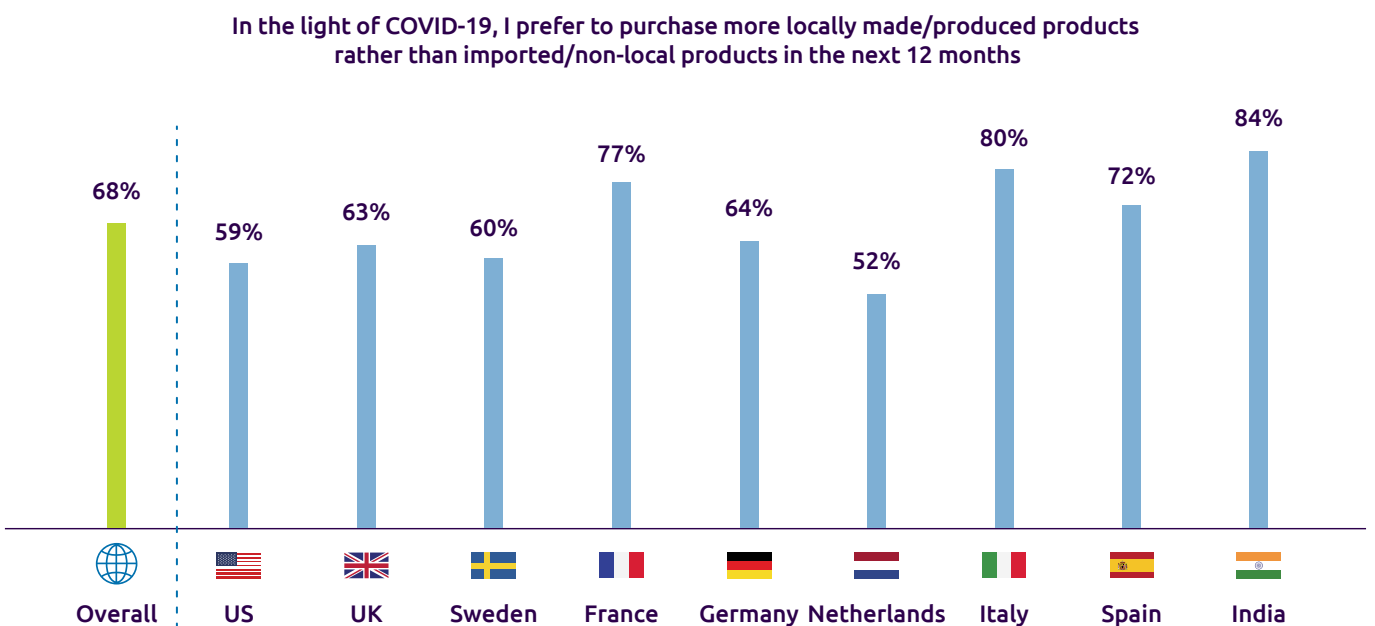
Source: Capgemini Research Institute, Supply Chain Survey, August–September 2020, N=1,000 organizations.

Our research has also identified that, in the next three years, organizations plan to have 43% of their supplier base situated locally – compared to 36% today. Similarly, organizations also expect to have 50% of their production plants situated locally, up from the current 43%.

A localization strategy has the added benefit of helping organizations align more closely with the growing customer preference for locally made products (see Figure 10, which is based on previous research we conducted into the Consumer Products and Retail sector).

Figure 10.   Consumer preference for locally produced products has risen in the wake of the COVID-19 crisis

In the light of COVID-19, I prefer to purchase more locally made/produced products rather than imported/non-local products in the next 12 months

Overall	US	UK	Sweden	France	Germany	Netherlands	Italy	Spain	India
68%	59%	63%	60%	77%	64%	52%	80%	72%	84%

Source: Capgemini Research Institute, Sustainability in Consumer Products and Retail Survey, March 2020, N=7,520 consumers.

68%
Organizations that are actively investing in diversifying their supplier base

3. Organizations are diversifying their supplier base and manufacturing footprint

The crisis has highlighted the risks inherent in supply chains that are optimized for cost at the expense of resilience. The focus on cost has meant organizations frequently relied on single sourcing or sourcing from specific geographies that offered cost advantages. The supply shortages that organizations faced during the crisis has been a wake-up call on the need to spread risk, even if it comes at a higher cost. As many as 68% of organizations are now actively investing in diversifying their supplier base in order to reduce their reliance on single source suppliers and 62% are diversifying their manufacturing base (see Figure 11).

Figure 11.   Organizations are actively investing in diversifying their supplier base and manufacturing footprint

How has the COVID-19 crisis influenced your organization's sourcing and manufacturing strategy?

We are actively investing in diversifying our supplier base (i.e. shifting from single to multi-sourcing wherever possible) — **68%**

We are actively investing in diversifying our manufacturing base (i.e. reducing our reliance on a single geographic region) — **62%**
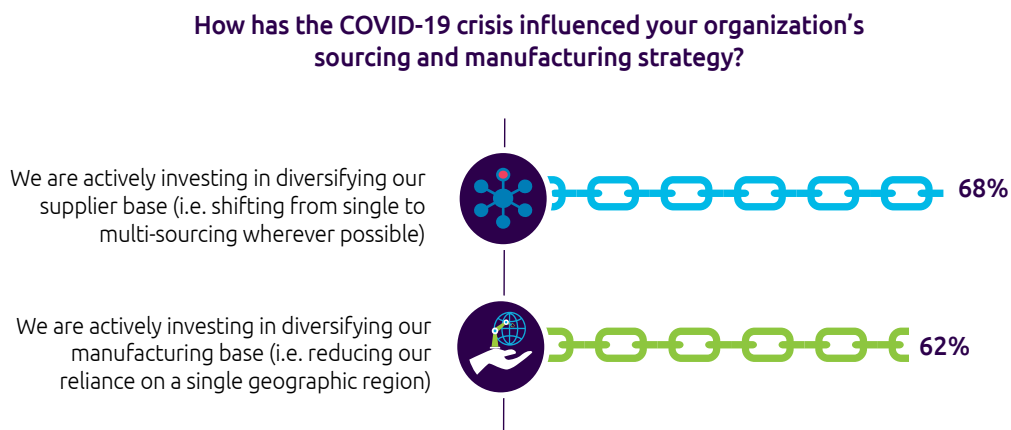
Source: Capgemini Research Institute, Supply Chain Survey, August–September 2020, N=1,000 organizations.

In addition to this, 86% of organizations see improving the diversity of transportation options (i.e., diversity in the number of partners and means of transport including ocean, air, rail and road) as a key post-COVID priority.

4. Organizations recognize the need to invest in supply chain sustainability initiatives

Improving supply chain sustainability is increasingly critical for a number of reasons:

- Without concrete action, it will be impossible to practically reach the goals set by the Paris Agreement or the net-zero emission goals of the EU and individual countries.[9]
- Actions taken to improve sustainability will give organizations a competitive advantage. For example, the sustainable fast-moving consumer goods market for US was estimated to be worth USD128.5 bn in 2018 and is expected to only grow further.[10]

- Organizations that do not focus on sustainability risk being out of sync with customer preferences. Recent research we conducted into this issue showed that 79% of consumers are changing their purchase preferences based on sustainability.[11]

A significant majority of organizations are aligned with this sentiment and recognize the importance of change, with 77% saying they are accelerating their investments in supply chain sustainability initiatives over the next three years. The key areas of focus are logistics and manufacturing (see Figure 12).

Logistics will be the top-most area of focus for improving supply chain sustainability
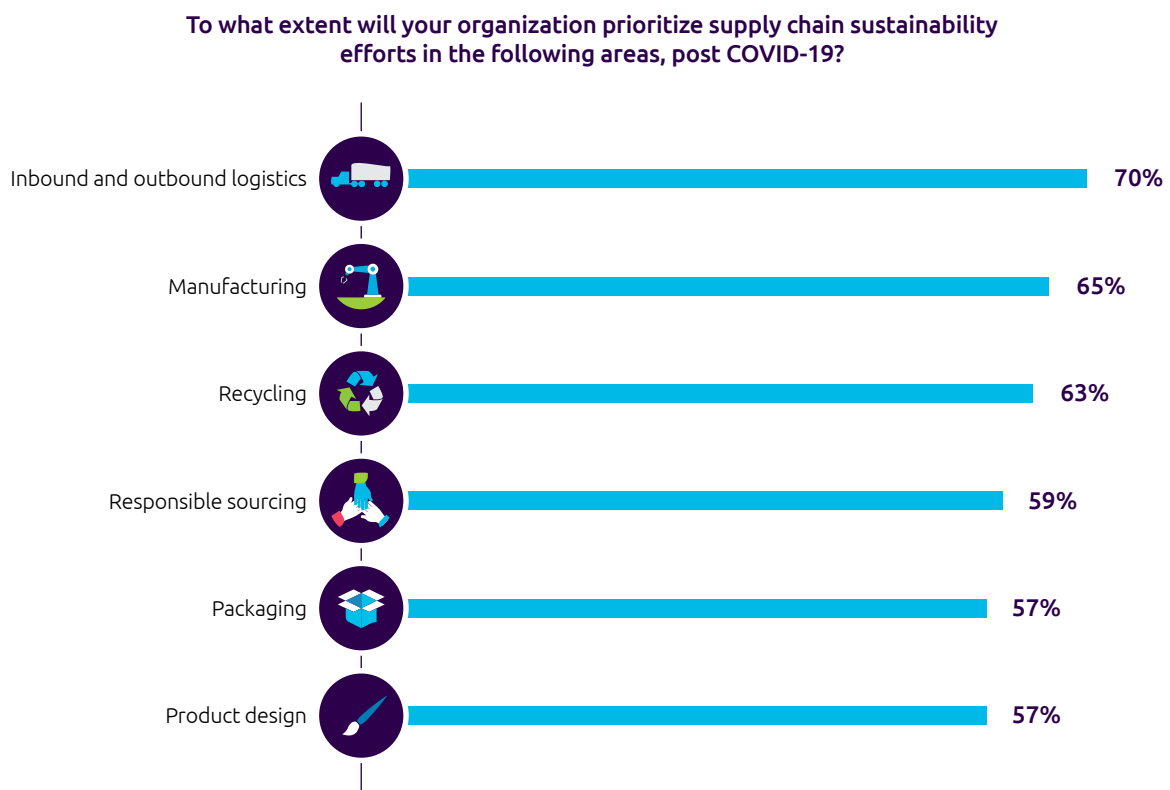
To what extent will your organization prioritize supply chain sustainability efforts in the following areas, post COVID-19?

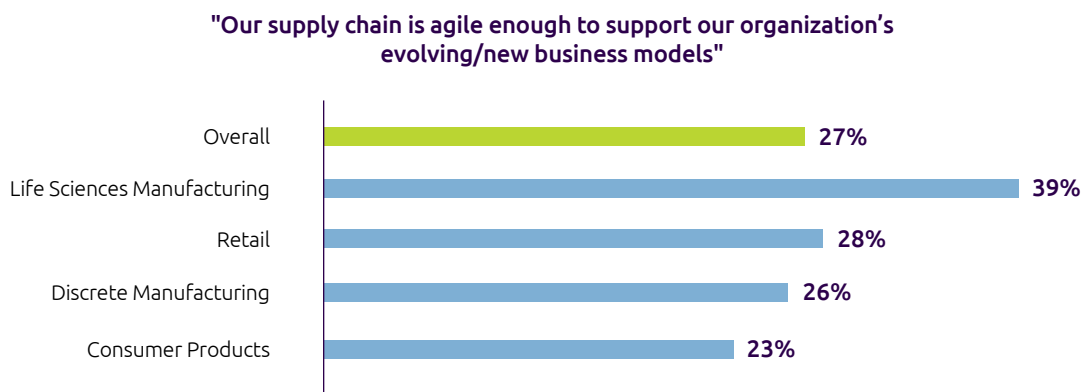| Area	Percentage
Inbound and outbound logistics	70%
Manufacturing	65%
Recycling	63%
Responsible sourcing	59%
Packaging	57%
Product design	57%

Source: Capgemini Research Institute, Supply Chain Survey, August–September 2020, N=1,000 organizations.

In the wake of the COVID crisis, Unilever, for instance, has further stepped up its sustainability efforts across its supply chain. In addition to committing to achieve net zero emissions from all its products by 2039, Unilever also announced plans to work closely with its suppliers in order to achieve its sustainability goals. As part of this, Unilever plans to set up a system that will require its suppliers to declare the carbon footprint of their products and services in each invoice. Further, Unilever also plans to use technologies such as blockchain, geolocation tracking and satellite monitoring to achieve a deforestation-free supply chain by 2023, as part of its commitment to responsible sourcing.[12]

5. Agility is a key area of improvement for supply chain organizations

Agility is a critical element of supply chain resilience as it reduces the negative impact of a disruption by enabling organizations to respond and recover rapidly. The COVID crisis has been a crucial test of supply chain agility, requiring organizations to respond to a wide spectrum of unexpected challenges. Going forward, organizations are taking actions to improve supply chain agility to be better prepared for future disruptions.

More than three in four organizations will prioritize an agile production facility

While consumer demand fell for industries such as automotive,[13] the pharma industry on the other hand had to struggle with sharp spikes in demand. In this volatile environment, the need for agility is paramount. Pharma firms such as GSK, Pfizer and Novartis are using micro-factories to produce vaccines and pills almost 10 times faster. Micro-factories, which are no bigger than a shipping container, cost less to build and operate, consume fewer resources and can be set up quickly.[14]

Going forward, this agility in production will be a major priority for manufacturers. Three in four oganizations in our research say that reconfiguring production lines in an agile manner will be a priority for them post COVID-19. Moreover, 83% of organizations want to be able to switch between make-or-buy in a flexible manner through subcontracting (see Figure 13).
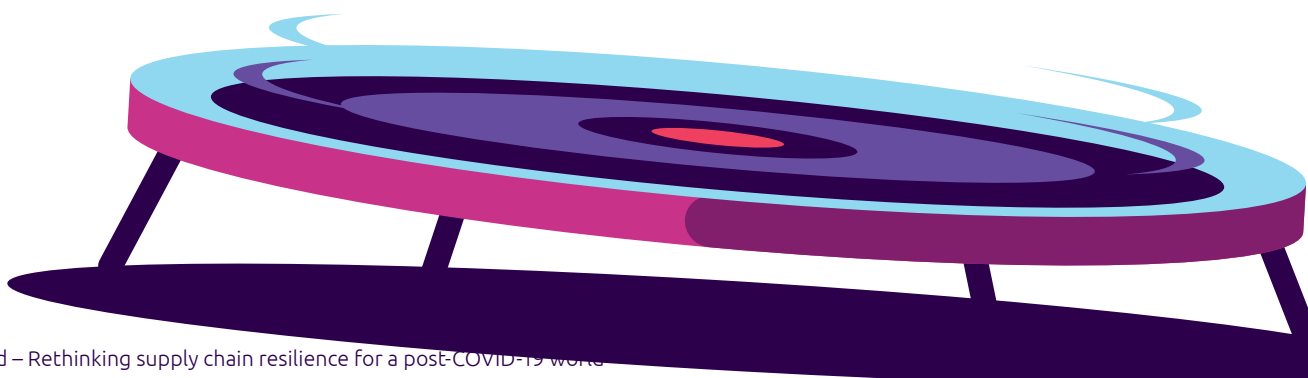
Figure 13. Agility in production will be a key priority for organizations, post COVID-19
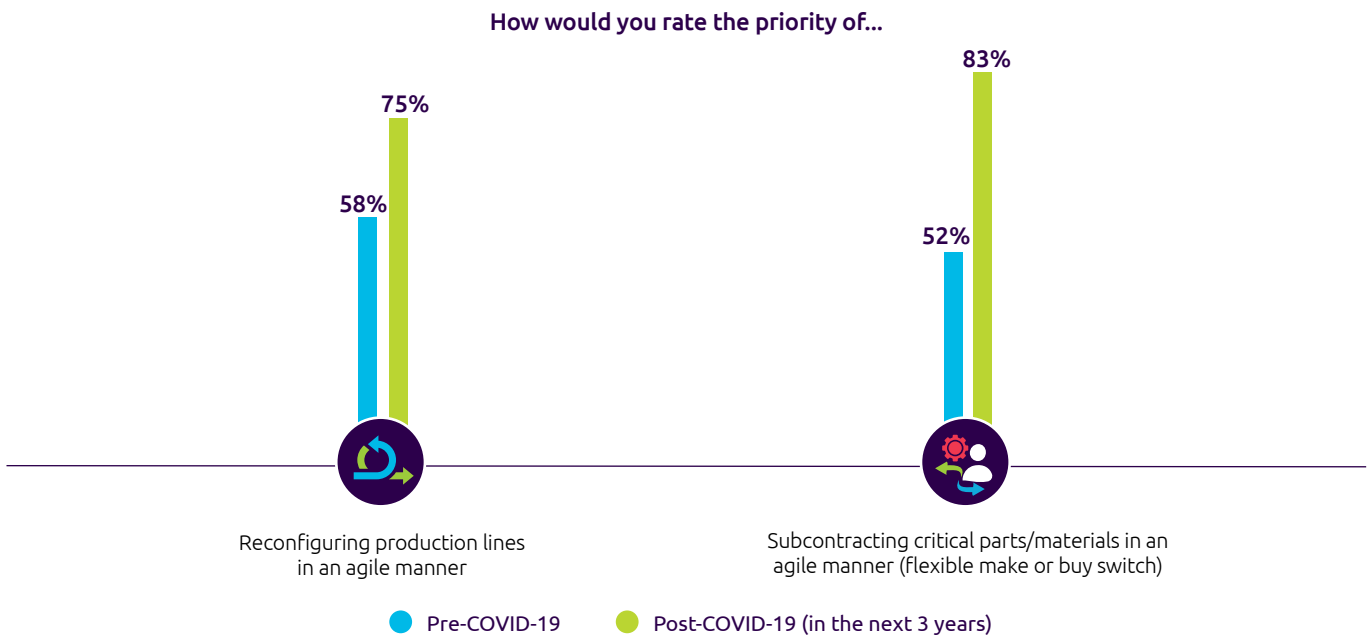
How would you rate the priority of...

58% **75%** Reconfiguring production lines in an agile manner

52% **83%** Subcontracting critical parts/materials in an agile manner (flexible make or buy switch)

● Pre-COVID-19   ● Post-COVID-19 (in the next 3 years)

Highlighting the importance of agility in the current environment, a senior supply chain executive at a global consumer products organization says, *"From a consumer goods perspective, consumption habits and channels have changed, and demand has become very unpredictable. So, forecasts become meaningless and that's where agility becomes that much more important. Agility in the supply chain to capture demand signals – and the flexibility to manufacture, supply and react to that demand – has become extremely critical."*

However, fewer than three in ten organizations agree that their supply chains are agile enough to support new business models

Our research found that a vast majority of organizations believe that their supply chains do not provide them with the level of agility they need. For instance, only 27% of organizations believe that their supply chains are agile enough to support a shift to new business models within the span of a few weeks (see Figure 14).

Figure 14. Only a minority of organizations feel that their supply chains are agile enough to support new business models

"Our supply chain is agile enough to support our organization's evolving/new business models"

Overall	27%
Life Sciences Manufacturing	39%
Retail	28%
Discrete Manufacturing	26%
Consumer Products	23%

6. Optimizing solely for raw material costs leaves organizations vulnerable to future disruptions

Supply chain historically has been viewed as a cost center. And direct costs such as raw material costs are often the most visible components of supply chain costs in certain industries. Perhaps for this reason, we found that 61% organizations have optimized their raw material costs and 57% have optimized their transportation costs (see Figure 16). Reliance on only one or two costs such as the lowest raw material costs will have unintended consequences. For instance, the Institute of Supply Management found that during the current crisis, 57% of companies experienced longer lead times for their Tier 1 components sourced from China.[15] Accounting for end-to-end supply chain costs is a key prerequisite to building supply chain resilience, as it allows organizations to accurately weigh

37%
Organizations that account for the costs arising from location-based risks

the impact of their supply chain strategies (such as the choice of a low-cost manufacturing destination) with the cost of associated risks. Currently however, organizations lack full transparency into their supply chain costs that increases their risk exposure. For instance, only 37% of organizations account for the costs arising from location-based risks (see Figure 15).

Figure 15. Around 60% of organizations optimize for raw material costs while fewer than 40% optimize for location-based costs

Percentage of organizations that have optimized each of the following cost categories

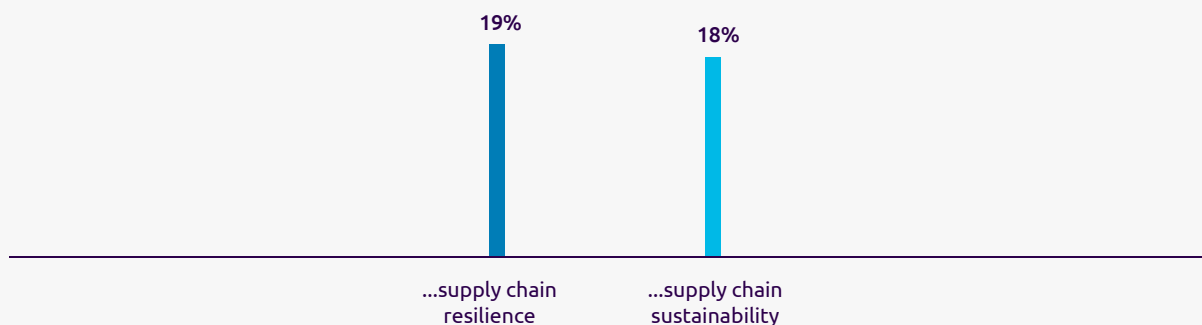| Cost category	Percentage
Raw material costs	61%
Outbound transportation costs	57%
Inbound transportation costs	57%
Inventory costs	56%
Production costs	56%
Plant maintenance costs	56%
Labor costs	54%
Warehousing costs	53%
Reverse logistics costs	51%
Carbon footprint	44%
Costs arising from location-based risks (e.g., frequent strikes/political unrest/ geographical and geological risks)	37%

Source: Capgemini Research Institute, Supply Chain Survey, August–September 2020, N=1,000 organizations.

However, organizations will have to look at a way to balance resilience with costs. Laura Garciandia, a supply chain executive based in Spain, says, *"Companies should find a balance between cost and resilience. For example, a way to improve resiliency is to have higher stocks and cover all the delay issues. But you know this is not possible because at the end you must have a lot of investment and stock in your warehouse and this is something that the company doesn't want. Instead, we need to work with the customers, with the suppliers to have the right information when we need and to react fast."*

Two in three organizations still consider cost savings a priority

Our 2018 supply chain research found that cost reduction was the number-one driver of supply chain investments (77% of organizations).[16] Today, it still remains a major priority for 66%. Our latest research also shows that 45% of organizations want to build resilience and sustainability while keeping a firm control on costs. However, over a quarter (27%) are comfortable with higher supply chain costs when driving these initiatives (see Figure 16).

Figure 16. While 45% of organizations want to keep a firm control over costs as they seek to build supply chain resilience and sustainability, 27% are comfortable with higher costs

What is your view about increasing supply chain costs in order to build more resilience and efficiency, in the wake of the COVID-19 crisis?

9%

19%

27%

45%

- We are focused on building resilience and sustainability while keeping a firm control on our costs
- While our organization tries to optimize costs while building resilience and sustainability, we are comfortable with higher supply chain costs
- We do not want to increase resilience or our sustainability at the cost of our supply chain costs
- We do not know our true end-to-end supply chain cost (there is no dedicated supply chain controlling in place to report on supply chain costs)

The 27% of organizations that are comfortable with an increase in supply chain costs, are willing to increase their supply chain costs by 19% in the next three years to improve resilience and by 18% to improve sustainability (see Figure 17).

7. The crisis has brought home the importance of visibility across the supply chain

Organizations are more willing to exchange data with their partners to improve supply chain visibility

Organizations have seen a major shift in customer demand during the crisis as well as disruptions to their supply and transport network. This has brought home to purchasing, demand, and supply planning functions the need for effective collaboration and access to data in order to build greater visibility into supply chains. At least 60% of organizations surveyed plan to increase data sharing with their ecosystem of partners, such as suppliers, subcontractors, distributors, and stores (see Figure 18).

Kevin Nash, SVP Global Integrated Logistics, Kuehne + Nagel, a transportation and logistics company, highlights how access to data gives them the foresight to identify risks. *"We use data from best-in-class technology partners, who leverage both structured and unstructured sources about what is happening in the world, from a port strike in Barcelona to a hurricane in the West Atlantic. We then take that 'potential risk' information, and the locations behind the information, and we overlay it on top of our customers' supply chain profiles. Then our algorithms, built by our data science team, assess those risks, provide those to our Global Control Tower operators who then take actions proactively."*

> We use data from best-in-class technology partners, who leverage both structured and unstructured sources about what is happening in the world, from a port strike in Barcelona to a hurricane in the West Atlantic..."

Kevin Nash
SVP, Global Integrated Logistics
Kuehne + Nagel

Figure 18. Majority of organizations plan to increase the level of data sharing with their ecosystem partners
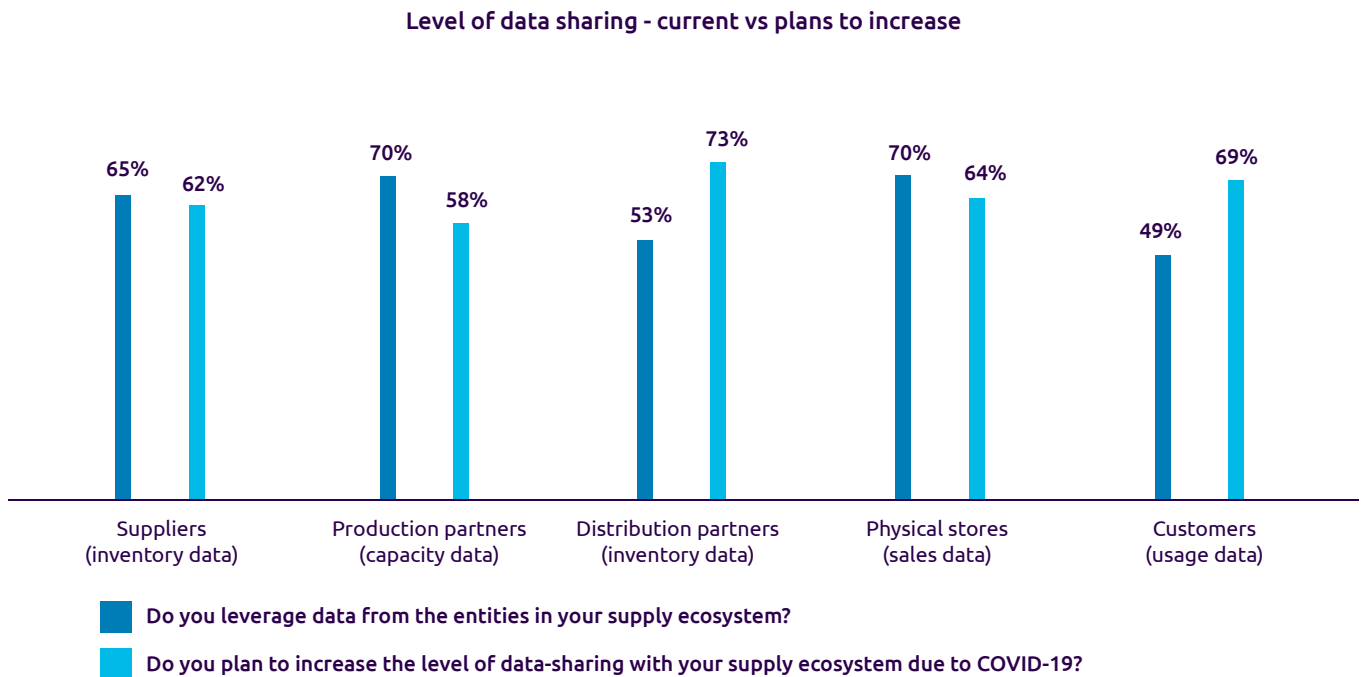
Level of data sharing - current vs plans to increase

Suppliers (inventory data): 65% / 62%
Production partners (capacity data): 70% / 58%
Distribution partners (inventory data): 53% / 73%
Physical stores (sales data): 70% / 64%
Customers (usage data): 49% / 69%

■ Do you leverage data from the entities in your supply ecosystem?

■ Do you plan to increase the level of data-sharing with your supply ecosystem due to COVID-19?

Source: Capgemini Research Institute, Supply Chain Survey, August–September 2020, N=1,000 organizations.

However, more than two in five organizations have still not mapped their supply networks

While organizations recognize the need for improving supply chain visibility, the vast majority have not taken measures to adequately map their supply networks. As many as 44% have not mapped their supply networks at all, while 26% have only mapped their Tier 1 supply networks (see Figure 19). This lack of visibility into their supply networks, especially their extended supply networks comprising Tier 2 and 3 suppliers, can blindside organizations to critical dependencies within their supply chains and to their overall exposure to risk. The proportion of organizations that have not mapped their supply networks at all is highest at 51% in the discrete manufacturing sector, and lowest at 34% in the retail sector.

"Companies should find a balance between cost and resilience. For example, a way to improve resiliency is to have higher stocks and cover all the delay issues. But you know this is not possible because at the end you must have a lot of investment and stock in your warehouse and this is something that the company doesn't want. Instead, we need to work with the customers, with the suppliers to have the right information when we need and to react fast."

Laura Garciandia
Supply chain executive based in Spain

To what extent have you mapped your current supply network?

- 44% — We have not mapped our supply network
- 26% — We have mapped our Tier 1 supply network but not the extended supply network
- 20% — We have mapped part of our extended supply network for critical parts
- 10% — We have fully mapped our supply network (we can identify the original source of every component in our products)
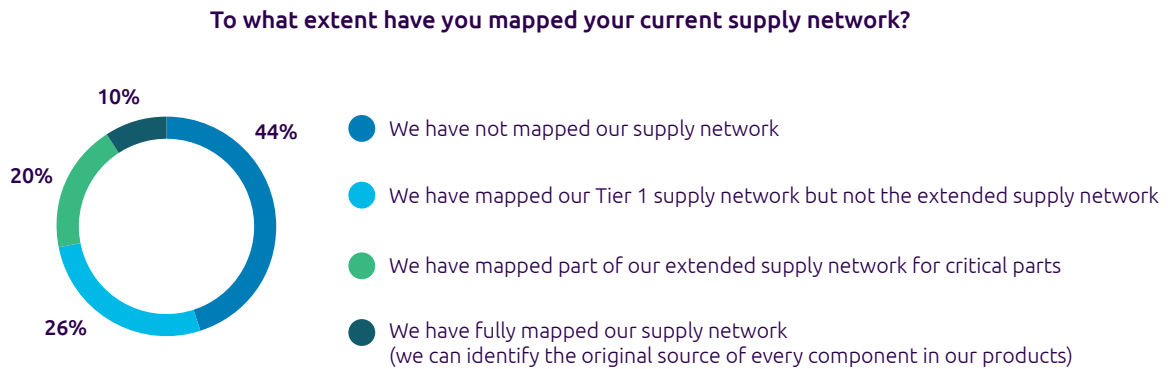
Source: Capgemini Research Institute, Supply Chain Survey, August–September 2020, N=1,000 organizations.

Highlighting gaps in supply chain visibility and the need to fill them, a senior supply chain executive at a leading automotive supplier says, *"We have very good visibility of our stocks internally, in raw materials, work in progress, or finished goods. But, the visibility of stocks with our customers or with our suppliers is not enough today. This is one of the fundamental gaps of the business."*

Investments in supply chain digitization are set to increase

Supply chain digitization has wide-ranging benefits – improved customer service, cost savings through operational efficiency, increase in revenue and even launching new business models. So, not surprisingly, our previous research on supply chain found that supply chain digitization is a top-three organizational priority for 50% of organizations.[17]

Our current research shows that in the wake of the COVID-19 crisis, 60% of organizations will increase their investments in supply chain digitization. Speaking on the impact of the crisis, Beiersdorf's Parmeshwaran Iyer says, *"We have been investing on digitization for the last five years. It's not as if we were waiting for COVID to happen to increase our digitization. However, having said that, we will accelerate a lot of our programs which was supposed to have been done like say in three years' time or four years' time. We will now anticipate them and do it in the next one, one and a half years."*

While the digitization of supply chains is a multi-year and a multi-technology program, the aftermath of COVID-19 has seen organizations increase their investments in technologies that make their supply chains more autonomous and intelligent – both of which are key enablers of resilience as they allow supply chains to sense and adapt more quickly to changes or disruptions. Our research shows that 47% of organizations are accelerating their investments in automation and 39% on robotics. Further, IoT, and AI are among the top focus areas for organizations, drawing higher investments in light of the crisis.

However, investments in certain technologies that are critical for building long-term resilience, such as control towers that enable increased visibility and digital twins that support contingency planning, are expected to accelerate at a slower pace than other areas (see Figure 20). This is a gap that organizations should seek to address.

Current adoption and accelerated investments in technology due to COVID-19
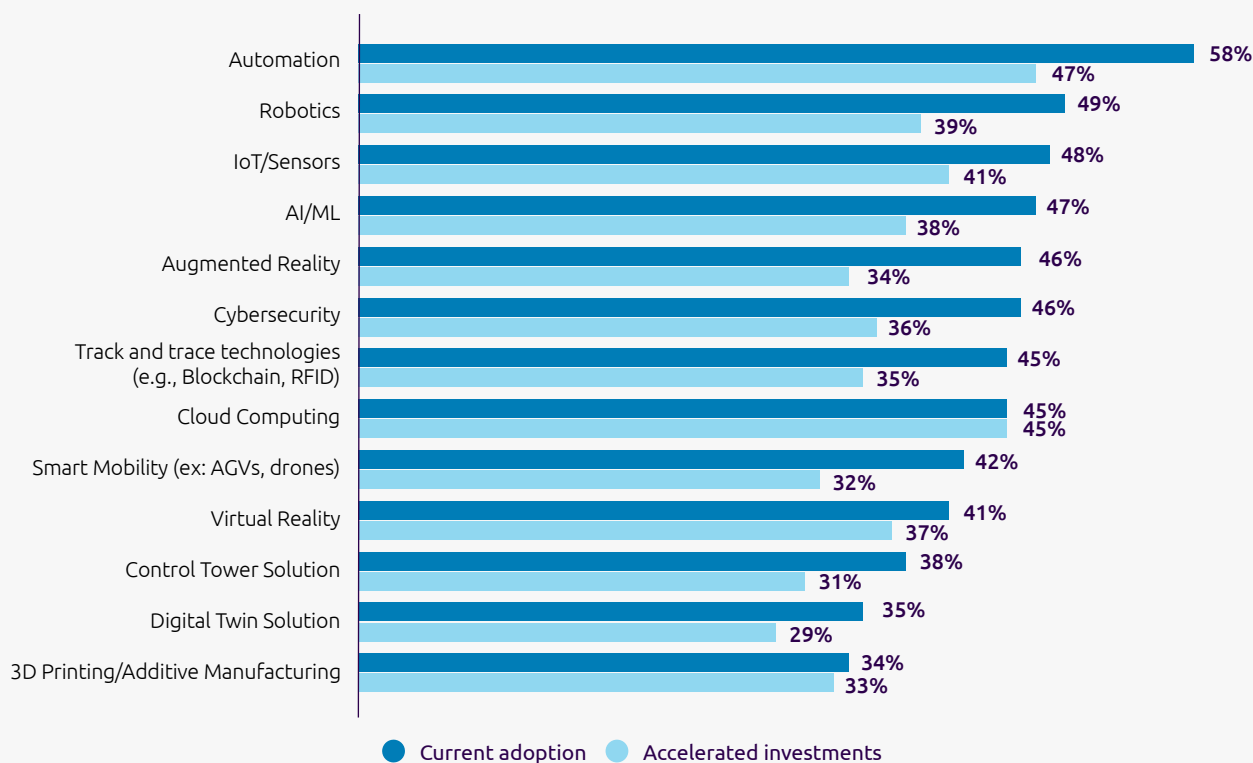
Technology	Current adoption	Accelerated investments
Automation	58%	47%
Robotics	49%	39%
IoT/Sensors	48%	41%
AI/ML	47%	38%
Augmented Reality	46%	34%
Cybersecurity	46%	36%
Track and trace technologies (e.g., Blockchain, RFID)	45%	35%
Cloud Computing	45%	45%
Smart Mobility (ex: AGVs, drones)	42%	32%
Virtual Reality	41%	37%
Control Tower Solution	38%	31%
Digital Twin Solution	35%	29%
3D Printing/Additive Manufacturing	34%	33%

● Current adoption   ● Accelerated investments

Source: Capgemini Research Institute, Supply Chain Survey, August–September 2020, N=1,000 organizations.

As the pandemic drove up online orders, many retailers found themselves lacking in the capabilities needed to fulfill those orders. Kroger accelerated investments in their warehouse automation solutions to achieve a quicker turnaround. The retail giant, which has already launched fully automated warehouses in collaboration with Ocado, announced three more Consumer Fulfillment Centers (CFCs) to further improve their ability to quickly and efficiently service online orders.[18] These CFCs use a combination of AI and robotics to primarily serve e-grocery orders which hit a record peak of USD7.2 billion in June.[19]

Mamunur Rahman, former global head of IT at one of Australia's leading logistics firms says, *"From a supply chain logistics point of view, COVID will challenge the current status quo. Automation will play a key role in the end-to-end logistics value chain from warehousing to delivery, in enabling the shift towards touchless or less touch-based operations. Having said that, the human touch will continue to remain important but where it is needed will change."*

While organizations have taken a number of steps to strengthen their supply chains in response to the current crisis, few are building these capabilities comprehensively. In order to be fully prepared for future disruptions, organizations will need to focus on all seven resilience aspects. However, as Figure 8 shows, less than 4% of organizations are currently doing so. In the next section, we look at how organizations can lay the groundwork for future-proofing their supply chains.

How can organizations future-proof their supply chains?

Based on our experience and the findings from our research, we recommend four key action areas for organizations that can enable them to be better prepared for future disruptions (see Figure 21).

How can organizations future-proof their supply chains?

4. Build the capabilities needed to recover rapidly from disruptions

- Standardize plant and process designs, and material and component choices for increased agility
- Foster strong relationships with ecosystem partners through collaboration and data-sharing

3. Build the capabilities needed to resist disruptions

- Diversify the supplier base and production footprint gradually
- Bring operations closer to consumption
- Focus on customer-centric supply chain planning through the use of analytics
- Invest in R&D to find alternate materials for critical raw materials
- Invest in identifying and closing supply chain skill gaps

1. Establish a supply chain resilience strategy

- Measure the current level of supply chain resilience
- Account for end-to-end SC costs to accurately determine trade-offs while building resilience
- Assess product portfolio to identify areas where building resilience will be critical and inculcate resilience thinking into the entire product lifecycle

2. Build the capabilities needed to anticipate disruptions

- Adopt systems and processes required to enable end-to-end supply chain visibility
- Expand the range of risk factors being monitored across the supply chain
- Invest in risk simulation and scenario planning capabilities
- Establish a regular cadence for testing and revising Business Continuity Plans (BCPs)

Source: Capgemini Research Institute analysis.

Establish a supply chain resilience strategy

Measure the current level of supply chain resilience

For years, organizations have not thoughtfully cultivated resilience in their supply chains. But this is changing in today's pandemic era, as the supply chain director at a UK-based retailer says, *"The crisis highlighted that fundamentally things need to be different to optimize the supply chain. So, I think a lot of businesses will be rapidly looking at the supply chain – its resilience and speed – and how to put in contingency planning in a much more rigorous way."*

The first step in building resilience means understanding the current state of play in your supply chain, in terms of agility,

visibility, diversification, as well as contingency planning. Some of the critical KPIs that can be used to assess performance in these areas include:

- **Agility:** share of critical parts subcontractable in an agile way (switching flexibly between make-or-buy decisions)
- **Visibility:** Level of inventory sharing and forecast sharing with suppliers, share of transport capacity with precise tracking
- **Diversification:** share of strategic parts produced in multi site (more than one site), share of critical components that are multi-sourced (as opposed to sourced from a single supplier/a single site)
- **Contingency planning:** Readiness of business continuity planning and time taken for response.

As seen above, building resilience requires careful consideration of a number of metrics. Organizations must determine the right mix of the above factors to arrive at the resilience they plan to build based on the industry they are in,

their product strategy and the product portfolio. Once they determine this resilience mix, they must develop a indicator or a basket of indicators which will allow them to monitor their level of resilience over time.

Account for end-to-end supply chain costs to accurately determine trade-offs while building resilience

As shown in Figure 15, 61% of organizations have optimized their supply chains for raw material costs, while fewer than 40% have accounted for costs arising from location-based risks. While such a strategy works during normal times, crises such as COVID-19, or the 2011 earthquake and tsunami in Japan, demonstrate the drawbacks of such a strategy. By not accounting for end-to-end supply chain costs, organizations tend to overestimate the costs associated with building resilience, leaving them vulnerable to other risks, such as location-based risks. In order to manage supply chain risks effectively – and to gain a clear picture of the trade-offs required to build resilience – it is critical that organizations accurately account for all potential supply chain costs.

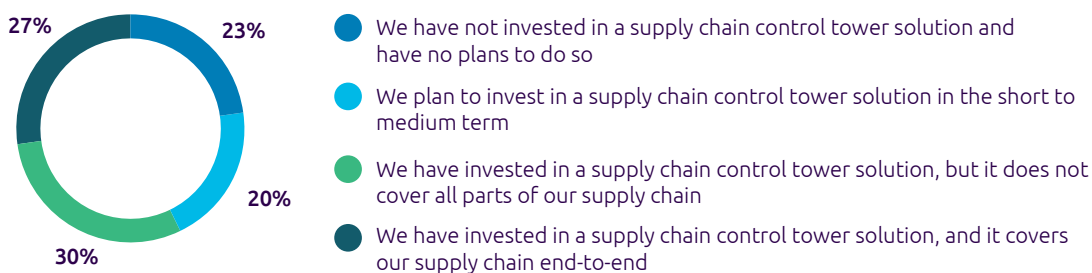Sergio Ligorati, a senior S&OP executive based out of Switzerland, says, *"Companies will rethink their footprint. You need to have part of the production that is leaning towards local sources, otherwise during a crisis like this, you will be really out of the game if you are only linked to one source of production far away from the main market. This means that in some cases your cost will become higher for local production and can be partially counterbalanced with lower logistics costs, but at least you keep serving your customer with a decent service level."*

Organizations must also look at their environmental costs. Regulators are imposing heavy penalties for breaching carbon emissions: for example, the European Emissions Trading System (ETS) has levied a penalty of £608,500 on a CHP (combined heat and power) operator for its failure to comply with EU ETS regulations.[20]

Assess product portfolio to identify areas where building resilience will be critical and embed resilience thinking into the entire product lifecycle

Building resilience across an entire product range would be expensive, time-consuming and often impractical. Instead, organizations should identify the areas where building resilience is critical. Some of the questions that organizations should consider in this phase include:

• Which of the products have a higher gross margin?
• Are you producing such products in at least two sites?
• Do any of the critical components of these products have a single supplier/single supplier with a single site?
• Can you shift production to a different site in case of a localized lockdown with minimal effort?

Once the organizations get into such detailed analyses, they can then determine where they need to focus and strengthen their resilience.

Ultimately, however, organizations must inculcate resilience thinking into the entire product lifecycle:

– They must start balancing the different aspects of resilience versus cost versus service levels
– This needs to be done right from research and development to product design to supply and demand planning
– At each stage, the organziation needs to decide on the choice between resilience versus profit margin.

Beiersdorf's Parmeshwaran Iyer illustrates how this might work in action, *"Let's say our product development team comes up with a product idea that uses an exquisite raw material that's only available from a single supplier in Timbuktu. We must be able to tell the team that sourcing this component comes with this cost and a low resilience factor. Then, the product team can decide if they want to go ahead with that sourcing after calculating the risks."*
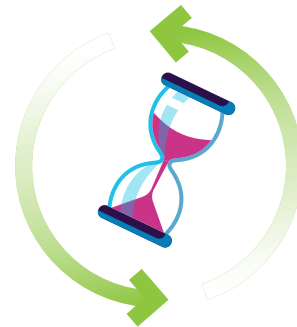
Build the capabilities needed to anticipate disruptions

A key step in the journey to supply chain resilience is being able to identify early warning signs of disruption and planning for contingencies in advance. This involves:

1. Adopting systems and processes required to enable end-to-end supply chain visibility
2. Expanding the range of risk factors being monitored across the supply chain
3. Investing in risk simulation and scenario planning capabilities
4. Establishing a regular cadence for testing and revising business continuity plans (BCPs).

Adopt systems and processes required to enable end-to-end supply chain visibility

A lack of adequate end-to-end supply chain visibility is a major roadblock to contingency planning. As many as 72% of organizations in our research faced significant challenges in

monitoring their supply chains end to end during the crisis. Supply chain visibility can be greatly enhanced through supply chain control towers. Control towers capture and use the data across the supply chain and provide enhanced visibility to organizations for short-and long-term decision making. They also help in monitoring and managing inventory and transportation across the supply chain.[21]

Colgate Palmolive implemented an end-to-end control tower and was able to:

- Drive meetings that deep dive into selected issues and identify root causes
- Develop global dashboards that present a common view of data across functions
- Allow its planners to use predefined analytics
- Spend more time on decision making and action items instead of data collection.[22]

With their ability to provide real-time information, control towers would have helped organizations during the current crisis with enhanced decision making, shifting supplier allocations, and in ensuring more accurate demand planning.[23] However, our research has shown that 43% of organizations do not currently have a control tower. Further, only 27% have a control tower that covers their supply chain end to end (see Figure 22). The life sciences sector is ahead of other sectors today in the adoption of control towers. We found that 68%

> "Companies will rethink their footprint. You need to have part of the production that is leaning towards local sources, otherwise during a crisis like this, you will be really out of the game if you are only linked to one source of production far away from the main market..."

Sergio Ligorati
A senior S&OP executive
based out of Switzerland

of life sciences organizations have already invested in a control tower solution that covers their supply chain either partially or fully, compared to only 54% of organizations in the discrete manufacturing sector.

Figure 22. 43% of organizations do not currently have a supply chain control tower

Adoption of supply chain control towers

- **We have not invested in a supply chain control tower solution and have no plans to do so** — 23%
- **We plan to invest in a supply chain control tower solution in the short to medium term** — 20%
- **We have invested in a supply chain control tower solution, but it does not cover all parts of our supply chain** — 30%
- **We have invested in a supply chain control tower solution, and it covers our supply chain end-to-end** — 27%

In addition to control towers, organizations must also improve their tracking and tracing capabilities across the value chain. Track and trace technologies help organizations in a number of ways:

- Determine with certainty the inventory at warehouses, in transit and at retailers
- Monitor the conditions of the goods during transit (temperature, humidity, etc.)
- Track the provenance of goods
- Establish consumer trust in the sustainable credentials of the organization.

For instance, using blockchain technology, Starbucks enables its US customers to trace the origin of coffee beans and where they were roasted. The technology also allows Starbucks to help farmers track where their produce went.[24]

Expand the range of risk factors being monitored across the supply chain

The ability to anticipate supply chain disruptions also depends on the level of visibility that organizations have over a range of risk factors. However, our research indicates that most organizations do not have a comprehensive view of their supply chain risks. For instance, only 45% of organizations in our survey go beyond financial parameters while measuring supplier risk. General Motors offers several best practices on monitoring supply chain risk comprehensively. The organization monitors a variety of threats, including factory fires and explosions, floods, storms, strikes, cyberattacks, forest fires, and civil unrest. This is enabled by a location-based intelligence system that allows GM to be better prepared for threats and to take proactive measures to avoid disruptions.[25]

Invest in risk simulation and scenario planning capabilities

Simulation and scenario planning tools can provide insights that enable organizations to plan ahead for contingencies. The capabilities that Johnson & Johnson (J&J) has established over the years, for instance, held it in good stead during the COVID-19 crisis. J&J leveraged risk simulation tools and mathematical models to predict worst-case scenarios using live data on staffing levels and production rates. This in turn allowed the company to plan interventions in advance such as shifting production to alternate locations or changing shipping methods. The system also allowed supply chain executives to plan for raw material requirements better and to avoid over or under ordering, and to save costs as a result. This is especially significant given that 68% of organizations in our research struggled with controlling supply chain costs during the crisis. *"One of the things I've learned after working on the supply chain for many years is that we need to expect the unexpected,"* says Lada Kecman, vice president of supply chain systems and solutions, Johnson & Johnson. *"The COVID-19 pandemic has reminded us how supply chain market patterns can be affected by outside events — but the latest technologies allow us to be more agile in response to those events."[26]*

Establish a regular cadence for testing and revising business continuity plans (BCPs)

Robust crisis preparedness requires that BCPs are regularly put to the test and updated as needed. In addition, such tests should also be extended to suppliers so that organizations have a clear view of suppliers' ability to respond rapidly when disruptions occur. In the aftermath of the 2011 earthquake in Japan, which severely disrupted supply chain operations for automotive OEMs across the world, automaker Nissan began mandating that Tier 2 and 3 electronics suppliers have the ability to switch production to alternate facilities if their primary facility was disrupted.[27]

Highlighting the need for organizations to build more robust BCPs, Mamunur Rahman, former global head of IT at one of Australia's leading logistics firms says, *"Many organizations are not good at creating a plan B and react only when a disruption happens. Organizations should not create BCPs only for the sake of documentation and meeting audit requirements. Rather, make BCPs really meaningful. Outline all possibilities, and review BCPs regularly. Be clear about what can be enabled digitally and what cannot."*

Build the capabilities needed to resist disruptions

Diversify the supplier base and production footprint gradually

Historically, organizations considered outsourcing of manufacturing as a way to cut their costs. While outsourcing itself is not an issue, heavy reliance on a single location or narrow supply base is a handicap at times like these. Once organizations determine their exposure to certain areas – and understand the critical parts and components that need a
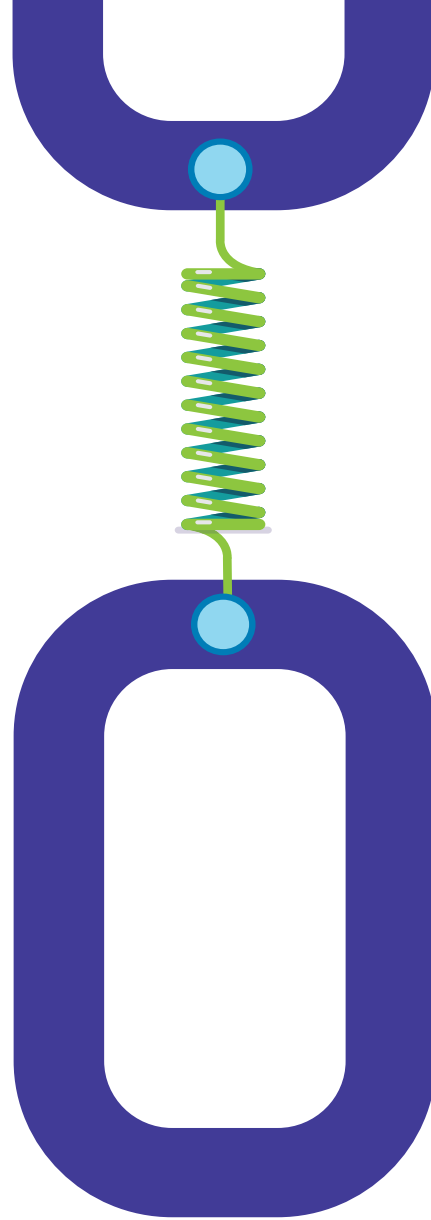
resilient approach – they can expand to other locations or source alternate suppliers. Elaborating on this approach, Christos Matzaridis, head of supply chain, EMEA at Amcor Flexibles, says, *"The crisis means that us taking a fresh look at our supply network planning has greater urgency. This is in regard to the way that we are allocating business to sites – assessing vulnerabilities in the network and increasing coverage and spreading capacity to avoid any bottlenecks. For example, if you have sites from one corner of the continent supplying customers to another, that could be a potential vulnerability in a scenario like this. So, these are the type of things that we're going to be looking at."*

For instance, Foxconn, which is one of Apple's largest suppliers, has traditionally manufactured mainly out of China. (twenty-nine out of Foxconn's 35 manufacturing facilities were located in China in 2018[28]). However, Foxconn has taken steps recently to diversify outside of China, as have two other major Apple suppliers – Wistron and Pegatron. The three suppliers have committed to investing a total of $900 million to set up or expand their footprint in India over the next five years. This is in response to the Indian government's production-linked incentive scheme that offers incentives of 4–6% on incremental sales to electronics companies that manufacture mobile phones and other electronic components in India.[29]

Bring operations closer to consumption

Global supply chains come with the flipside of being complex and vulnerable. These complexities also increase the inherent risk of failure. Localization of supply chain, even if it is focused on the most critical parts and products, can significantly reduce these risks and vulnerabilities. This will be critical for strategic areas such as technology and pharmaceuticals. Like diversification, localization also involves a cost and time element to set up. The decision to localize will also depend on the type of industry as well as geopolitical considerations. Organizations will need to weigh these factors against the rewards of localization that come in the form of greater availability and reduced risk of failure.

A localized supply chain also offers other benefits, such as a greener supply chain, quicker turnaround, and greater control. T.V. Narendran, global CEO of Tata Steel, said, *"After this pandemic, you will see more and more localization of supply chains. They will be ideally in the same country, and it'll be even better if they are in the same neighborhood."*[30]

Focus on customer-centric supply chain planning through the use of analytics

As seen in Figure 20, nearly half of organizations are using AI in their supply chains and, as a result of COVID-19, 38% are accelerating their investment in these smart systems. Supply chain analytics can drive benefits across the value chain, as Figure 23 shows.

Figure 23. Sample supply chain analytics solutions

Planning
- Demand forecasting
- Supply planning
- Capacity vs demand analytics
- SKU rationalization

Sourcing
- Supplier risk and performance analysis
- Supplier collaboration assessment

Manufacturing
- Manufacturing footprint optimization
- Workforce optimization
- Predictive maintenance
- Asset utilization

Warehousing & Distribution
- Inventory optimization
- Logistics network optimization
- Transportation optimization

Sales
- Pricing optimization
- Customer sentiment analysis

Source: Capgemini.

The crisis means that us taking a fresh look at our supply network planning has greater urgency. This is in regard to the way that we are allocating business to sites – assessing vulnerabilities in the network and increasing coverage and spreading capacity to avoid any bottlenecks."

Christos Matzaridis,
Head of supply chain, EMEA
Amcor Flexibles

For instance, US-based logistics provider XPO Logistics Inc outlined at a recent conference how it can use predictive analytics to answer key questions. In terms of workforce capacity for example, it can take a given day, look at what kind of labor levels it had and how many pallets, and ascertain how much labor it will need over the coming weeks. This will help them to plan effectively and avoid both overstaffing and understaffing.[31]

However, during the COVID-19 crisis, organizations struggled to predict the shift in customer demand. For analytical models to run accurately, it is important for organizations to understand the market and react quickly. In order to accomplish this, they should work closely with their customers to understand the changes in demand, track changes in consumer behavior using internal and external data sources, and then feed this data back into the S&OP processes and analytical models.

Talking about how their organization readjusted processes to capture changing demand signals during the crisis, a supply chain vice president at a tyre manufacturer told us, *"Very early in the crisis, the group decided to run a weekly S&OP. Our initial process was not designed to run on a weekly basis. However, with a few adjustments, we were able to go from a monthly to a weekly process. Our sales and marketing teams needed to interact much more closely with our customers to catch extremely sensitive signals that helped us understand a number of areas: how much the crisis was impacting our business and our customers' business, how fast we could expect to recover, and what kind of signals we could monitor in order to be ready to restart our business."*

Invest in R&D to find alternate materials for critical raw materials

Organizations in many sectors are frequently dependent on a single supplier or a single country for certain raw materials. For example:

- In the aftermath of the Japanese earthquake, Volvo found that a metallic paint shade used in its cars was solely sourced – i.e. sourced from the only supplier of that shade in the world. Moreover, the supplier had only plant where the shade was manufactured, which was located in Onahama, Japan. The plant was damaged in the earthquake which severely affected Volvo's sourcing plans.[32]
- Today, when we look at the mining of rare earth metals used in high-tech industries, China remains the largest producer of these rare earth metals. In 2019, China's production of rare earths accounted for 63% of the global production with 132,000 MT (million tons) while the second largest country, the US, produced 26,000 MT (12.4%).[33]
- During 2015–18, the US completely relied on Canada for its entire import of Cesium (used in mobile phones, GPS, optical glass[34]) and Nepheline Syenite (used in ceramic, glass industries).[35]

For critical raw materials, organizations must look at finding alternate materials. This will help in the longer term by reducing reliance on a single supplier or a single region. Even if organizations do not rely on "sole source" procurement (where only one supplier can deliver a particular raw material), over-reliance on a particular region for a material can also affect them in unexpected situations. So, organizations must determine the critical raw materials from their bill of materials that rely on a single supplier or region. Based on the resilience mix identified for the end product, as discussed earlier, they must invest in research to identify alternate materials which are easier to source.

Invest in identifying and closing supply chain skill gaps

The COVID-19 crisis has cast the spotlight on the technology levers that are required to build supply chain resilience – automation, robotics, IoT, and AI. Organizations will need to invest in building the necessary skill sets in these areas. Our previous research on automation and workforce shows that organizations that have an ongoing upskilling program have more successful intelligent automation initiatives, higher productivity, and higher employee morale.[36] Shell, for instance, has a team of 160 data scientists, but it has also trained 800 of its employees with basic coding skills to work on AI projects.[37] Upskilling programs will be especially critical in industry sectors (such as the aviation sector) that have been severely disrupted by the crisis and are seeking to rebuild themselves. Our research shows that the life sciences sector is ahead of other sectors when it comes to skill development. As many as 76% of life sciences organizations are investing in upskilling and reskilling their employees compared to the global average of 66%.
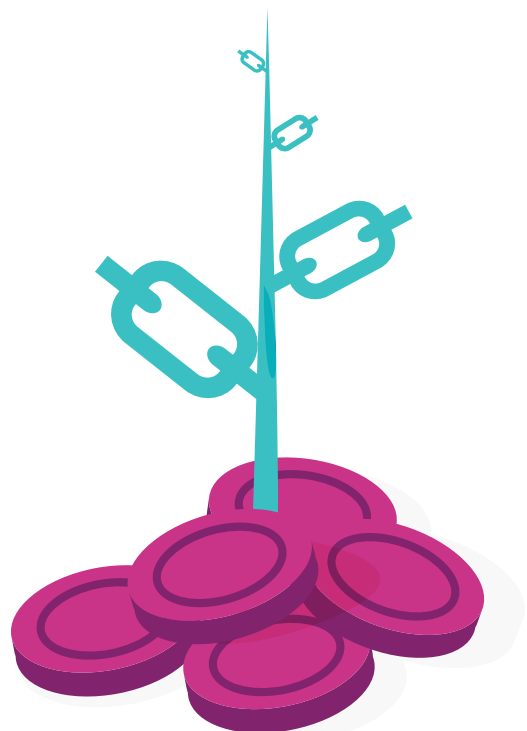
Build the capabilities needed to recover rapidly from disruptions

To be fully prepared for disruption, organizations cannot only focus on their ability to anticipate and resist disruptions. They also need to build the capabilities that allow them to recover rapidly should a disruption be unavoidable. This requires a focus on two key areas:

1. Standardizing plant and process designs and material and component choices for increased agility
2. Fostering strong relationships with ecosystem partners through collaboration and data-sharing

Standardize plant and process designs and material and component choices for increased agility

In order to reduce complexity and drive agility in their supply chains, organizations should identify opportunities for standardization across the supply chain, including product design, processes, choice of materials and components, and packaging.

US-based food and beverage firm Mondelez, for instance, has adopted a standardization strategy called "platform lifecycle management" to identify ways to standardize its SKUs, suppliers, and supply chain processes. Highlighting the impact of the strategy on agility, Daniel Myers, executive vice president of integrated supply chain at Mondelez, says, *"Platform management is a simple concept that requires company-wide coordination and adoption. A focus on standardization will drive speed and margin improvement."* Such a strategy also provides cost savings, offering further opportunities for organizations to increase resilience while still being cost efficient. For instance, a study sponsored by Mondelez found that standardization helped a global fragrance company to realize costs savings of 15% by reducing the number of lavender fragrances from 16 to three.[38]

Foster strong relationships with ecosystem partners through collaboration and data-sharing

Strong collaborative relationships with supply chain partners can go a long way in helping organizations react rapidly to disruptions. Speaking on the need for these relationships, especially in light of the COVID-19 crisis, Marc Engels, chief supply chain officer, Unilever, says, *"The new normal will demand agile responses to changes in the marketplace. The power of partnerships will be critical to unlocking agility and innovation in the end-to-end value chain. If there ever was a need to strengthen value-chain collaboration and partnerships, it is now. And that can only be enabled by real-time communication."[39]*

While strong relationships are founded primarily on trust, they also need to be backed by the right technology platforms, data, and processes. In the automotive sector, for instance, OEMs, suppliers and transportation service providers have come together to form a community called "AutoSphere", which is dedicated to sharing data and building visibility. Members of the community use a common set of processes and a common database to manage their supply chain transactions. The secure collection, sharing, and analysis of data is handled by a third-party technology provider that also provides the required software and hardware solutions for the initiative. Founding members of AutoSphere include Honda, Toyota, Fiat Chrysler Automobiles, Nissan, and General Motors. The enhanced levels of visibility that this level of collaboration provides comes with many advantages. Not only does it make community members more resilient by giving them more insight into unexpected events and helping them plan better, but it also results in reducing inefficiencies and providing cost savings through reduced delays and production interruptions.[40]

Collaboration should play an integral role as organizations look towards future-proofing their supply chains. P&G, for instance, views collaboration with suppliers as critical to achieving its supply chain sustainability goals. As part of this, P&G actively focuses on fostering a common understanding of these goals with its suppliers through its "supplier citizenship program." The program focuses on driving responsible sourcing and supplier diversity through sharing of tools and guidelines.[41]

Conclusion

Disruptions such as COVID-19 are not new to supply chain organizations. In the past decade, they have also witnessed the earthquake in Japan, the Ebola crisis, and Hurricane Maria, among others. However, no other crisis has highlighted the underlying risks of current supply chains as COVID has.

Historically, supply chain organizations have been viewed as cost centers. But, the global and prolonged impact of the crisis has made organizations realize the need for strengthening supply chain resilience. Building resilience into supply chains means examining diversification and localization decisions while strengthening supply chain agility, visibility, and contingency planning capabilities. Supply chain sustainability is another key area with growing importance.

In the aftermath of COVID-19, our research has shown that organizations are planning to increase their efforts in this new direction. However, when we look at the current levels of supply chain resilience and account for plans for the next three years, only a small minority seem to be adequately prepared to withstand the next storm. While organizations' future aspirations are indeed on the right track, the critical mission for supply chain executives right now is to ensure that their organizations follow-through on these goals to be more resilient.

Organizations must determine the right mix of resilience that they want to build into their products and revisit their supply chain strategy to ensure that resilience is embedded into research and development, product design, and planning. By focusing on building resilience comprehensively, and ensuring it is not seen as an afterthought, organizations can be better prepared for whatever the future brings.

Research Methodology

This research followed a two-pronged approach.

We surveyed a thousand supply chain executives at the level of director or above between August and September of 2020. All of these organizations reported revenues of more than USD 1 billion for the last financial year.

Organizations by country

- 20%
- 10%
- 10%
- 10%
- 8%
- 7%
- 7%
- 7%
- 7%
- 7%
- 7%

Legend:
- US
- France
- Germany
- UK
- India
- Italy
- Spain
- Netherlands
- Norway
- China
- Sweden

Organizations by industry

- 20%
- 20%
- 10%
- 50%

Legend:
- Consumer Products
- Retail
- Life Sciences Manufacturing
- Discrete Manufacturing

Organizations by industry

Category	Industry	Percentage
Consumer Products	Foods & Beverages Manufacturing	5%
	Apparel, Footwear and Accessories	3%
	Household Care Products Manufacturing	3%
	Personal Care Products Manufacturing	3%
	Consumer Electronics Manufacturing	3%
	Luxury Goods	3%
Retail	Grocery Retailing	6%
	Fashion and Apparels Retailing	5%
	Home Improvement/Furniture & Furnishings	4%
	Consumer Electronics Retailers	5%
Discrete Manufacturing	Aerospace	7%
	Automotive Original Equipment Manufacturers	10%
	Automotive Suppliers	11%
	Hi-tech	12%
	Industrial Machinery & Equipment	10%
Life Sciences Manufacturing	Pharmaceuticals	4%
	Biotechnology	3%
	Healthcare Equipment	3%

Organizations by revenue
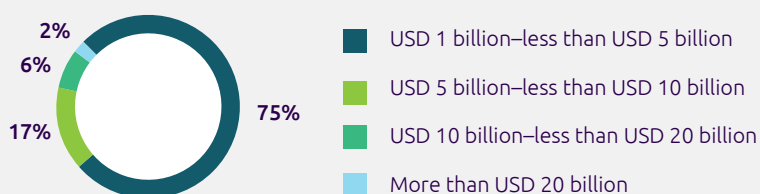
- 75%
- 17%
- 6%
- 2%

Legend:
- USD 1 billion–less than USD 5 billion
- USD 5 billion–less than USD 10 billion
- USD 10 billion–less than USD 20 billion
- More than USD 20 billion

Source: Capgemini Research Institute, Supply Chain Survey, August–September 2020, N=1,000 organizations.

Appendix

Capability	Assessment Metric
Contingency Planning	How would you rate the priority of the following? - Increasing crisis preparedness using simulations - pre COVID-19 and post COVID-19 Which of the following statements corresponds most closely with the current adoption of digital twin supply chain solutions in your organization? a. We have not invested in a digital twin solution and have no plans to do so b. We plan to invest in a digital twin solution in the short to medium term c. We have invested in a digital twin solution, and are using it to conduct scenario planning exercises on an ad-hoc basis d. We have invested in a digital twin solution, and are using it to conduct scenario planning exercises on a regular basis
Localization	How has the COVID-19 crisis influenced your organization's sourcing and manufacturing strategy? a. We are actively investing in regionalizing and localizing our supplier base b. We are actively investing in regionalizing and localizing our manufacturing base (i.e. nearshoring production) Pease indicate the geographical distribution of your supplier and manufacturing base. Current distribution of local suppliers Current distribution of local manufacturing base
Diversification	How has the COVID-19 crisis influenced your organization's sourcing and manufacturing strategy a. We are actively investing in diversifying our supplier base (i.e. shifting from single to multi-sourcing wherever possible) b. We are actively investing in diversifying our manufacturing base (i.e. reducing our reliance on a single geographic region) How would you rate the priority of the following ? a. Multi-sourcing of critical parts/materials (multiple suppliers or same supplier from multiple geographical regions) – pre COVID-19 b. Improving diversity in transportation options (number of partners, different means of transport such as ships, air freight, trains etc., flexibility in purchasing additional transportation capacity) – pre COVID-19 and post COVID-19

Capability	Assessment Metric
Sustainability	How would you define your organization's maturity on the implementation of supply chain sustainability initiatives in the following areas? **Product design –** a. Product design with a circular or cradle-to-grave approach (e.g., maximum material recycling after product usage, easily taken apart into components, etc.) b. Developing products that have lower CO2 emissions **Responsible sourcing –** a. Sourcing products from certified sustainable sources (e.g., fair trade labelling, Rainforest Alliance) b. Local sourcing of raw materials **Manufacturing –** a. Powering manufacturing plants with renewable energy (e.g., wind, solar, etc.) b. Recycling and reusing water (e.g., installing water treatment plants) c. Responsible disposal of waste/by products produced **Inbound and outbound logistics** a. Route optimization (FTL, full truck load) for reducing miles travelled/emissions produced b. Using electric vehicles for freight transportation to stores/distribution centers **Packaging –** a. Using recycled/recyclable packaging b. Focus on minimal packaging and light-weighting c. Using bio-degradable/compostable packaging **Recycling/reuse –** Upcycling unsold inventory/used products/old packaging back into the value chain (e.g., as new packaging materials) **Others –** a. Fair labor policy (policy against child labor, forced labor, fair pay, etc.) b. Providing safe working conditions c. Reduce impact of digital footprint (e.g., by cloud storage, data collection, increased GPU) d. End-to-end traceability of the supply chain ……… To what extent will your organization prioritize supply chain sustainability efforts in the following areas, post COVID-19? a. Product design b. Responsible sourcing c. Manufacturing d. Inbound and outbound logistics e. Packaging f. Recycling

Capability	Assessment Metric
Agility	Our supply chain is agile enough to support our organization's evolving/new business models .... How would you rate the priority of the following? a. Reconfiguring production lines in an agile manner – pre COVID-19 and post COVID-19 b. Subcontracting critical parts/materials in an agile manner (flexible make or buy switch) – pre COVID-19 and post COVID-19 .... Please indicate the proportion of the following strategies that your organization has adopted/will adopt for its product portfolio (post COVID-19) a. We will shift from lean and just-in-time sourcing and manufacturing wherever additional costs are not significantly higher b. We are actively building redundancy even if it means significantly higher costs
End-to-End Cost Transparency	To what extent has your organization optimized the following supply chain costs? a. Raw material costs b. Inbound transportation costs c. Inventory costs d. Production costs e. Plant maintenance costs f. Labor costs g. Warehousing costs h. Outbound transportation costs i. Reverse logistics costs j. Carbon footprint k. Costs arising from location-based risks such as one prone to frequent strikes/political unrest/geographical risks (hurricane), geological (earthquake)

Capability	Assessment Metric
Visibility	**To what extent have you mapped your current supply network?** a. We have not mapped our supply network b. We have mapped our Tier 1 supply network but not the extended supply network (i.e. Tier 2, Tier 3 and above suppliers) c. We have mapped part of our extended supply network for critical parts (i.e., Tier 2, Tier 3 and above suppliers) in addition to Tier 1 suppliers d. We have fully mapped our supply network (we can identify the original source of every component in our products) .... **Please indicate the level of visibility that your organization has into its supply chain.** a. Stock levels at Tier 1 suppliers b. Stock levels at contract manufacturers' sites c. Stock levels at warehouses/distribution centers d. Stock levels at retail stores e. Position of inbound and outbound shipments f. Condition of inbound and outbound shipments g. Sales data (for insights into real-time customer demand) .... **Do you plan to increase the level of data-sharing with your supply ecosystem due to COVID-19?** a. Suppliers b. Production partners (capacity data) c. Distribution partners d. Physical stores e. Customers .... **Which of the following statements corresponds most closely with the current adoption of supply chain control towers in your organization?** a. We have not invested in a supply chain control tower solution and have no plans to do so b. We plan to invest in a supply chain control tower solution in the short to medium term c. We have invested in a supply chain control tower solution, but it does not cover all parts of our supply chain d. We have invested in a supply chain control tower solution, and it covers our supply chain end-to end

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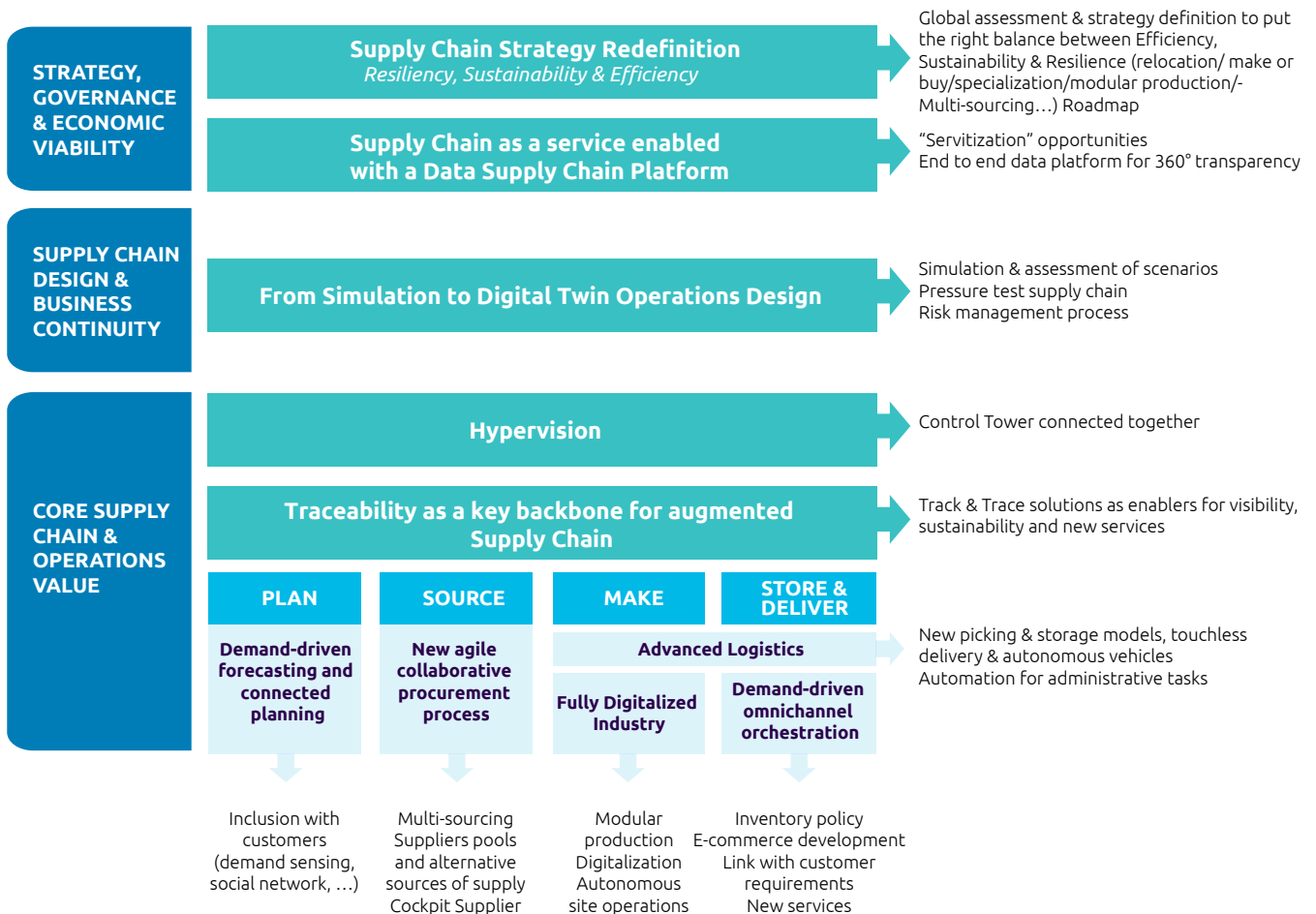michael.eriksson@capgemini.com

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Leverage Capgemini's capabilities for re-inventing the new

The Covid-19 crisis confronts businesses with a variety of challenges. We help companies to ensure business continuity and re-invent their operations.

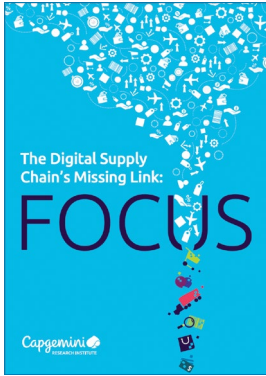## Solutions framework for "Re-invent the New Supply Chain"

STRATEGY, GOVERNANCE & ECONOMIC VIABILITY	**Supply Chain Strategy Redefinition** *Resiliency, Sustainability & Efficiency*	Global assessment & strategy definition to put the right balance between Efficiency, Sustainability & Resilience (relocation/ make or buy/specialization/modular production/-Multi-sourcing…) Roadmap
	Supply Chain as a service enabled with a Data Supply Chain Platform	"Servitization" opportunities End to end data platform for 360° transparency

SUPPLY CHAIN DESIGN & BUSINESS CONTINUITY	**From Simulation to Digital Twin Operations Design**	Simulation & assessment of scenarios Pressure test supply chain Risk management process

CORE SUPPLY CHAIN & OPERATIONS VALUE

Hypervision	Control Tower connected together
Traceability as a key backbone for augmented Supply Chain	Track & Trace solutions as enablers for visibility, sustainability and new services

PLAN	SOURCE	MAKE	STORE & DELIVER
Demand-driven forecasting and connected planning	**New agile collaborative procurement process**	**Advanced Logistics**	
		Fully Digitalized Industry	**Demand-driven omnichannel orchestration**

New picking & storage models, touchless delivery & autonomous vehicles
Automation for administrative tasks

| Inclusion with customers (demand sensing, social network, …)	Multi-sourcing Suppliers pools and alternative sources of supply Cockpit Supplier	Modular production Digitalization Autonomous site operations	Inventory policy E-commerce development Link with customer requirements New services

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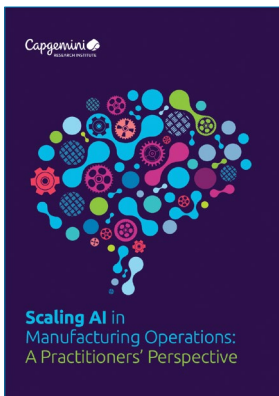
The Digital Supply Chain's
Missing Link: Focus

Smart Factories @ Scale:
Seizing the trillion-dollar
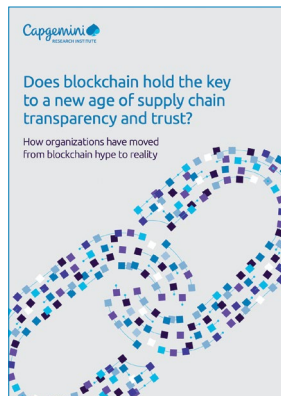prize through efficiency by
design and closed-loop
operations
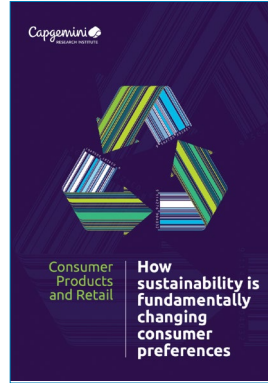
Consumer Products and
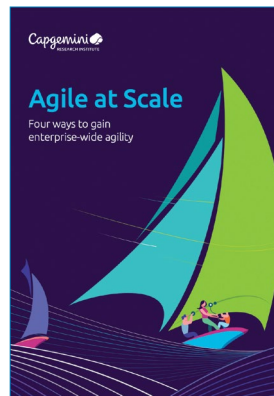Retail: How sustainability is
fundamentally changing
consumer preferences
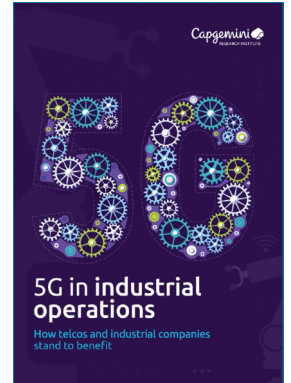
5G in industrial operations:
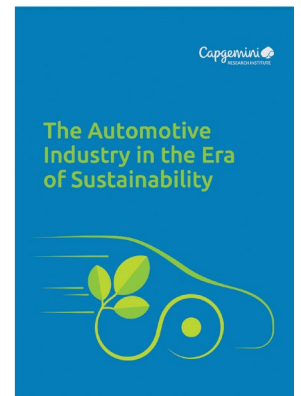How telcos and industrial
companies stand to benefit

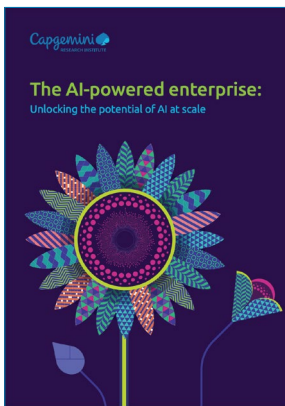Scaling AI in Manufacturing
Operations:
A Practitioners' Perspective

Does Blockchain hold the key
to a new age in Supply Chain
transparency and trust

Agile at Scale
Four recommendations to
gain enterprise-wide agility

The Automotive Industry in
the Era of Sustainability

The AI-powered enterprise
Unlocking the potential of AI
at scale

The Art of customer centric
Artificial Intelligence
Raising the bar on AI in
customer experience

Upskilling your people for the
age of the machine

Digital Transformation
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