

# Reinventing supply chains 2030

Towards an adaptable, sustainable  
and cognitive ecosystem



## **Reinventing supply chains 2030**

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# A Introduction



Supply chains are under enormous strain. While managers navigate disruption from external events such as geopolitical conflicts, trade disputes, and both natural and human-caused disasters, they are also having to face sustainability challenges, talent shortages, rapidly advancing technologies, and growing competition from evolving ecosystems and new business models. Each of these trends is highly disruptive, interconnected and challenging to master. The bottom line: reinventing supply chains is inevitable.

Our latest survey of more than 1,000 supply chain executives around the world supports this view. Leaders of major industries – from automotive to retail – say they feel enormous pressure to adapt. Globally, we are witnessing the largest supply chain overhaul in decades. But although a small percentage of companies are wholly transforming their supply chains from end to end to meet disruptive challenges, many companies remain in the early stages.

Indeed, getting started may be the hardest part. Supply chain transformation is a complex, seemingly overwhelming task. It happens alongside the day-to-day running of a business in which revenue generation remains a priority. As a result, supply chain managers tend to tinker around the edges. But marginal improvements to quality or service aren't enough. A more comprehensive approach is required.

The most successful transformations are characterised by end-to-end approaches, and with leaders focused on a bigger prize: creating supply chains that are adaptable, sustainable and cognitive – i.e. able through technology to think, grow smarter and evolve. Our survey identified 8% of industry leaders, or Supply Chain Champions<sup>1</sup>, who say they have fully transformed their supply chains to meet disruptive trends. These leaders are taking a more purposeful, deliberate approach that includes having a clear vision, roadmap and goals, as well as resource capacity and staff buy-in to make the transformation happen. Transformation is also an opportunity to create value: Champions say that they anticipate supply chain cost reductions of 19% and revenue gains of 16%. Ultimately, disruption can be viewed as a positive, particularly for companies that emerge more resilient and competitive for the future.



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<sup>1</sup> See "About the survey" for more information about how we identified Champions and the other three stages of supply chain maturity: Innovators, Followers and Novices.



# B Reinventing supply chains



# Introduction

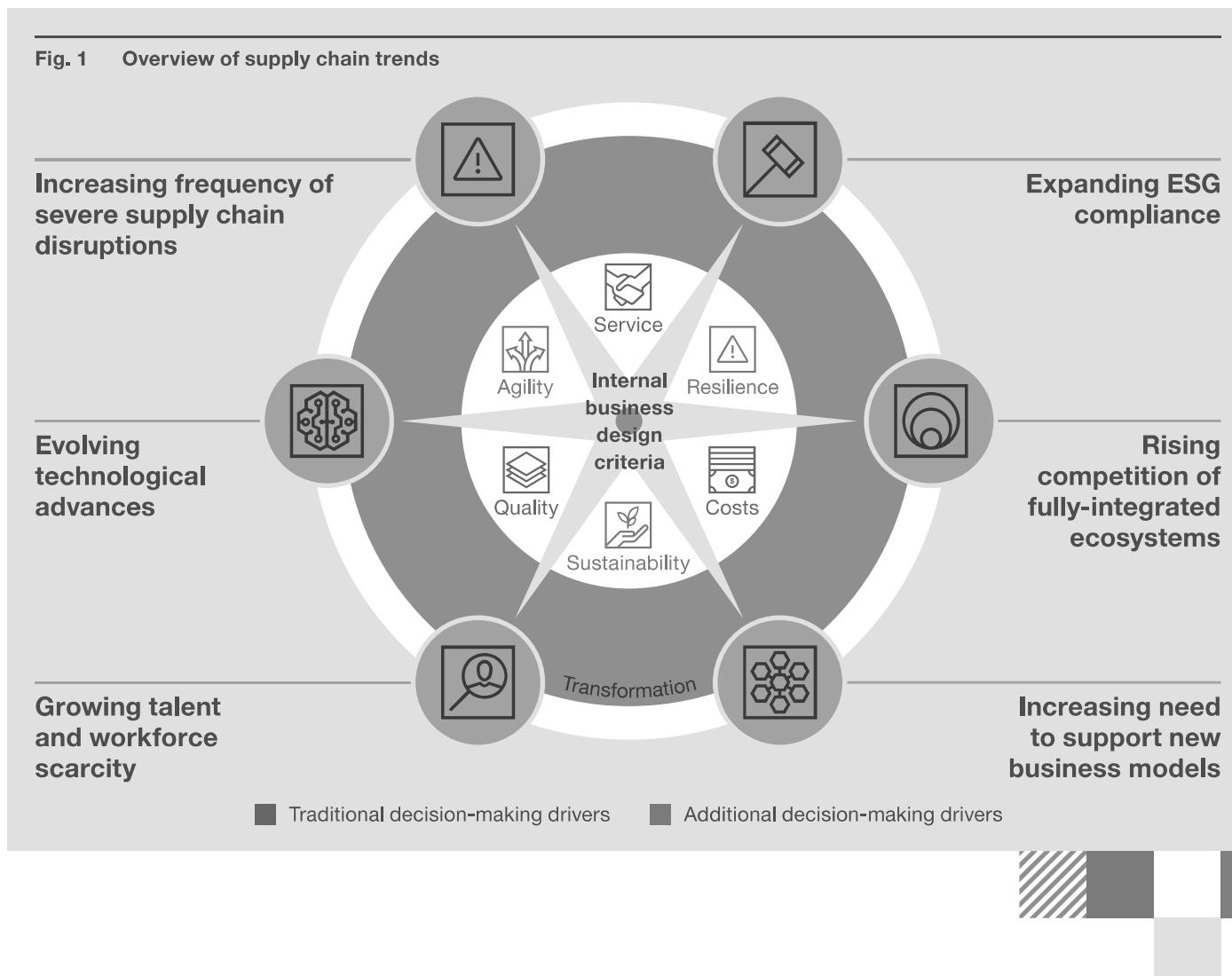
Supply chains currently face severe disruption on all fronts: political, ecological, technological, social and financial. Geopolitical conflicts and trade disputes are disrupting global footprints and creating material shortages. Amid heightened alarm over the environmental crisis, governments and consumers are calling for companies to step up their sustainability efforts. Companies are responding to sustainability demands, in part by building ecosystems and adapting their business models. Meanwhile, technological disruption – compounded by acute labour shortages from AI talent to truck drivers – is resulting in major transformations of supply chain operations. Adding to these disruptions are financial pressures, such as rising costs and inflation. Companies survived the pandemic, only to be tossed into a turbulent world of continuous disruption.

We have distilled these major disruptive forces into six key trends, as shown in Figure 1.

# Research

To understand the impact of these trends, and to learn how companies are coping, PwC interviewed more than 1,000 senior supply chain executives globally across six major industries. We asked what impact disruption is having in the short and long term, and what capabilities and technologies companies are employing to compete now and in the future. Our research reveals two top-line discoveries:

1. Supply chain executives expect disruptive trends to intensify as the decade continues.
2. Supply chains are undergoing a metamorphosis in response to these trends.

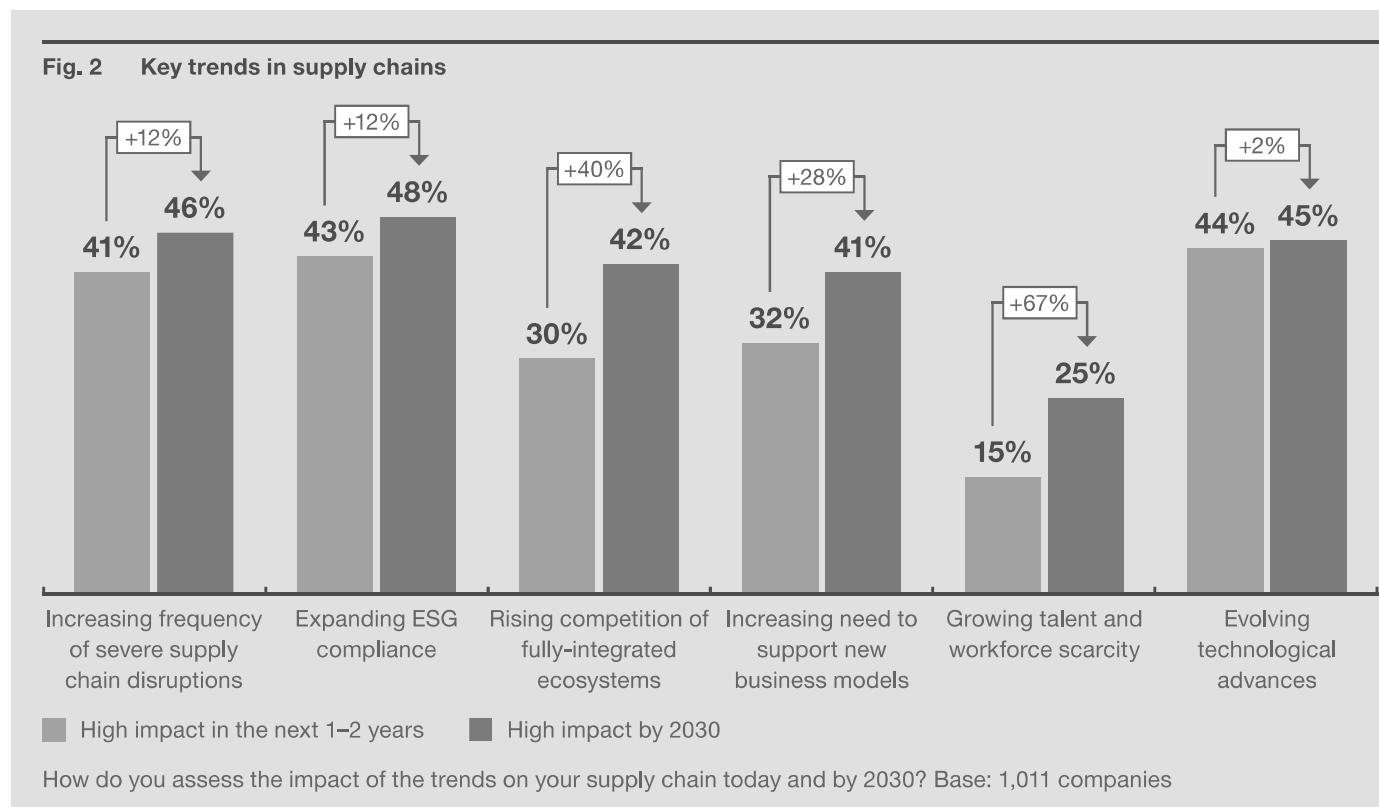


## Findings

The headline finding is that some companies – our identified supply chain leaders, or Champions – aren't just surviving disruptive trends, they are mastering them by intentionally restructuring their supply chains to be more resilient and adaptable. Continuous disruption is forcing companies to take a more holistic view of their supply chains. Our survey shows that companies are working more transparently, productively and collaboratively with stakeholders to address shared challenges and promote economic growth.

A third of Champions, for example, are participating in fully integrated supply chain ecosystems, which provide a more seamless, transparent and efficient way for stakeholders – from raw material producers to customers – to share information, collaborate across entire value chains and react faster to problems. We are seeing competition growing between these ecosystems as companies clamour to join them.

Environmental disruption is making companies prioritise sustainability. With governments and consumers pushing for greater environmental protection, executives have placed more emphasis on renewable energy, green technologies, sustainable practices and better compliance. Indeed, survey respondents say ESG compliance is their top concern. Half of respondents expect that facing penalties from a lack of compliance will put global supply chains under pressure between now and 2030.



Customer demands for sustainability – along with the expectation of competitively priced goods delivered to doorsteps – are leading companies to adopt service-oriented and sustainable business models. Our survey shows increasing interest in offering broader supply chain services through multiple channels, and in circular economy models that design products with a plan to recycle, reuse and refurbish.

Companies are coming up with new solutions to offset labour shortages. Demographic shifts and changing technological requirements mean that companies have fewer skilled workers to rely on. To remain competitive, they are automating their warehouses and fulfilment centres. Leaders are rethinking what roles employees serve and how these roles will change as technologies evolve, as well as how they might recruit and train staff differently.

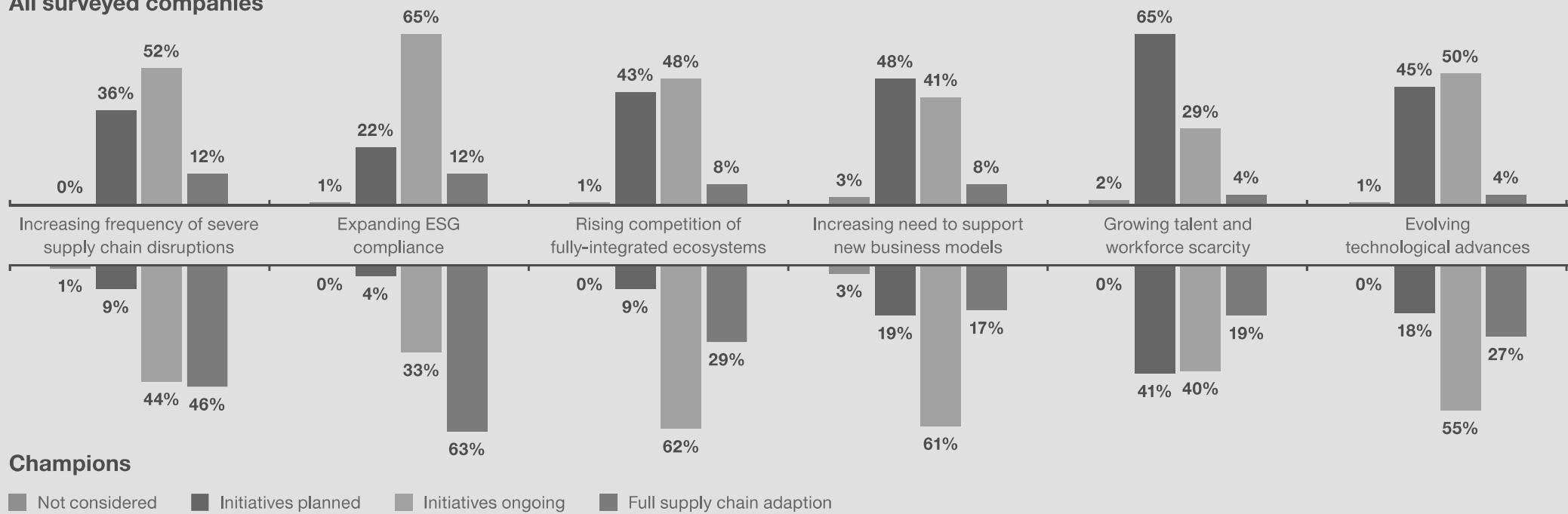
Rapidly changing technologies are impacting not just supply chains, but all other major trends too. Digital twins increase transparency on environmental problems, for example, and help companies cut their carbon footprints. To combat talent shortages, companies are implementing advanced tools such as AI to automate repetitive tasks, streamlining the supply chain and freeing up workers for more thoughtful roles. Rapid technological disruption is a top concern for nearly half of company leaders.

Between now and 2030, we expect one further major upheaval, one of a competitive nature. Some companies will rise to meet disruptive trends, while others – paralysed by uncertainty and failing to act – will fall behind and be unable to compete. Companies that don't master these trends – managing compliance, for example, or failing to support new business models to meet evolving customer needs – will find it increasingly challenging to compete.

Ultimately, our survey shows an uneven picture of where things stand: a small subset of Champions are making dramatic progress by implementing capabilities and technologies to meet trends head-on. But most leaders, while concerned about these trends, remain in the early stages of transformation. What distinguishes successful companies from others is their levels of engagement, internal alignment and clarity of purpose. More than that, it's about not allowing disruptive trends to shape a company, but deliberately and strategically mastering these trends to increase competitiveness and move forward.

**Fig. 3 Supply chain trend readiness**

### All surveyed companies



To what extent is your company prepared for and able to deal with, address and overcome the listed supply chain trends? Base: 1,011 companies

## Supply Chain Compass

Traditionally, businesses have designed supply chains to meet internal service, quality and cost targets. Nowadays, to stay competitive, supply chains need to be reinvented with resilience, agility and sustainability targets in mind. To help companies undertake this transformation and quickly grasp which capabilities and technologies are needed to tackle these trends, we've developed the Supply Chain Compass – a strategic tool that combines

PwC expertise with insights from more than 1,000 supply chain executives worldwide. The Supply Chain Compass is a guiding framework to show what companies are doing in response to various trends, and the benefits of these actions. Fundamentally, the Supply Chain Compass enables companies that are falling behind to catch up, and those who are already leading to gain a further competitive advantage.

In this report, we'll be taking a look into six major disruptive trends, investigating what drives them, how concerned supply chain executives are about them, and to what degree leaders are responding from a capability and technology perspective. The report features case studies to illustrate the steps companies are taking to transform various areas of their supply chains, the hurdles they face, and the many benefits that come with transformation.

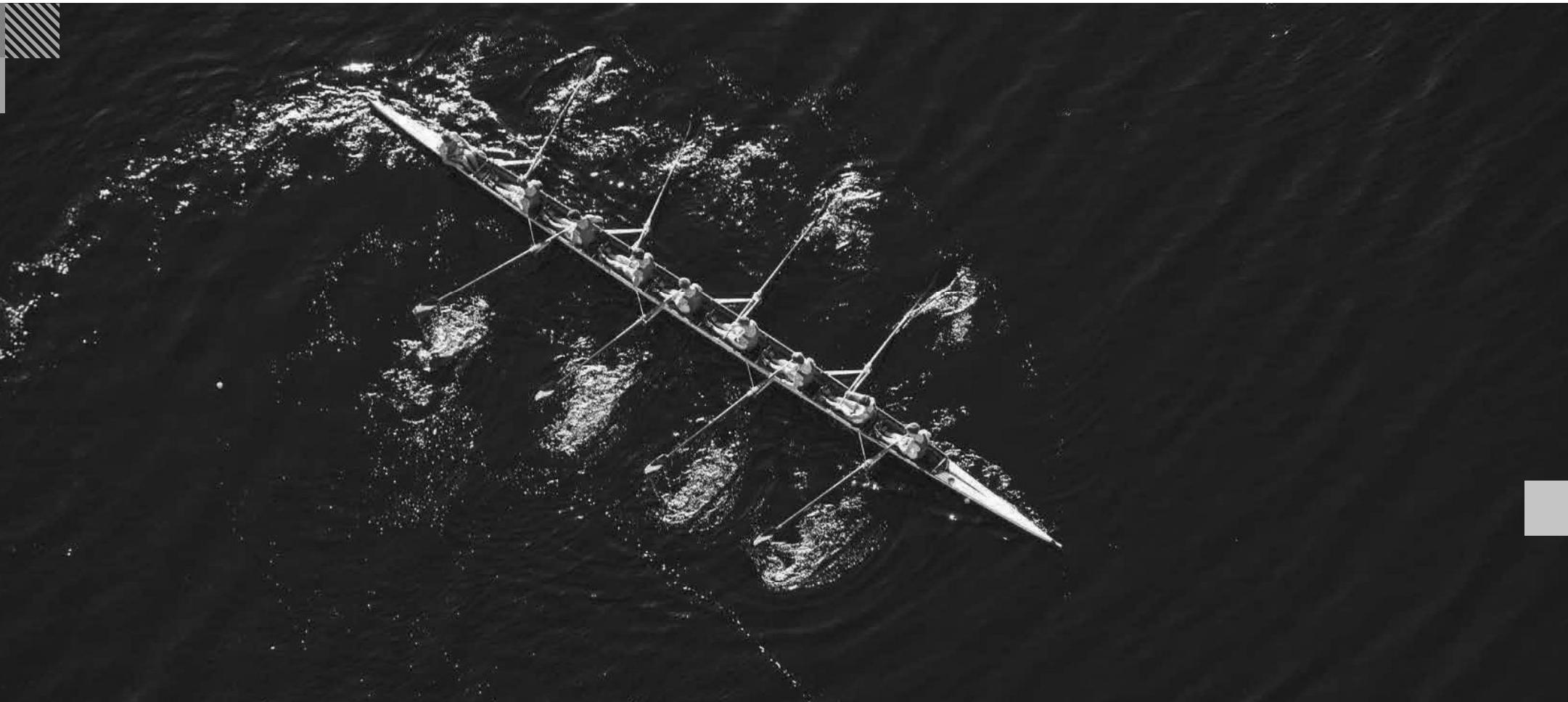
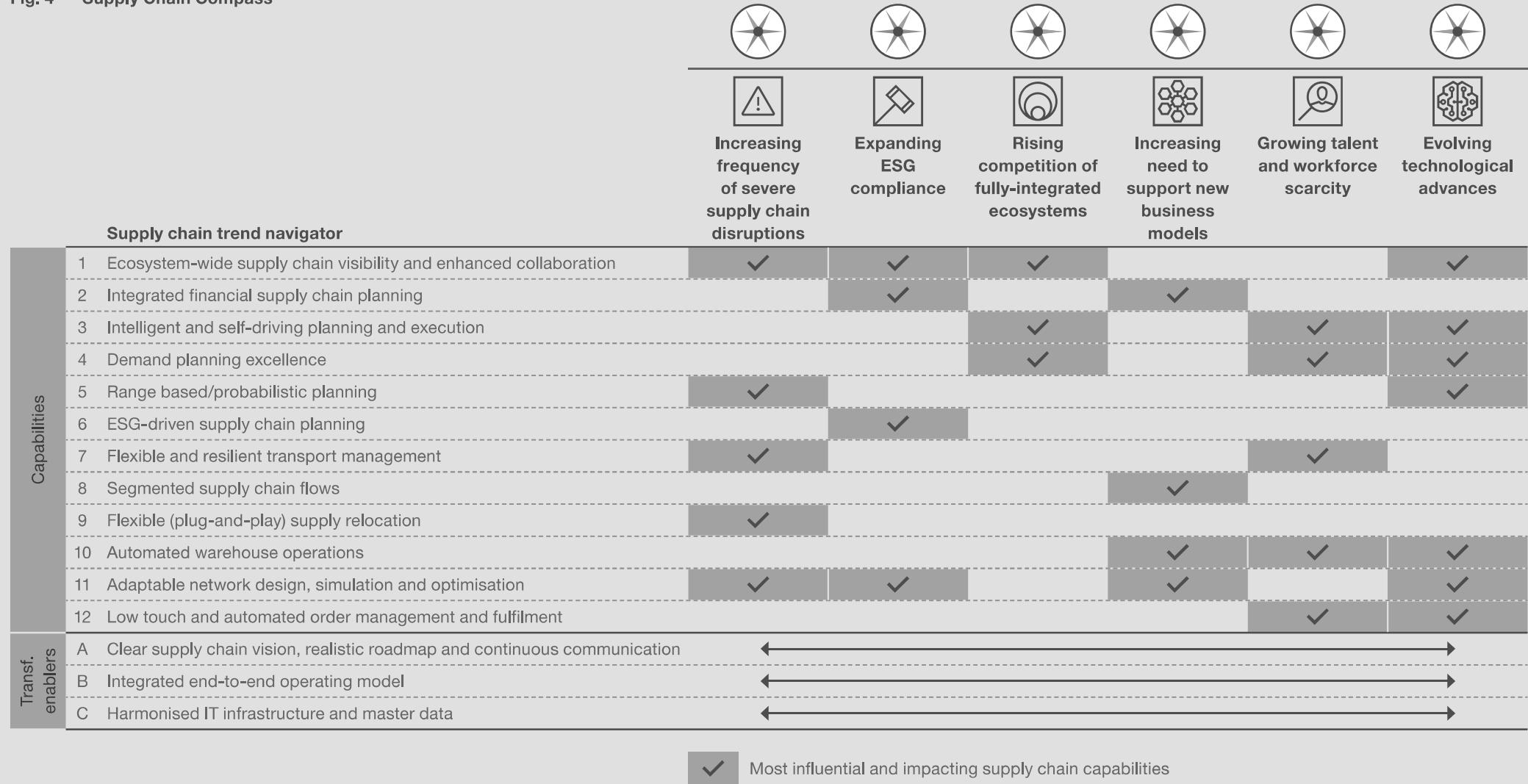
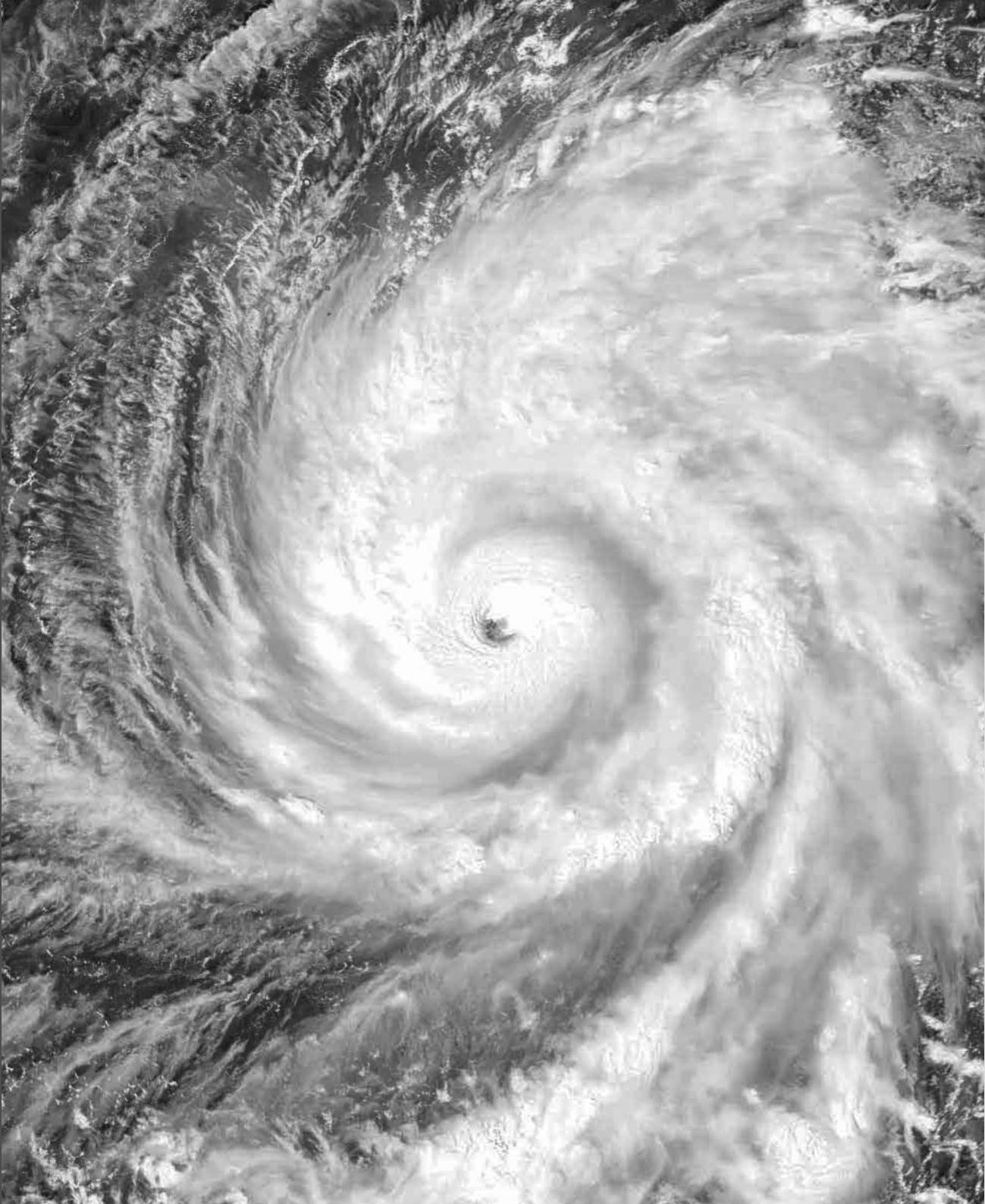


Fig. 4 Supply Chain Compass



C Increasing  
frequency  
of severe  
supply chain  
disruptions



## Introduction

Severe threats – geopolitical, environmental and economic – continue to disrupt supply chains. Disruptive threats include conflicts such as wars and trade sanctions, price hikes, energy crises, inflation, extreme weather, pandemics and unavailability of infrastructure, which impact labour, transport and raw material costs. Without serious interventions, companies will continue to face operational downtime, higher costs and lower sales. In response, companies are building more collaborative, transparent and resilient supply chains. Some companies are changing their supply chain footprint to avoid disruption, and most are harnessing technologies and real-time data to react faster to disruption.

Reactions vary depending on whether disruptive events represent immediate threats requiring ad-hoc responses, or longer-term threats needing more substantial changes. The cargo ship that crashed into the Key Bridge in Baltimore, for example, required an immediate response as companies scrambled to reroute cargo. This event also needed a medium-term and long-term response – much like the rerouting of cargo in the Red Sea due to conflict – as it was unclear how long the Port of Baltimore would be out of commission.

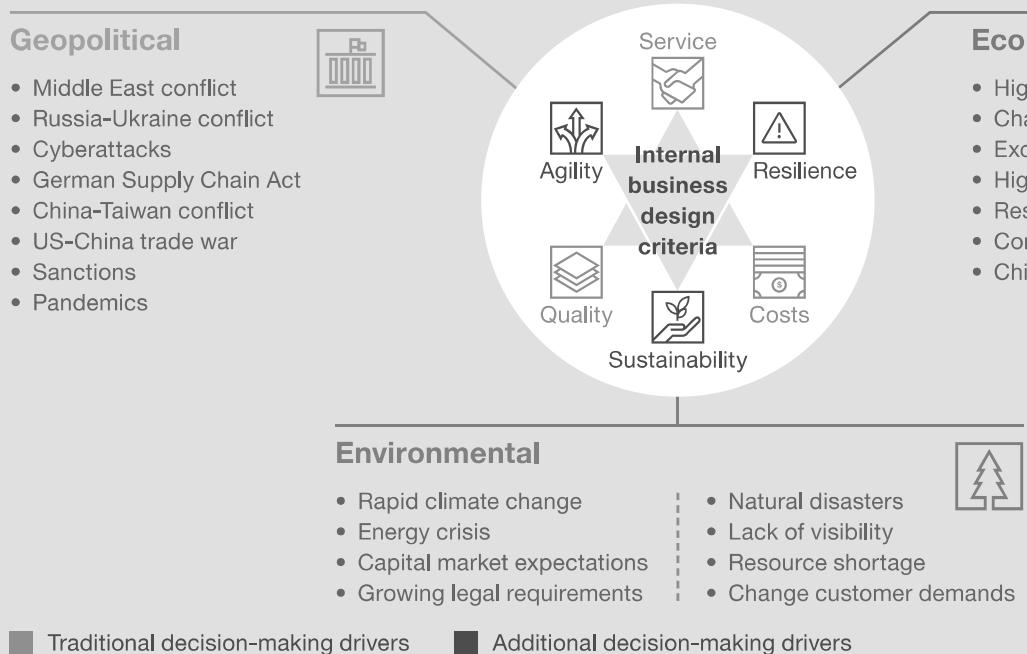
## Executive concerns

More than 60% of champions are very concerned about supply chain disruption in the short term, and expect this to continue through to 2030. Automotive suppliers, semiconductor companies and consumer electronics manufacturers appear most concerned about the immediate impact of disruptive events such as shortages of materials. Significant shortages of lithium, gallium and possibly germanium are predicted to hit chipmakers, for example, with knock-on effects for the automobile industry, a big buyer of microchips. Disruption to the production of lithium-ion batteries, which are used in electric vehicles, will affect automotive suppliers as well.

In the long term, supply chain disruption is expected to put the construction, metal products and fast-moving consumer goods (FMCG) industries under pressure. Managing disruption in energy-intensive industries such as chemicals and pharmaceuticals started some time ago, but the results of this study show that concern is highest in FMCG. The construction industry faces shortages of sand, a key component in concrete and glass. Between now and 2030, higher demand for metals such as copper, nickel, and cobalt – required for green energy and a low-carbon future – will stress metal supplies and cause major price hikes.

Leaders are rethinking where their suppliers are located. Many are considering nearshoring and localisation, not just to avoid disruption, but to better cater to local market demand and shorten lead times, reduce costs and shrink carbon footprints.

Fig. 5 Supply chain disruptions

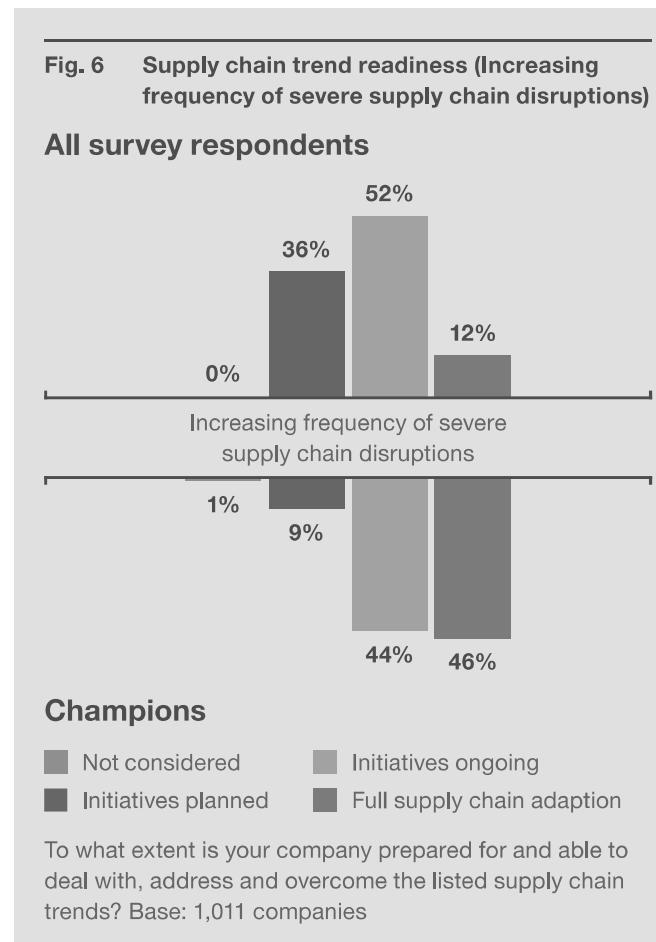


## State of transformation

More than 60% of companies surveyed indicated that they are adapting their supply chains to manage disruption. They are increasing transparency to identify and monitor potential risks. Improved collaboration, flexibility and staff training are necessary to react faster to external shocks. While 12% of companies surveyed have fully reinvented their supply chains to be more resilient, 88% remain in the transition phase, including 52% with initiatives underway and 36% with initiatives planned. 40% of companies have initiatives ongoing to regionalise their supply chains; 11% have already implemented these plans.

Companies from all industries are experiencing disruption, but some are gaining a first-mover advantage by fully adapting their setups. 15% of automotive suppliers have fully adapted their supply chains to guard against material shortages, price increases, stock fluctuations and operational downtime, among other disruptive events. 9% of companies in consumer electronics have fully adapted their supply chains; 6% have done so in the semiconductor industry. Serious continued investment to improve technology and boost visibility and collaboration is expected in the short run across all industries.

The survey results show that big businesses appear more proactive than smaller ones. A fifth of companies with more than \$5 billion in revenue say that they adapted their supply chains to guard against disruption, and 43% have initiatives ongoing. Of companies with revenue below \$5 billion, just under 6% have fully adapted; 39% have initiatives underway to shift from a global to a regional setup.



## Key capabilities

### Look for opportunities to relocate

Our survey shows a strong correlation between companies facing serious disruption – such as trade route blockages – and those shifting from global to regional supply chains. More than a quarter (28%) of European companies say that relocation is very important now and will become more important over time. Moving supply and production closer to key markets not only circumvents potential disruption in global trade, but can also reduce delivery times, cut shipping costs, and help companies shrink their carbon footprints. For critical components and materials, companies are diversifying their supplier bases with dual or multiple sourcing, and revisiting strategies to minimise risks – make-or-buy or risk-adjusted inventory sizing, for example. To enhance organisational efficiency and enable centralised control over supply chains, capabilities are managed centrally when investing in localised supply chains.

### Improve supply chain planning capabilities

Nearly half (48%) of companies are prioritising expansion of supply chain planning capabilities through financial planning integration. 55% rate this as highly significant over the long term to account for various supply and demand scenarios that may arise. Reaction time to disruption can be dramatically reduced by investing in these potential scenarios and backup solutions.

As companies are hit by price fluctuations, this strategy will become more important over time. A quarter of the companies which are highly concerned about disruption say that range-based or probabilistic planning is critical for short-term, medium-term and long-term planning and, in particular, for handling crises.

## Achieve flexible, resilient transport management and faster transport mode changes

30% of survey respondents consider it a top priority to have flexible and resilient transport management in order to effectively respond to unexpected disruption. Agility requires the integration of real-time data from transport routes. By monitoring for blockages or increased transit times, businesses can proactively identify potential issues and plan for alternative carriers, modes or future routes. Using AI, businesses can identify transport issues, and quickly find an alternative to ensure that goods can be delivered efficiently and on time. To act fast, organisations should create centralised task forces and streamline processes. To be successful, companies must change the way they work and train their staff to handle these new requirements.

## Invest in supply chain visibility and partner collaboration

30% of respondents who view supply chain disruption as having a severe impact say that they are highly prioritising supply chain visibility and partner collaboration. To do this, companies first create visibility across supply chains to include relevant data on supply and demand, as well as on the status and progress of shipments and current inventory. Next, they put processes in place to monitor and manage flows of information, goods and money to and from each stakeholder involved. Close collaboration with suppliers, carriers and customers, along with common processes and procedures, is essential: this builds mutual trust and identifies who is responsible when challenges arise. Successful collaboration is best achieved when network partners mutually invest in growth, have joint supply chain setups, and agree upon similar approaches to resolving issues.

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# 83%

of Champions see **relocation of supply chain setups** as crucial to managing future disruption.

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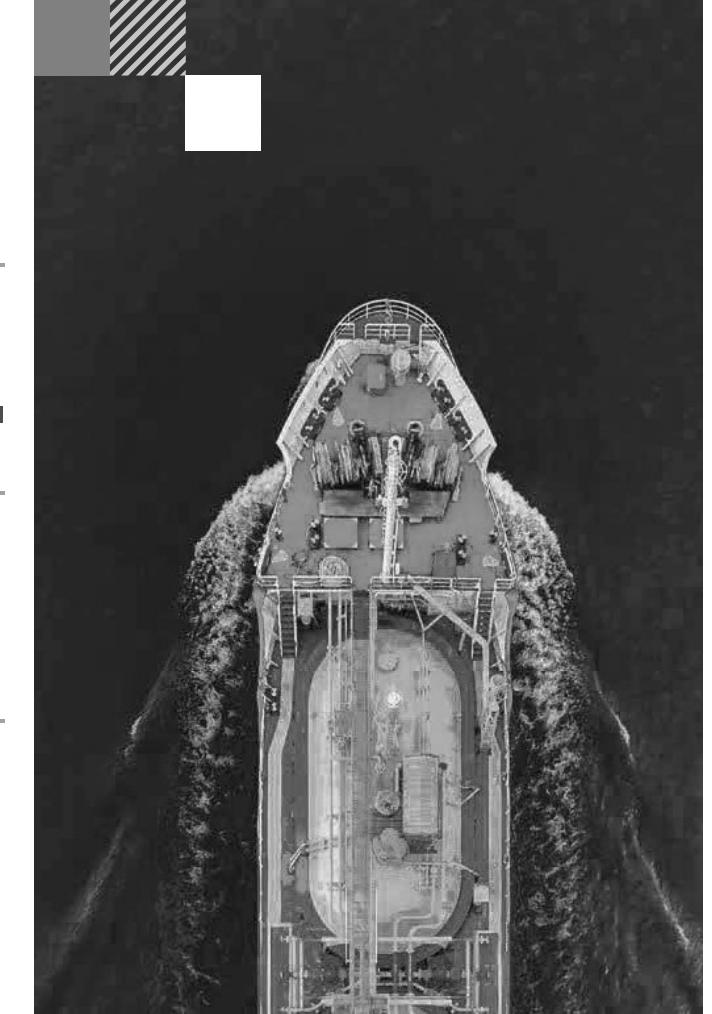
# 52%

of Champions consider investing in **range-based/probabilistic planning capabilities** to be very important.

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# 36%

of Champions are convinced that **flexible and resilient transport management** and the **ability to quickly change modes of transport** will be key in the future.



## Takeaways

1

Market turbulence and disruption will continue to impact supply chain performance, requiring serious interventions to avoid operational downtime, higher costs and loss of revenue.

2

To better respond to challenges, companies should invest in visibility, integrated partner collaboration and planning, flexible transport management, and explore alternative sourcing strategies.

3

To combat disruption while enabling sustainable growth, companies should establish a continuous resilience improvement cycle to monitor risks, with robust metrics, and an assessment system to cope with short-term, medium-term and long-term turbulence.



## Case study

### Electrolux

During the pandemic, Electrolux, a global appliance manufacturer, was hit by shortages of steel, plastics and microchips. The frequent disruptions increased transportation complexity, extended lead times and reduced Electrolux product availability. In response to disruptions, and to make their supply chain more resilient, reliable and consumer-centric, the company introduced a new strategy.

Three initiatives have helped improve Electrolux' resilience:

#### Risk management and resilience framework

Electrolux initiated short-term measures such as implementing carefully selected strategic stock buffers for critical components. The team assessed numerous defined supply chain risks such as market volatility, component availability and container constraints, as well as internal factors such as product range complexity and options for qualifying alternative suppliers. The risks and impacts were incorporated into a playbook. The playbook outlines structural measures such as adjusting towards a flexible footprint and vertical integration, and process integration measures such as a fully connecting the sales and operations planning process with enhanced supply chain visibility. This resilience governance structure, which is embedded into the larger organisation, is continually updated and addressed during monthly, quarterly and annual forums involving cross-functional stakeholders.

#### Supplier capacity and material visibility

A second initiative increased transparency and visibility on supplier capacity and material availability for components. With the visibility tool (reporting dashboards), Electrolux can better manage operational supply and material bottlenecks. These dashboards involve close collaboration with key users, and onboarding of relevant data sources into a central cloud-based data lake. Data pipelines transform and consolidate data, and push back relevant information to the dashboard.

One dashboard focuses on urgent component groups. Users can drill down to understand root causes of supply shortages, while planners can analyse predefined KPIs in combination with supportive data such as inventory balance and predictions. The tool shows the impact of deviating inbound supply on production capacity and points out shortages of incoming goods compared to production requirements. The assessed quantitative impact of to-be-produced products per factory is compared to historically placed orders and incoming goods, offering a detailed breakdown analysis into component and component-group levels. Since the application of this tool, Electrolux has benefitted from on-demand and real-time supply visibility, enabled by a standardised and automated reporting solution. This has led to better control and initiation of countermeasures with suppliers.

#### Collaboration and diversification of suppliers

Considering global disruptions and the impact on lead times, Electrolux analysed the global footprint of its suppliers. The goal was to find the right balance of nearshore/localised and global suppliers. This diversification allowed Electrolux to effectively manage supply in constrained scenarios by switching, for example, to a secondary source. Electrolux significantly invested in supplier collaboration by adjusting contractual supplier agreements to reflect the changing nature of the relationships.

#### Company snapshot

Electrolux is a global leader for home and professional appliances such as refrigerators, washing machines, vacuum cleaners and ovens. The company was founded in 1919 in Sweden and has since grown to become one of the largest appliance manufacturers in the world. Electrolux operates in more than 120 countries, employs a global workforce of around 45,000 employees, and operates numerous manufacturing facilities and research and development centres worldwide.



## Case study

### Infineon

Infineon, a global semiconductor company, has faced significant disruption in recent years. During the COVID-19 lockdowns, for example, people bought fewer cars, leading to a 50% drop in orders from OEMs. To respond to disruptions like these, and other industry challenges, the company established the Tailored Supply Chain (TSC), which offers a variety of premium services for customers and automates previous manual tasks like order management.

This end-to-end comprehensive supply chain solution is integrated into an existing planning system landscape. It addresses issues typical to the semiconductor industry such as volatile demand and high capex requirements, and effectively manages the long cycle times and complexities of semiconductor manufacturing.

#### Premium Customer Service

Semiconductors can take up to nine months to produce. Long planning horizons are in place, limiting flexibility. Sudden changes in demand and disruptions impacting production have serious consequences for buyers as well as semiconductor producers. Due to exponential demand growth, semiconductor companies (Moore's Law) typically use a (global)-Available-to-Promise (ATP). Infineon begins production on wafers and chips without assigning capacity to specific customer requests. The ATP is then used to match capacity with orders to promise timely delivery of goods to customers.

Infineon strategically strengthened its end-to-end supply chain by engaging in more long-term agreements. A premium customer service, for example, lets customers reserve production capacities upfront. This gives

Infineon better planning overview, increases equipment productivity, and improves cash flow. By selling capacities upfront, for example, money paid in advance can be invested to further increase and secure production capacity. This system also helps level off demand and supply, and not just when disruptions occur.

#### Automated Order Management

The new Tailored Supply Chain offers a holistic supply chain process that is completely embedded in Infineon's current supply chain planning and fulfilment a unified overview of operations. Each day, more than one million customer requests are matched against expected available supply. A dashboard gives staff across divisions real-time visibility on which products, and in what quantities, can be negotiated with customers based on incoming customer requests. While in the past requests for multiple products could take up to a month—as capacity checks involved several business divisions and various production sites—requests now take days. Transparency on contracts, orders, and delivery tracking, as well as checks with financial and legal departments for premium services, completes the new setup.

The automated process gives teams greater ownership over decision-making by clarifying responsibilities, and offering clear rules about which contracts can be approved and prioritised by staff, versus which requests should be escalated internally.

#### Changing Mindset

The biggest transformation challenges have related to changing mindsets, and getting interdisciplinary teams – IT, customer logistics management, finance, legal, and

supply chain planners – to work collaboratively amid enormous pressures. High demand for semiconductors meant the new system went live as Infineon was still introducing staff to new technologies and processes. Today, trainings are run globally to explain the purpose and benefits to employees and familiarise staff with all changes. Trainings are supported by online materials including games and videos to help staff upskill. To date, more than 1,000 have adapted to the evolving processes and systems.

#### Acceptance & Benefits

As the system has yielded results – EUR 1 billion of Joint-Capacity-Invest in the first months of the offering with pre-payments from customers – acceptance has grown. Even as long-term commitments are dropping as the chip shortage crisis abates, the new set-up is far more effective than before. The premium service fee added directly to the top-line result, without additional cost. The system has also resulted in a more stable product mix, optimised production, and fewer “blind spots” in investment decisions resulting from better demand and forecast accuracy. Most important, customers and the company both benefit from greater end-to-end supply chain resilience.

#### Company Snapshot

Infineon Technologies AG is a global semiconductor leader in power systems and IoT. Headquartered in Germany, it has around 58,600 employees worldwide and in fiscal year 2023 generated revenue of about €16.3 billion.



## D Expanding ESG compliance

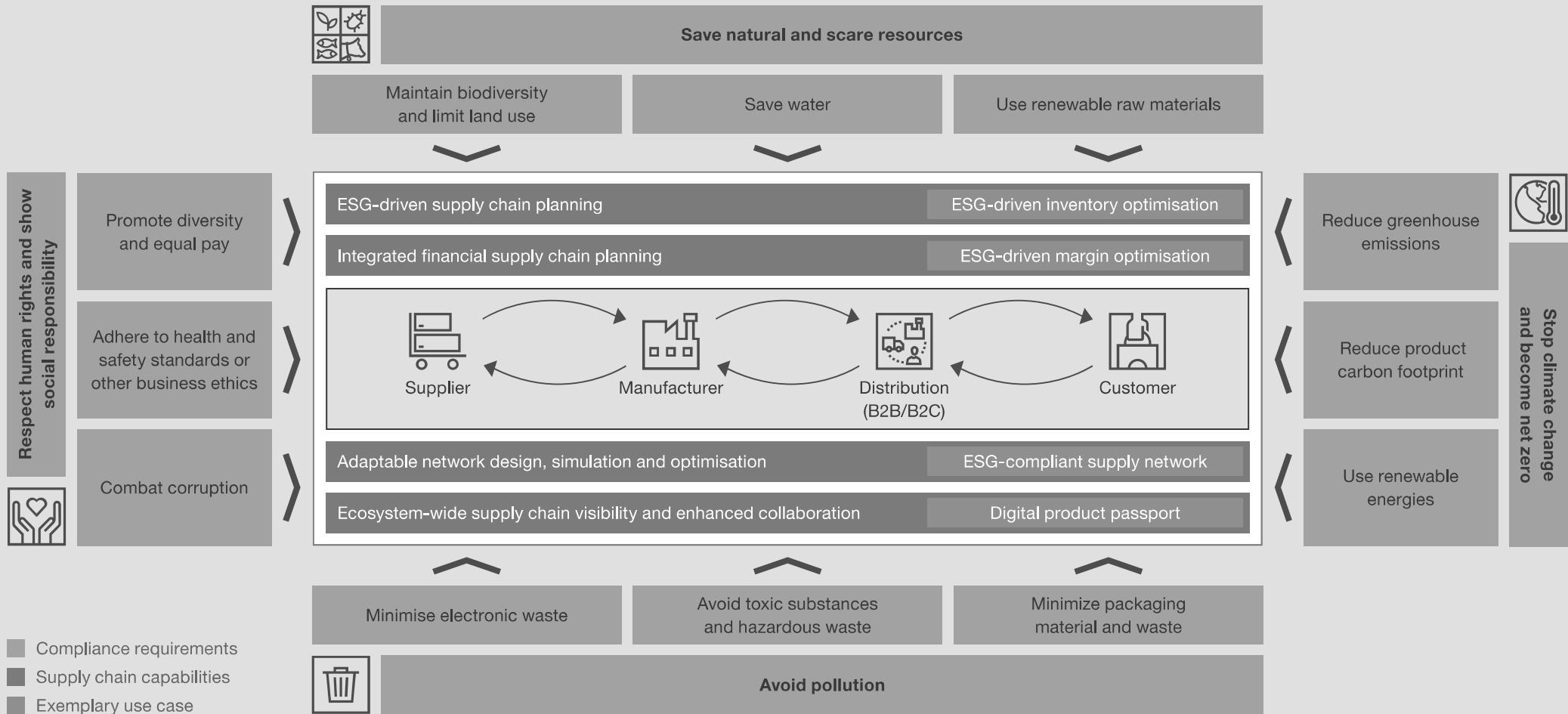


# Introduction

Over the next decade, environmental risks are expected to make up half of the top ten risks facing the planet, according to the World Economic Forum's Global Risks Report 2024. Extreme weather, critical changes to Earth's

systems, biodiversity loss and ecosystem collapse, and natural resource shortages top the list. Governments are responding with more aggressive regulations.

Fig. 7 ESG-compliant supply chain framework

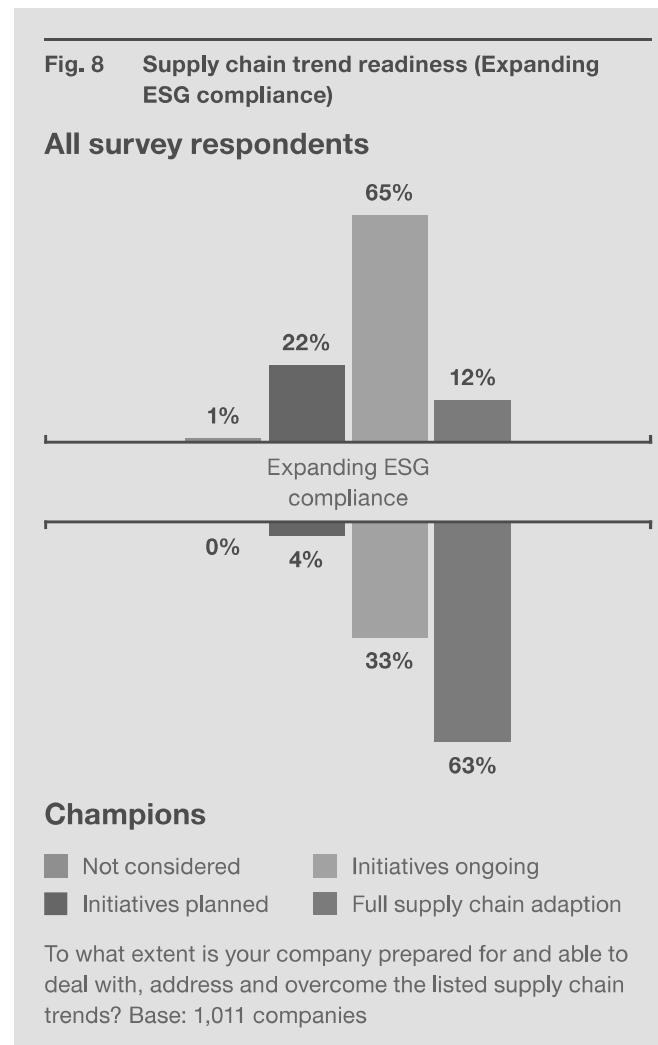




A significant wave of ESG requirements have recently gone into effect, forcing companies to produce and transport goods more sustainably, and to be more transparent about how they operate. Reporting requirements are becoming standardised and further-reaching. For example, the EU's Corporate Sustainability Reporting Directive (CSRD) will require non-EU companies with subsidiaries in the EU to audit the impact of their corporate activities on the environment and society from 2025 onwards. The German Supply Chain Act, which previously applied to companies with at least 3,000 employees, now (2024) applies to companies with more than 1,000 employees. Given these developments, companies across all industries are reshaping their supply chains to be more ESG-compliant.

## Executive concerns

More than 40% of companies surveyed regard this trend as highly disruptive now and for the future. Those most concerned about the short-term impact of the trend towards sustainability are in the process industries, retail and consumer goods, and industrial manufacturing. Coming up with more sustainable solutions is clearly on the minds of process industry executives as energy prices continue to rise, partly due to increasing regulations. Retail and consumer businesses are under pressure from customers to reduce their carbon footprints, produce less packaging waste and respect human rights in their supply chains, among other things.



## State of transformation

Over 12% of companies say their supply chains have been fully remodelled to suit this trend. This means they have largely implemented key capabilities like ESG-driven circular network design and ESG supply chain planning. 66% have initiatives ongoing; 22% of companies say their organisations have not yet started transforming to meet this challenge.

Larger companies appear further advanced than smaller companies. Leaders of businesses with \$10 billion or more in revenues say they have adapted supply chains to the highest possible standard in roughly a third or more cases, compared to 12% of overall participants who say they have fully adapted supply chains. As regulators have been scrutinising bigger companies longer, this is to be expected. But increasingly strict reporting standards will apply to smaller companies, forcing them to act.

Of industries most impacted by the trend, some appear more prepared than others. 12% of process industry companies, 11% of retail and consumer companies, and 16% of industrial manufacturers have fully remodelled their supply chains. Most companies in these industries are mid-transformation, with ongoing initiatives to make their supply chains more ESG compliant (65% of process industry companies, 70% of retail and consumer companies and 57% of industrial manufacturers). These numbers suggest that companies are acutely aware of the need to transform.

## Key capabilities

### Apply net zero, circular and ESG compliant network design, simulation and optimisation

91% of companies rate these capabilities as having a high short-term impact. In the past, cost factors mostly drove network design decisions. Today, being net zero with a circular and ESG-compliant network is one of the most highly rated capabilities for the long term. This capability includes modelling of sustainability trade-offs in network design – for example, costs vs. cutting emissions. The model scenario could lead companies to make decisions such as moving production facilities to low-carbon locations, or sourcing from ESG-compliant suppliers, or considering recycling, reusing and reducing product waste.

### Consider ESG metrics in tactical and operational supply chain planning

90% of companies consider tactical and operational changes to be highly relevant over the next one to two years, and in the long term. Companies are improving transparency across their entire supply chains and establishing joint planning access for all stakeholders. Other ESG plans include switching to green transportation with reduced fuel consumption and emissions, as well as making warehouse facilities more energy efficient by cutting energy consumption and waste – for example, by recycling waste heat, energy or water for multiple processes in operations.

**Provide ecosystem-wide supply chain visibility and enhanced collaboration with supply chain partners**  
Companies regulated by government ESG policies are usually responsible for ensuring that their suppliers are ESG compliant up to a certain tier. This calls for greater visibility of suppliers' operations, and particularly of their fundamental human rights and labour standards. Additionally, companies are required to improve and standardise communication and data exchange between suppliers and customers, and thoroughly understand their own processes and their dependence on partners. Often, companies lack a complete picture of their own processes and connections to external partners, which might affect compliance with ESG legislation. 51% of Champions see ecosystem-wide visibility and collaboration as a crucial capability for the next one to two years.

### Expand supply chain planning through financial planning integration

More than half of survey respondents (52%) see the value of integrating financial planning into supply chain planning. Becoming ESG compliant increases costs and shrinks margins – at least in the short term. Companies should look at the bigger picture, considering efficiency gains from reduced waste and energy consumption, reduced carbon pricing costs on the way to net zero, and higher sales owing to a positive brand image. Supply chain planning with integrated financial planning takes into account all impacts of ESG-relevant actions on investments, liquidity, revenue and margins.

## Takeaways

- 1 Companies must comply with ESG regulations, which are growing in scope and complexity, or risk serious financial penalties, exclusion from public contracts and reputational damage.
- 2 ESG improvements can be achieved by enhancing upstream transparency, introducing circular network design and incorporating ESG goals into demand and supply planning.
- 3 Making a supply chain sustainable from product design to last-mile delivery improves sourcing decisions, conserves energy, cuts waste, boosts sales and creates a positive brand image.

91%

of survey respondents believe **net-zero, circular and ESG principles in network design, simulation and optimisation** will have a significant short-term impact.

90%

of companies consider including **ESG targets in tactical and operational planning** to be highly relevant over the next one to two years.

51%

of Champions said that **ecosystem-wide visibility and transparency** is a foundational capability for ensuring ESG compliance.



## Case study

### ALTANA

ESG compliance is growing more complex. German chemical company ALTANA, for example, is subject to the German Supply Chain Act (LkSG). The act sets uniform standards and processes for German businesses with more than 1,000 employees. It requires companies, for example, to analyse supply chain contracts to identify risks to human rights.

To comply with the new regulation, ALTANA started a project involving more than 60 separate entities. These included four main ALTANA divisions in Germany, production plants, subsidiaries, and offices in 26 countries including the US, India, Brazil, and China—as well as a broad spectrum of stakeholders in departments including sales, procurement, human resources, environmental, health and safety (EH&S), legal and technology, among others.

As an early step, ALTANA ran screenings of its own operations and with suppliers to identify potential topics related to the new uniform standards set by the LkSG. At the time the law passed, ALTANA had more than 17,000 suppliers. With so many suppliers to screen, the company used a technology solution from IntegrityNext to automatically filter out suppliers based on special search parameters.

Internally, the company updated policies, procedures, and reporting mechanisms for risk management. With nine months to establish the main processes, ALTANA appointed an ESG supply chain risk manager to oversee

the coordination of stakeholders, integration of data and systems, and processes, and establish standardised procedures.

Frequent communication with relevant stakeholders was essential, as was ensuring staff stayed informed. ALTANA ran information sessions and workshops for employees to explain the law, and how this would change the business.

Further challenges during the nine-month transformation project included managing different stakeholder opinions, meeting deadlines and collecting data.

ALTANA employed an AI-supported platform ‘EMPOWER’ to not just gather data but to digitally transform procurement. Data processes were automated to minimise errors and free up employees to focus on strategic purchasing decisions. The new technology provides information on raw materials, suppliers, categories, prices and quantities, and links these with suppliers’ country and industry risks, which are required for compliance with the German regulation. As a decentralised company, employees now have direct access to more than 40,000 raw materials from its more than 17,000 suppliers, making the company more resilient than ever.

The ‘EMPOWER’ platform proved to be highly scalable, during the recent acquisition of a competitor with an annual revenue of more than CHF 220 million (Von Roll Holding AG), and a supplier database of more than

7,000 new suppliers globally, which had to be screened for LkSG suitability. Here ‘EMPOWER’ enabled a fast and LkSG-compliant integration into the ALTANA ESG-reporting.

Complying with the regulation has meant:

- To lift ESG compliance and consciousness at ALTANA – although already highly important – to the next level
- Better transparency on supplier performance
- Enhanced transparency and accountability across the entire value chain, more positive employee perceptions, and improved overall efficiencies
- Improved collaboration as the company embraced an environment of openness and secured buy-in from stakeholders across the organisation
- Bolstered ALTANAs corporate reputation and operational resilience

#### Company Snapshot

ALTANA is a global leader in true specialty chemicals. The Group offers innovative, environmentally compatible solutions for coating manufacturers, paint and plastics processors, the printing and packaging industries, the cosmetics sector, and the electrical and electronics industry. Headquartered in Wesel, Germany, the ALTANA Group has 64 production facilities, 68 service and research laboratories worldwide, and 8,000 staff.

# E Rising competition of fully-integrated ecosystems

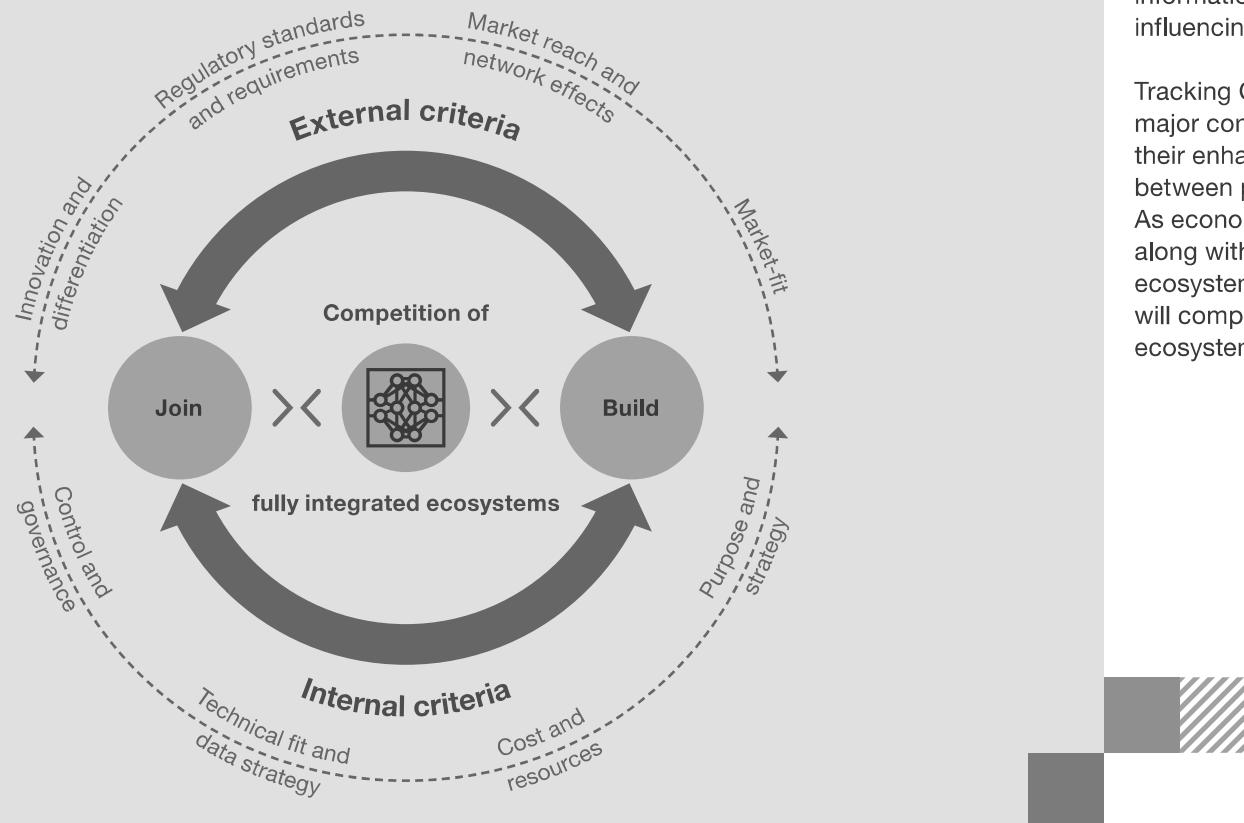


## Introduction

Major supply chain disruption, sustainability challenges and increasing regulations have led to a rise in the number of value chain ecosystems. In a value chain ecosystem, stakeholders (raw material producers, manufacturers, distributors, customers and others) can collaborate seamlessly, transparently and efficiently to share data, react faster to problems and improve customer experiences.

An increase in the number of value chain ecosystems is being driven partly by the need for greater resilience and efficiency. This rise is also in response to growing regulatory demands for industries to ensure sustainability by effectively tracking and tracing materials and goods as they move through supply chains.

Fig. 9 Rising competition of integrated supply chain ecosystems



## Executive concerns

Half of Champions consider this trend to be important in the short term and the long term, while less mature companies tend to assume this trend won't become relevant until later. This makes sense, as large multinationals are more exposed to global disruption, and are greatly impacted by regulatory and consumer demands for transparency on sustainability and human rights practices. 40% of companies say they are worried about increasing competition from ecosystems, and are considering whether to create their own or to join an existing one; concerns over sharing proprietary information and partnering with competitors are influencing their decisions.

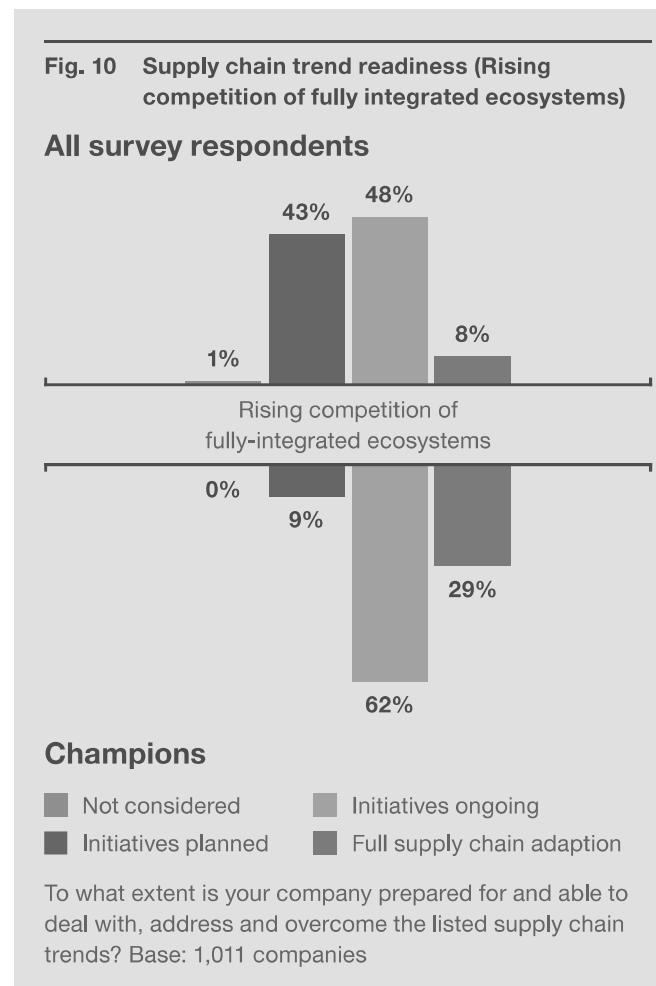
Tracking CO<sub>2</sub> emissions throughout the value chain is a major concern for large companies. Ecosystems, with their enhanced visibility and improved collaboration between partners, provide an effective way to do this. As economic and environmental challenges continue, along with increasing regulations, the need to build ecosystems that serve specific purposes will grow – as will competition between companies and their respective ecosystems.

## State of transformation

Overall, the results of this study suggest there is tremendous uncertainty over how to deal with increasing competition from ecosystems. Only a small percentage of companies (8%) consider their supply chains to be prepared for this trend. Champions displayed a greater readiness to get involved in an ecosystem. 29% of Champions think their supply chain has been fully adapted, suggesting they are either part of a network or have created one of their own. 62% have initiatives ongoing; 9% have initiatives planned.

Champions are three times more likely to be part of an ecosystem than other companies. The disparity between Champions and other companies may result from the fact that mature companies are drivers of their value chains. Smaller companies that operate regionally and are less affected by global regulations and disruption are more likely to join existing ecosystems than to build their own, and they do so at a later stage of development.

Companies that consider this trend highly important are typically in high-tech manufacturing industries. These include semiconductor, automotive and consumer electronics companies with complex global supply chains in far-flung places. In recent years, these companies have faced significant disruption, such as from the Covid-19 pandemic, the Suez Canal blockage, and geopolitical tensions in Taiwan, home to the world's biggest semiconductor chip manufacturer.



## Key capabilities

### Don't compromise on ecosystem-wide supply chain visibility

41% of Champions that rate this trend as highly important in the next one to two years also view ecosystem-wide supply chain visibility and enhanced collaboration with supply chain partners as important. These capabilities offer two key benefits:

- Enhanced collaboration: With end-to-end visibility, all stakeholders in the supply chain ecosystem can access real-time data and insights. This promotes collaboration and information sharing, allowing for better coordination and communication between different parties. For example, suppliers gain visibility into demand forecasts, enabling them to plan production accordingly, while retailers can share sales data to help suppliers optimise inventory levels.
- Proactive issue resolution: End-to-end visibility enables early detection of unexpected supply chain disruption. By having real-time data, stakeholders can identify bottlenecks and delays and take proactive measures to resolve them. This helps to minimise disruption and maintain smooth operations across interconnected ecosystems.

**41%**

of Champions see **ecosystem-wide supply chain visibility and collaboration** as a key capability within a complete ecosystem environment.

Some companies are equipping logistics assets (e.g. trucks, containers, pallets) with IoT devices and tracking technologies to capture real-time data on location, condition and status. This data can include GPS coordinates, temperature, humidity, shock/vibration and other relevant parameters. This type of information can be used within the ecosystem to monitor shipments throughout the supply chain and track relevant parameters, which might be needed for compliance with new international regulations.

#### **Build intelligent and self-driving supply chains**

Intelligent supply chain systems leverage advanced technologies such as IoT and AI to gather and process real-time data from various supply chain nodes within an ecosystem. These technologies produce massive

amounts of data. To make this data useable, integration is required. Data integration provides enhanced visibility of inventory levels, demand patterns, transportation status and production schedules across interconnected ecosystems. By sharing real-time data and insights, these systems enable faster resolution of problems, better coordination between suppliers and manufacturers, and improved customer service. This visibility enables better decision-making and responsive processes. For example, a company can automatically reorder inventory, adjust transportation routes based on real-time traffic data, or reroute supply flows to avoid disruption. This autonomy reduces the need for human intervention in routine tasks and accelerates response times. Champions have recognised these opportunities, as 43% of them rate this capability as highly important in the next one to two years.

## Takeaways

- 1** Value chain ecosystems are growing in number and in complexity. There is fierce competition to join or build one.
- 2** Leading value chain ecosystems are characterised by end-to-end process thinking and visibility, open data, and seamless collaboration with partners through integrated planning and execution.
- 3** Companies must understand the purpose and benefits of various ecosystems, as well as the work involved in joining or building one.



# 43%

of Champions see a significant need to invest in **intelligent and self-driving supply chain planning and execution** capabilities.

#### **Foster demand planning excellence by enriching traditional statistical forecasting with AI**

Champions' interconnected supply chain ecosystems use a wealth of real-time data from various interactions and touchpoints with customers for demand planning, such as point-of-sale and store data. 45% of Champions say this integration leads to demand planning excellence being an important capability for establishing or joining ecosystems. This data includes sales data, inventory levels, market trends, promotional activities, and external factors such as economic indicators and weather patterns. Improved data visibility allows more precise demand forecasts.

- Demand planning excellence is enhanced when multiple stakeholders contribute to the forecasting process with their unique insights and local market knowledge. By leveraging interconnected data sources, demand planners can make agile adjustments to their forecasts and inventory plans to optimise supply chain performance.
- Interconnected supply chain ecosystems help demand planners adopt a more customer-centric approach to forecasting. By capturing customer preferences, feedback and buying habits from various touchpoints, demand planners can tailor their forecasts to specific market segments or individual customers. This personalised approach improves customer satisfaction and drives business growth.



## Case study

### Metro

In 2023, Metro, an international food wholesaler, created an integrated ecosystem with major suppliers to work more collaboratively with core customers. With 626 stores in 21 countries, the German-headquartered company aimed to improve stock availability for core business customers, including hotels, restaurants, caterers and independent traders such as grocery stores, while keeping inventory levels low.

Previously, Metro's relationship with suppliers was more of a traditional supplier-customer relationship involving yearly meetings to discuss pricing and inventory levels, but meant mostly infrequent interactions. The new approach is proactive, focusing on improving upcoming deliveries with more frequent collaboration and intensive data sharing. For example, partners work closely on delivery schedules, managing performance levels and ensuring critical items are always in stock.

Metro's challenge was to find a way to work more collaboratively but with minimal additional effort and using existing teams. A digital ecosystem offered an efficient operating model in which data could be shared automatically, resulting in fewer emails and phone calls, and enabling a greater focus on important issues.

Metro's biggest challenge involved changing the mindset of internal and external stakeholders. People needed to think and act as a team with supply partners. This required a different way of working, sharing information and joint problem-solving. People had to buy into the new model.

To build support for the new model, the company shared best practices, targeted clear global KPIs, and developed its digital ecosystem together with its national branches and suppliers. This transformation has not only increased internal commitment, but also boosted transparency, performance and results.

Technology has played a key role in automating data sharing. The company uses a web-based platform, which is backed up by a cloud-based big data ecosystem. This lets Metro share insights with partners seamlessly. Still, it has been challenging to navigate regulations and legal obligations in different countries, which require country-level customisation on user interfaces and data content.

Metro's supply chain transformation, although not yet complete and only part of a larger supply chain transformation, has already yielded benefits. KPIs have

improved. Metro is seeing a mindset change within its organisation and with its partners, as well as increased sharing and transparency. All parties involved appreciate the benefits of greater collaboration, better data availability and the ability to intervene before problems such as stock shortages become serious. Additionally, continuous dialogue has increased sales, as well as improved customer perception of Metro's products and channels.

Future goals include further automating the workflow, which would result in fewer unnecessary interactions and more meaningful collaboration to improve planning.

#### Company snapshot:

Metro is a leading international food wholesaler that operates in more than 30 countries and employs more than 90,000 people. The store network includes 626 stores in 21 countries, 524 of which offer out-of-store delivery, and 80 dedicated depots. In nine countries, Metro operates exclusively with its own delivery companies (Food Service Distribution, FSD).

## F Increasing need to support new business models



## Introduction

Customers are increasingly demanding sustainable, climate-neutral products and services. They want businesses to behave ethically and transparently. At the same time, they want ease, convenience, fast deliveries and value for money – i.e. quality, durability and functionality at a competitive price. 45% of CEOs believe their company's business model won't be viable in ten years if their company stays on its current path (PwC's 27th Annual Global CEO Survey). To meet customer demands, companies are developing new business models and transforming supply chains to support them.

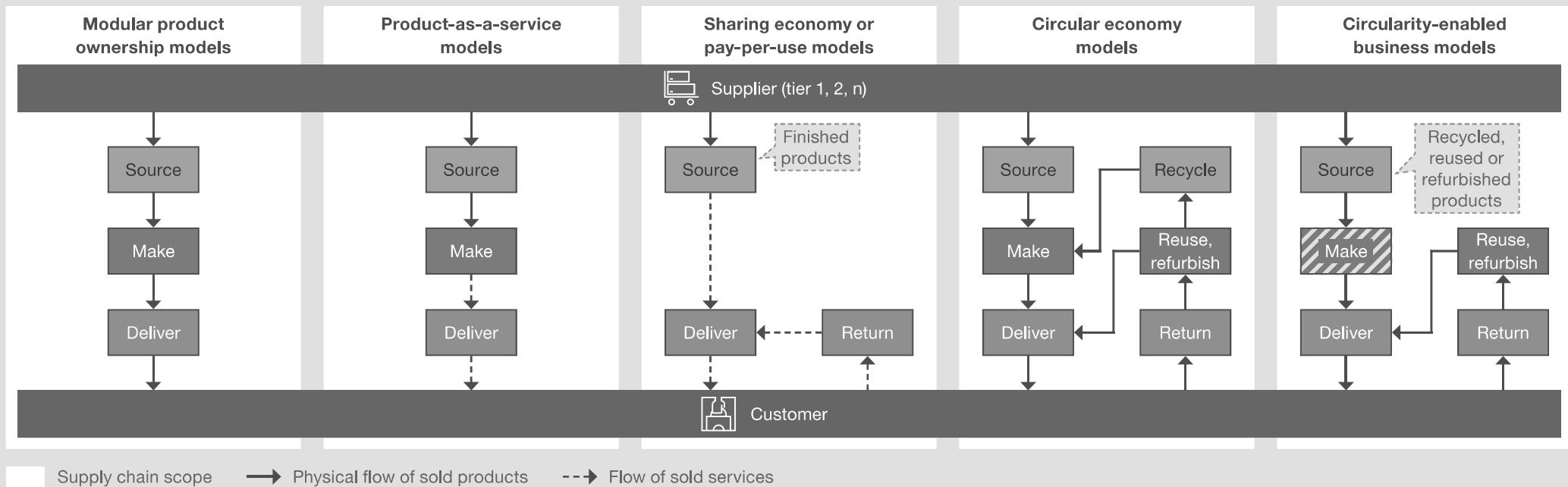
## Executive concerns

Companies are concerned about satisfying conflicting demands from customers. On the one hand, customers want sustainable products and practices, but aren't necessarily willing to pay extra for them. They want ease and convenience too, such as products delivered the next day, even though next-day deliveries carry environmental costs. Added to this are increasing ESG regulations. Balancing sustainability demands with profitability requirements is leading companies to rethink their business models.

More than one third of leaders view the short-term impact of this trend as highly disruptive; 41% say the same about the long-term impact. First there are costs to consider. Initial investments impact financial performance.

Adopting sustainable and service-orientated business models involves cultural and organisational changes. Organisations often reinvent and re-engineer their entire value chains from product development (e.g., using product modularisation) through to customer returns to grow sustainably and meet ESG targets. This involves creating and implementing new strategies and processes. Employees need to be aware of these changes, collaborate cross-functionally (e.g., with product development) to understand new requirements, and embrace advanced technologies. Finally, leaders are thinking about how to accurately track and quantify the impact of their new business initiatives and effectively communicate this information to stakeholders.

Fig. 11 Overview of new business models

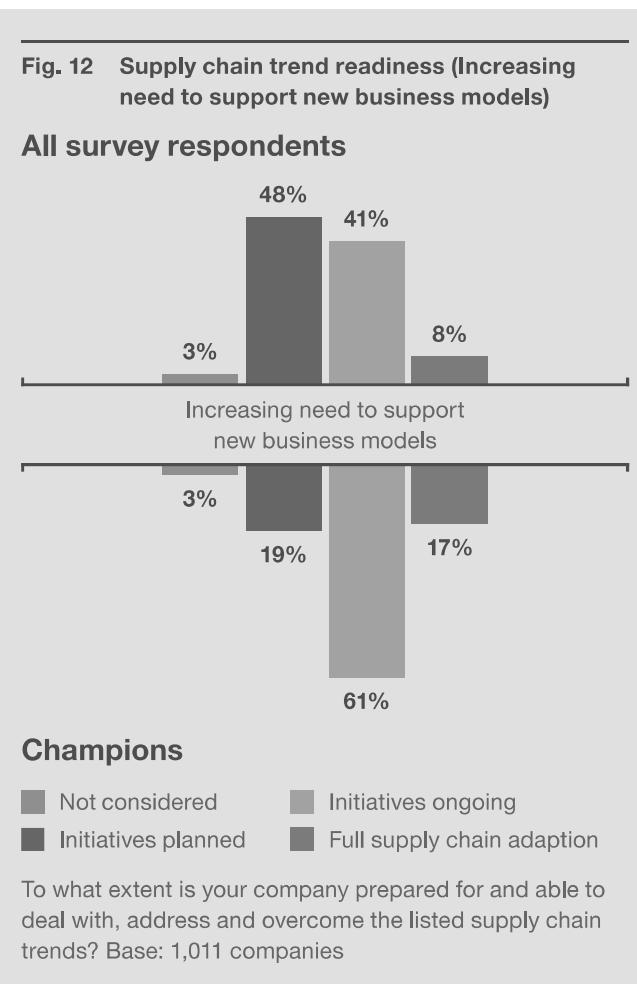


## State of transformation

Most companies are aware of the challenges but have yet to take significant action. 92% of respondents admit that their supply chains aren't fully ready to support service-oriented business models or offer sustainable solutions to customers. Fewer than half of the respondents surveyed (48%) say they have initiatives planned.

Among the 30% of those surveyed who said that the trend is very important, less than 13% are fully prepared. 58% have initiatives ongoing. These companies are actively implementing sustainable and service-oriented practices, such as fully embedding the principle that customers belong at the centre of strategy, and ensuring supply chains and product and service offerings are sustainable. Only a small percentage of companies have reached this stage.

Champions are far more likely to have embraced this trend. 17% said that their supply chains have already been transformed, suggesting that they have fully embedded customer-centric capabilities into their organisational culture, decision-making processes and performance management. 61% have initiatives ongoing, such as building distribution setups, increasing visibility and applying segmented supply chain flows.



## Key capabilities

### Build net zero, circular and sustainable distribution networks, and footprints

80% of survey respondents said that that building a net-zero, circular supply chain network, including transport and warehousing, is essential to supporting service-oriented and sustainable business models. Champions think that this capability is indispensable for the future.

Omnichannel and direct-to-customer business models put customer demands first – convenience and sustainability. To meet both goals, new distribution setups with optimised delivery routes and multiple well-managed carriers and logistics partners are required to deliver goods to customers' doorsteps. At the same time, circular business models are necessary to prioritise the return and reuse of products and materials. With circularity in mind, distribution networks can integrate packaging designs that support waste reduction, ensure efficient handling of returns, and adapt networks to use more efficient energy sources, such as electrical charging infrastructure.

### Apply segmented and differentiated supply chain flows that allow specialisation where required

In contrast to the one-size-fits-all approach where supply chains are designed around one set of standardised processes across all businesses, segmented supply chain setups allow for greater efficiency, flexibility and specialisation. The supply chain is segmented (or tailored) to meet different customer needs while meeting internal goals such as cost savings, asset efficiency or reducing greenhouse gas emissions.

41%

of Champions believe segmenting supply chain flows will strongly support new business models in the future.

This methodology tops leaders' agendas as omnichannel and direct-to-consumer models grow more popular. Segmented supply chains bring other benefits – such as streamlined processes, reduced lead times and improved overall supply chain performance – and can help companies meet ESG targets. Finally, segmentation can mitigate risks by diversifying suppliers, manufacturing locations and distribution channels, thereby reducing dependence on single sources.

#### **Expand supply chain planning through financial planning integration**

More than half of survey respondents (54%) see the integration of financial planning with supply chain planning as a crucial capability to support new business models. Shifting from volume to value planning typically yields successful results. Through integration, organisations can assess the scalability and flexibility of new business models. By considering financial factors in scenario planning, such as necessary investment, return on investment and cash flow projections, companies can evaluate the feasibility of scaling up or down their operations to support the growth of new business models.

Integrated financial and supply chain planning supports financial viability assessment of different supply chain configurations by analysing cost structure, revenue generation potential and pricing strategies to make better choices that align with business objectives. This helps companies make better informed investment decisions to ensure the financial success of new circular and sustainable ventures.

#### **Set up automated warehouse operations**

Automated warehouse operations use advanced technologies such as robotics – for example, in the form of automated guided vehicles (AGVs) or AI – to ensure quality and improve efficiency. These help businesses minimise both excess stock and stockout situations, leading to improved customer service and satisfaction. In parallel, these technologies support the adoption of a more sustainable inventory management approach. By leveraging data analytics and predictive modelling, businesses can optimise their use of warehouse space, equipment and labour to reduce energy consumption and lower a warehouse's carbon footprint. Automated inspections, sorting, refurbishment and packaging of returned products allow for waste reduction and minimise

the use of materials in reverse logistics and circular setups. Companies transforming their current business models already have warehouse automation on their radars: a third of Champions mentioned that automated warehouse operations enabled by collaborative robotics are key to supporting circular business models.

# 54%

of surveyed participants see the **integration of financial planning with supply chain planning** as a crucial capability to support new business models.

## Takeaways

- 1** Companies need to move to more service-oriented, sustainable and circular supply chain models to be competitive.
- 2** New business models require investments in circular-enabled networks, segmented supply chain flows, technologies such as warehouse automation, and financial planning integration.
- 3** Transforming business models requires courage. It is a significant step that can undermine earnings and sustainability targets in the short term, but yields long-term benefits such as increased market share and revenue.





## Case study

### Global Battery Alliance

Government regulations such as the European Green Deal, and collaborative efforts to accelerate sustainable change such as Climate Action, are significantly impacting supply chains. In response, supply chain managers are evaluating how to report on things such as product origins and carbon footprints, and how to gather and manage information – not just internally, but across whole value chains. Questions arise over how to finance initiatives, which technical platforms to choose, who should store the data, and how to share data securely and without compromising commercial secrets.

In some industries, OEMs are driving initiatives. In other cases, entire value chains are coming together to address these key questions and the solutions required. The Global Battery Alliance (GBA) is a good example.

The GBA is made up of more than 150 value chain companies, from mining to recycling, as well as representatives from NGOs, governments, financial and academic institutions, and industry standard setters.

The group shares the explicit goal of establishing a “sustainable, responsible and just” battery value chain and has developed a “battery passport”, which enables companies to report on ESG as required by regulations globally. The battery passport is a digital record of a battery’s lifecycle, from raw materials to recycling, and contains four types of information: labelling data, technical data, usage data and sustainability data.

Sustainability data is one of the most critical types of data to collect, manage and report to avoid violations of human rights or greenwashing. Therefore, GBA wants to create an impact by providing rulebook guidance for companies reporting on ESG issues. For each ESG issue, clear reporting KPIs are defined. Through a scoring logic, which is a mechanism to rate a battery’s ESG score, GBA aims to motivate companies to act sustainably and avoid greenwashing. In addition, GBA is planning to run pilot programmes to validate the rulebooks and the ESG scoring logic, and test the concept’s practicality.

The EU will require companies to have the battery passport ready by 2027. By 2025, companies must report on the carbon footprint of battery products, according to the EU. As a result, battery industry companies are under pressure to deliver information for the battery passport, while GBA is busy ensuring that companies can use the rulebook and scoring logic for reporting.

While preparing companies for the upcoming regulations, GBA is liaising with key regulators and standard setters globally to ensure its rulebook is adopted as the global industry standard. By joining the GBA, battery value chain companies and other stakeholders can actively shape ESG reporting requirements.

#### Company snapshot

The Global Battery Alliance is a partnership of 150+ businesses, governments, academics, industry actors, international and non-governmental organisations. GBA ensures that battery production not only supports green energy, but also safeguards human rights and promotes health and environmental sustainability. GBA members collaborate on key initiatives related to ensuring a sustainable and responsible battery value chain, through the formation of Action Partnerships.

# G Growing talent and workforce scarcity

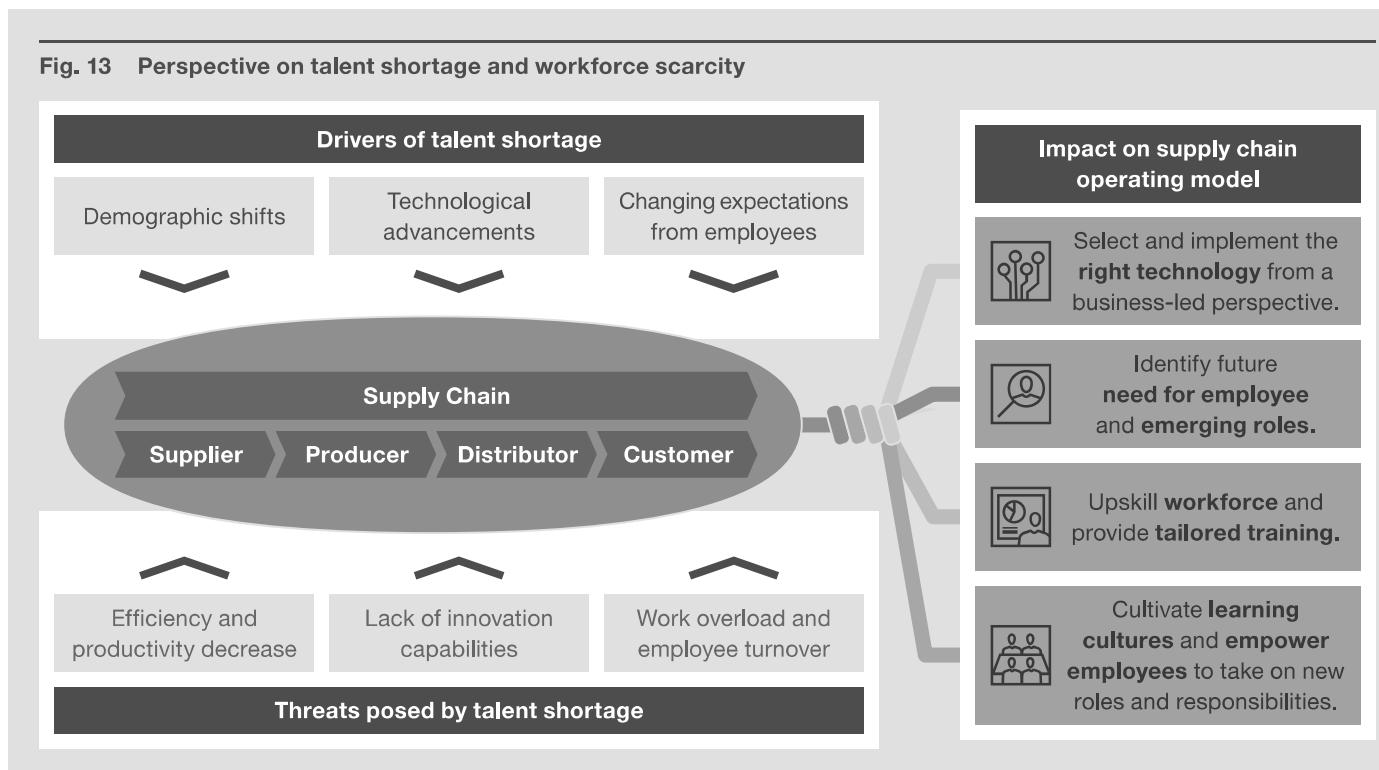


# Introduction

Companies are facing severe talent shortages, creating serious bottlenecks, which are disrupting daily operations and leading to delays in production, warehousing, order fulfilment, transportation and delivery. This disruptive trend undermines productivity and efficiency, while also impeding a company's ability to grow, transform and compete. Contributing to worker shortages are demographic shifts in mature economies with ageing populations and changing employee expectations in areas such as flexible hours and working environments that align with personal values. As a result, hiring and retaining workers is getting harder. Meanwhile, advances in AI, machine learning, automation technologies and more are creating new job profiles, leading to a mismatch between available worker skills and those required for emerging roles. According to a World Economic Forum survey, employers anticipate labour market churn of 23% of current jobs over the next five years.

## Executive concerns

In our research, 15% of respondents believe the talent shortage will be highly disruptive over the next one to two years. A quarter of those surveyed think disruption will grow as the decade progresses. In the short term, leaders are focused on meeting regulatory demands and upgrading systems to remain competitive, productive and efficient with fewer staff. In the long term, attention will shift to finding skilled workers and retraining current staff to run new systems, solve problems and innovate.



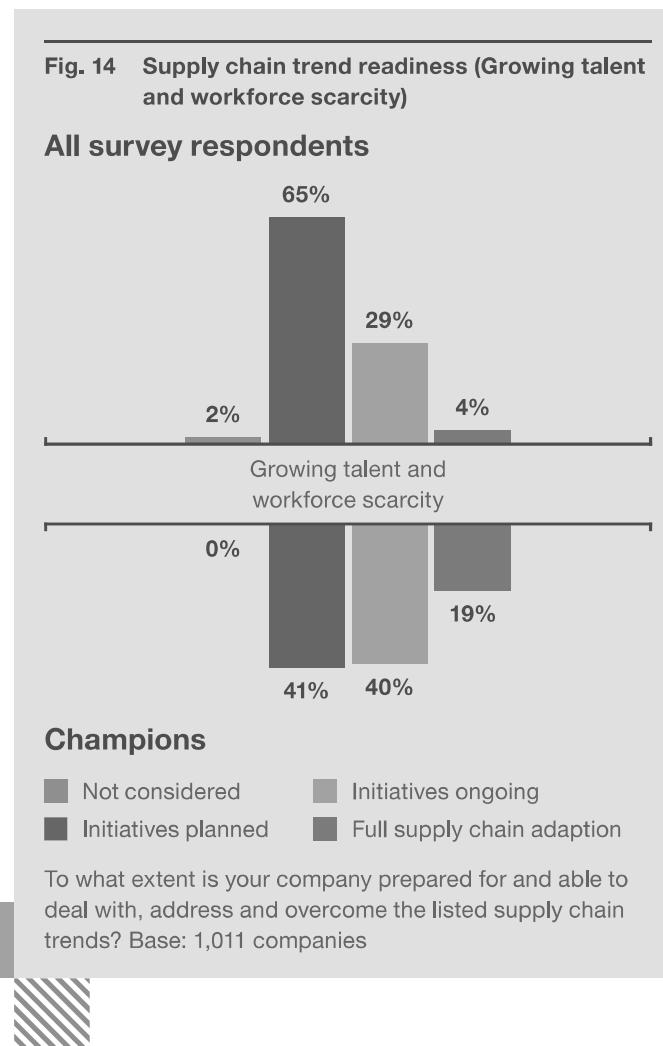
The survey shows that talent shortages affect all industries. Particular concern was raised by executives in highly technical industries such as electronics, medtech and pharmaceuticals, which depend on technicians, engineers, computer scientists and mathematicians. New technologies and new roles are expected to emerge in the future, leading to increasing concern.

It isn't just highly skilled and digital talent that is in short supply. Leaders are also worried about filling jobs in logistics and transport. Globally, millions of trucking jobs remain unfilled. The number is still growing, and this shortage is hampering expansion and hurting business retention.

## State of transformation

Most companies acknowledge challenges associated with talent shortages, with some more advanced than others at overcoming it. Our survey shows 4% of companies say they have fully transformed their supply chains by means such as automating tasks and reskilling workers. A significant majority of companies (94%) are in the transition phase, with 29% actively implementing initiatives and 65% planning future action to guard against talent shortages. Of those companies most impacted by talent shortages, less than 4% have fully adapted their supply chains such as by upskilling workers or implementing technologies to keep productivity high with fewer staff.

A lack of clarity about which roles will be required partly explains why more companies haven't adapted. For many companies, addressing the skills shortage will come later, once it becomes clear which jobs and skills will be required. The challenge is for companies to avoid delaying their response; otherwise, they risk falling behind.



## Key capabilities

### Implement intelligent supply chain planning and execution processes while simultaneously upskilling staff to leverage new technologies

Nearly 75% of survey respondents who say their supply chain is fully adapted to the talent shortage have largely or partially implemented intelligent supply chain planning and execution to automate processes. Intelligent supply chains rely on technologies such as AI and machine learning to leverage algorithms that analyse big data and provide suggestions, so that supply chain planners can make better decisions quickly and efficiently.

A good example is demand planning. More than 80% of our survey respondents with adapted supply chains have largely or partially implemented AI-based demand planning with statistical forecasting to improve forecast accuracy. Technologies like decision intelligence systems can tap into historical data, trends and patterns to predict customer demand accurately, optimise inventory levels and reduce stockouts.

Intelligent supply chain planning and execution processes can help companies address talent shortages by optimising operations, reducing costs and improving efficiency with fewer staff. Automation of routine tasks allows staff to focus on strategic activities. These technologies may require new skills, which workers might not possess, making upskilling essential.

**40%**

of surveyed companies believe **intelligent and self-driving supply chain planning and execution** helps reduce manual work.

# 50%

of Champions have outlined that **low-touch and automated order management and fulfilment** is the most important capability to bypass workforce shortages.

## Enhance logistics operations to reduce human intervention and increase productivity

Among respondents with supply chains fully remodelled to combat talent shortages, 60% have implemented at least some low-touch and automated order management and fulfilment processes. Addressing the growing talent shortage can be facilitated through automation, particularly in handling routine tasks such as data entry, invoice management, order fulfilment and returns processing.

Additionally, 50% of survey respondents have largely or partially implemented initiatives to automate physical warehouse activities. Systems such as intelligent sorting systems or advanced robotic systems are used in fulfilment centres for order picking, packing and shipping to increase productivity with fewer workers.

88% of survey respondents with fully-adapted supply chains to address talent shortages have largely or partially implemented flexible and resilient transport management to leverage automation in transport planning and execution processes. For example, AI-driven routing algorithms to optimise delivery routes in real-time can improve transportation performance with less manual work. Logistics operations can be enhanced by using technology to reduce human intervention and errors, and boost productivity with fewer staff. Realising these benefits means investing in technologies and upskilling workforces to handle new technical requirements.

## Takeaways

- 1** Talent shortages – driven by demographic shifts, changing worker expectations and new technological demands – are creating supply chain bottlenecks, undermining productivity and efficiency.
- 2** Amid workforce shortages, productivity and efficiency can be maintained by automating physical tasks (e.g., using robotics) and decision-making, and then retraining workers to take on high-tech and problem-solving roles.
- 3** As supply chains and technologies evolve, it is unclear which skills will be needed. Companies should cultivate learning cultures, and train and empower employees to take on new roles.





## Case study

### Appose

Over the course of the 2020s, the talent shortage problem is expected to get worse, adversely impacting supply chains. Amid rapidly developing technologies such as AI and robotics, it is predicted that millions of jobs globally will emerge, while millions of others will become obsolete. This is happening during an already tight labour market. Meanwhile, supply chain processes are evolving and expectations from employees are changing.

This presents a serious challenge for companies. Leaders lack clarity about what kinds of workers and which jobs will and won't be needed in the future. Additionally, employers need to know whether existing employees are prepared to meet these challenges. Can they flexibly adapt and be trained to take on new roles? Or should employers recruit new workers? And if so, what skills should they look for? The problem is compounded by the fact that companies will likely be meeting these challenges with fewer resources, while still needing to maintain efficiency and productivity.

One data-driven solution that can help companies rethink their workforces, recruit more effectively and develop employee skills to meet evolving business needs is talent management software from Germany company Appose.

This software helps companies reconfigure their workforces by using predictive analytics to anticipate future competency requirements. The software leverages big data, AI and insights from various sector-specific institutions (e.g. trend radars) to proactively identify future industry needs.

At the same time, the software's machine learning algorithm analyses the individual competencies of a company's workforce. The result is a clear picture showing which skills a company needs to build up for the future, and which ones are likely to be unnecessary.

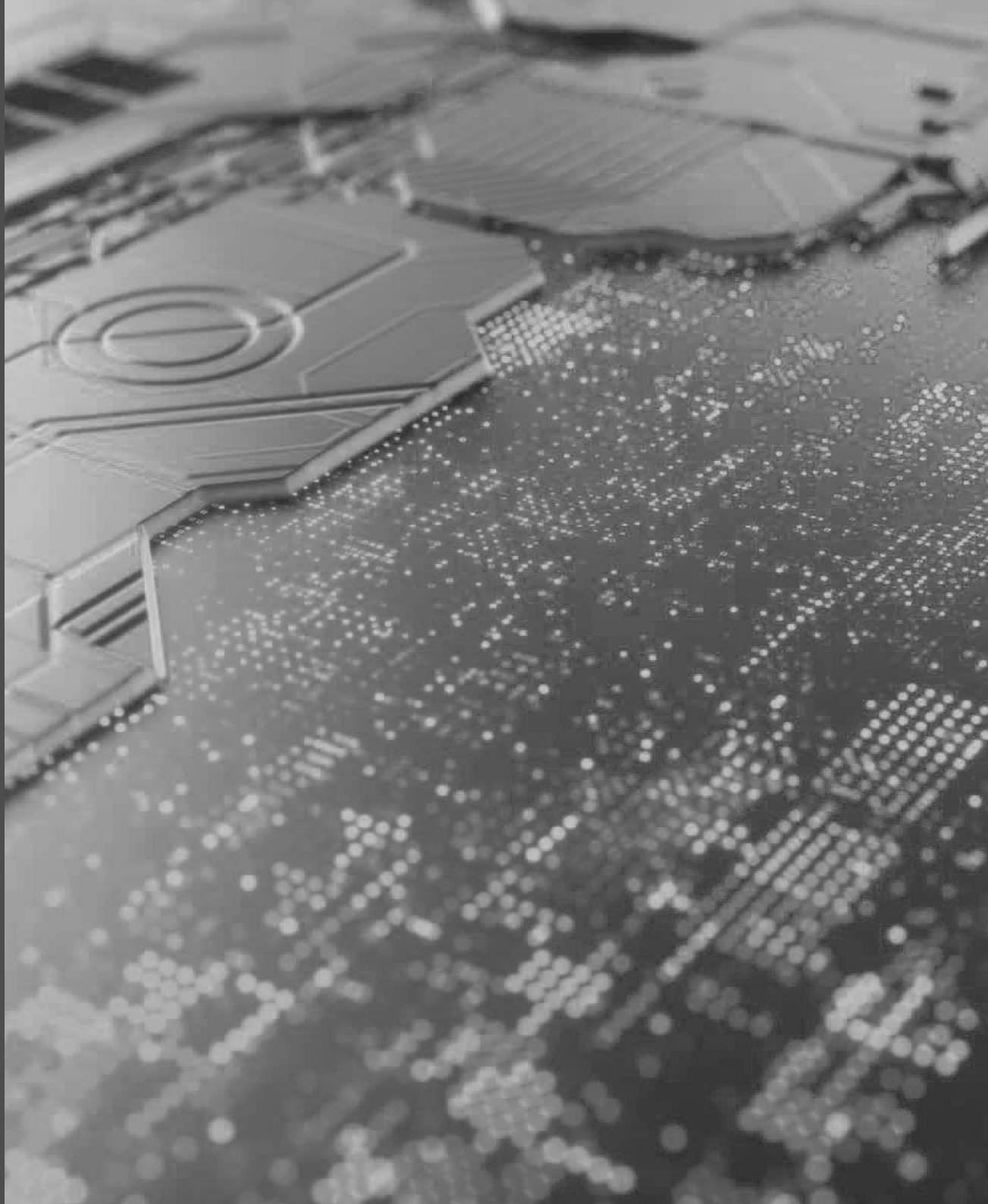
The algorithm suggests training for current employees to upskill them for emerging roles. Ultimately, this benefits both companies and employees. The company makes good use of existing talent, while simultaneously increasing employee loyalty by preparing workers for the future.

#### Company snapshot

Appose is a Germany company, founded in 2019, which makes skills management and workforce transformation software. It was founded by CEO Marko Albrecht and co-founder Muammer Yüksel, and has locations in Heidelberg, Frankfurt, London and New York City.



# H Evolving technological advances



## Introduction

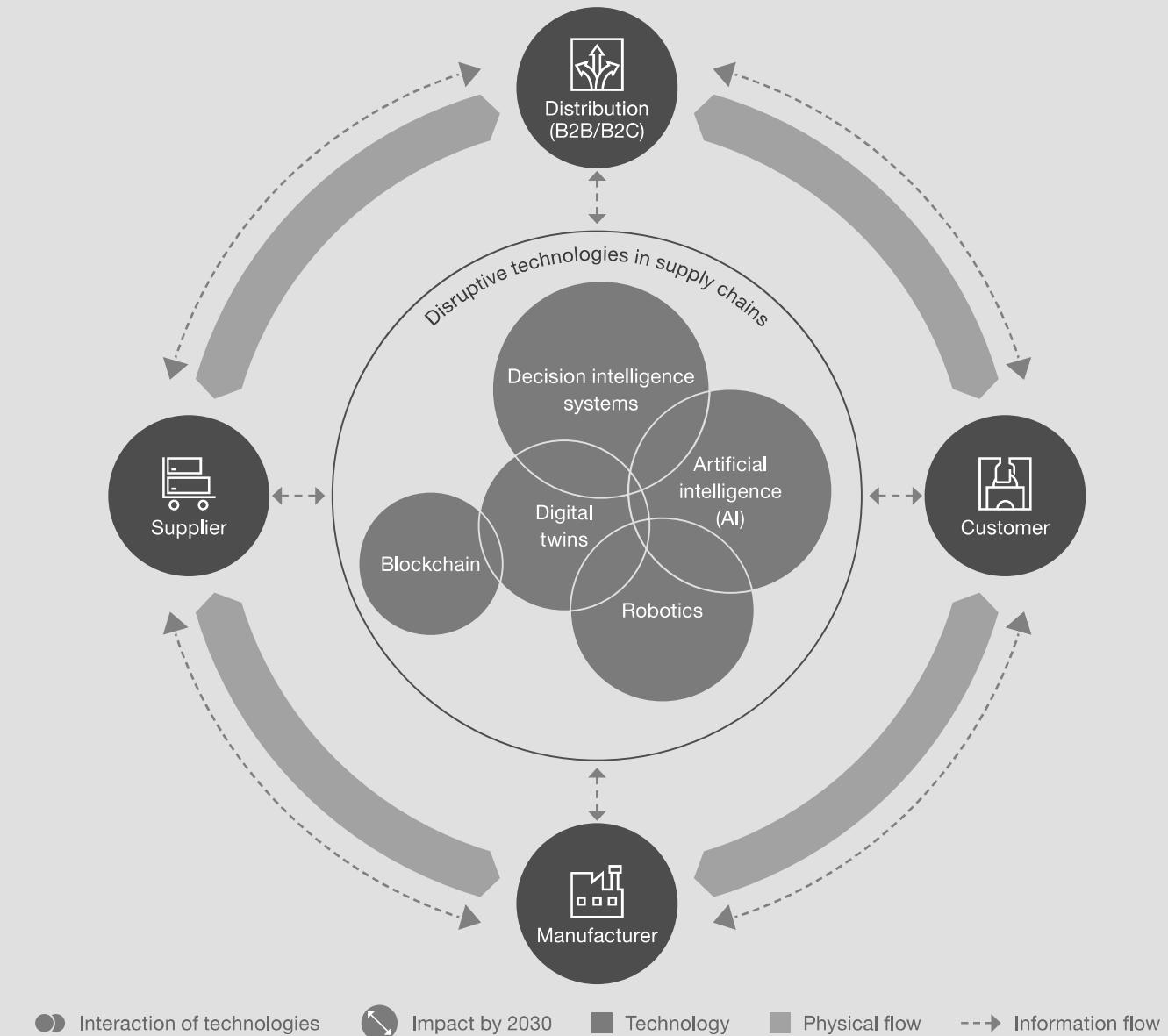
Rapidly evolving technologies represent a significant disruptive threat to companies, but also offer new opportunities to revolutionise supply chains. Organisations are making their businesses more resilient by using cutting-edge technologies to improve data visibility, automate processes and decision-making, improve communications, and enhance collaboration across entire value chains. The following top five technologies are mentioned by survey respondents.

## Digital twins

A digital twin collects and integrates real-time data from sensors to create dynamic and interactive virtual replicas of physical objects, systems and processes. Companies use digital twins to monitor supply chains and logistics, and to optimise entire supply chain networks. A digital twin can be used for testing scenarios such as the impact of a closed shipping port, or the loss of a key supplier, and responses can be prepared based on the results. Many companies surveyed mentioned using a control tower – a digital twin use case which provides real-time visibility of often siloed data in a user-friendly way. Control towers create a window through which all stakeholders can see flows of goods, and track and trace things like raw materials and inventory levels, as well as monitor potential bottlenecks.

56% of companies said that digital twin solutions will have an immediate impact on their supply chains. 37% of companies that have fully adapted their supply chain technology, use digital twins in supply chain planning. 28% use them for logistics – to help identify potential delays, for example, and adjust plans accordingly. Companies with ESG initiatives underway say they are most focused on this type of supply chain modelling to evaluate different scenarios.

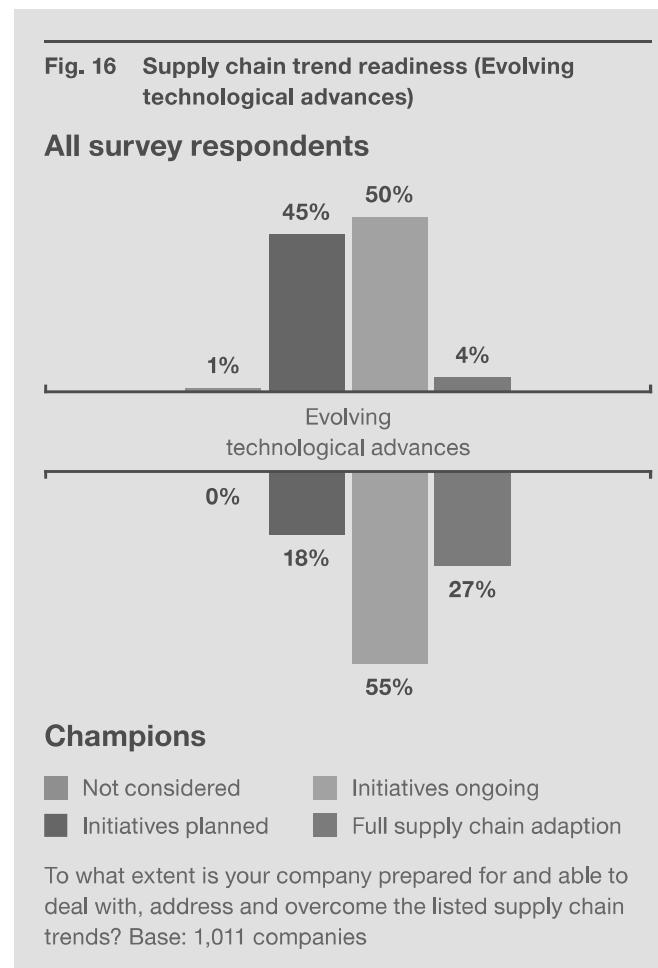
Fig. 15 Disruptive technologies in supply chain



# AI

While digital twin technology provides visibility, AI can identify patterns in disconnected data across complex global supply chains to make decisions based on real-time data and simulate future outcomes. Data from suppliers, customers, vendors and other service providers such as transport carriers or news sources are fed into a machine learning algorithm. This gives stakeholders instant access to data to improve supply and demand forecasting, optimise inventory levels, and improve transport planning. Large language models (LLMs) have led to major breakthroughs, with AI chatbots now being used as virtual assistants in supply chains. Other AI agents can help solve complex, real-world problems without prior knowledge – in much the same way that AI can learn to play Go or Chess.

Champions are attuned to the disruptive impacts of AI. Two-thirds of them said that AI is already having a big impact; 39% of all survey respondents recognise its long-term value. Most Champions apply AI in supply chain planning and inventory optimisation (49%), logistics planning and execution (40%), order management (38%) and risk identification/simulation (36%) to quickly adapt to sudden, unforeseen changes.



## Decision intelligence systems

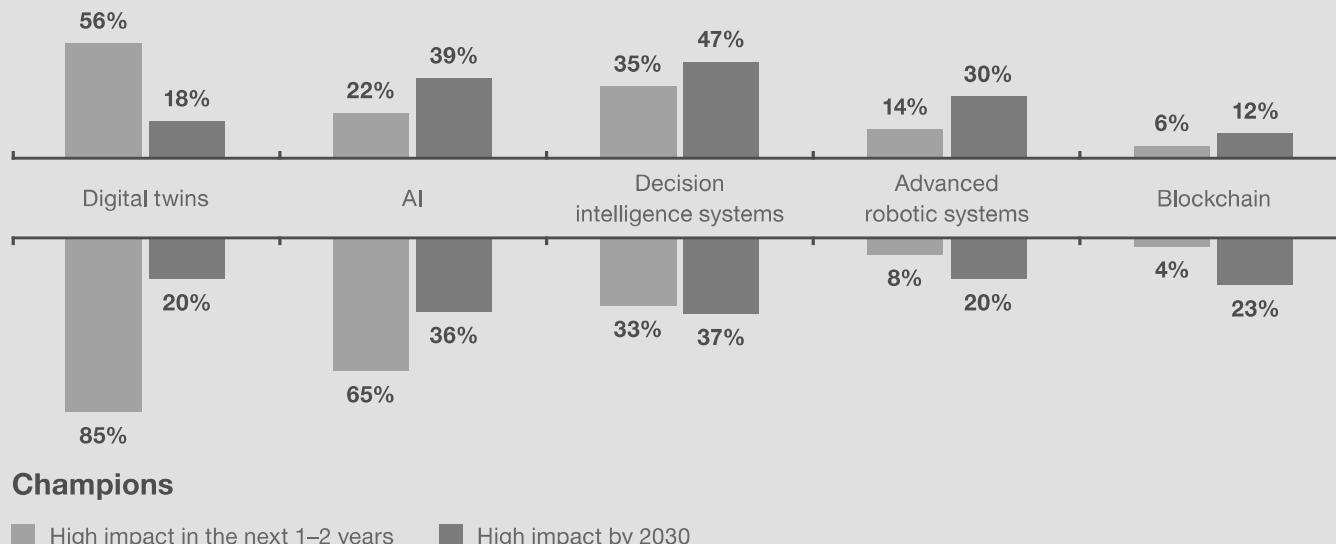
These systems harness the power of AI and machine learning, visualised data and collaboration technologies to provide insights and recommendations to improve – and potentially automate – decision-making. Decision intelligence systems can significantly optimise the entire value chain. These systems use both historical and real-time data – weather patterns, fashion trends and traffic information, etc. – to generate recommendations to underpin decisions that consider multiple scenarios and their potential impacts. Decision intelligence systems can support business operations such as the sales and operations execution (S&OE) process by providing recommendations to planners in the order promising process, and by creating full visibility on the impact of different decisions on relevant metrics.

A third of surveyed Champions consider decision intelligence systems highly relevant. Almost 60% of companies believe the technology is key to efficiently participating in ecosystems, identifying trade-offs between costs and sustainability goals, and simulating how different supply chain configurations might impact carbon emissions.

## Advanced robotic systems

Fig. 17 Overview of most influential technologies

### All survey respondents



How would you evaluate the below listed technologies in terms of addressing the rated trends for your company?

Base: 1,011 companies

To improve efficiency and combat worker shortages, companies are automating repetitive and physically demanding activities associated with the shop floor, warehousing and delivery. In fulfilment centres, for example, advanced robotic systems such as AGVs and drones undertake stock taking and transport. Automating these processes reduces human intervention and manual errors, increases efficiency and streamlines processes, while freeing up staff for more complex tasks. Robotic systems are also used in return processes and circular supply chain models to sort and separate different types of materials and to assist in disassembling, cleaning and refurbishing used products, thereby extending their lifecycles.

29% of Champions who say talent shortages are largely impacting their businesses see a need for advanced robotics systems. In addition, more than 40% of respondents who say that supporting new business models will be highly important in the future consider robotic systems a must-have.



## Blockchain

Blockchain provides a transparent and immutable ledger that can record and track financial transactions and movements of goods in real time. This end-to-end traceability means that stakeholders – from raw material producers to customers – can identify the origin, location and status of products at any point in the supply chain. Blockchain technology is particularly valuable for circular business models, ensuring transparency and accountability. It identifies inefficiencies, reduces waste, supports emission tracking, and lessens a company's environmental impact overall. It reduces the risk of fraud and manipulation.

Survey respondents said that the technology is not disrupting supply chains as dramatically as many had thought it would, but it is still considered one of the top five technologies crucial to supply chain development over the 2020s. 23% of Champions believe that blockchain will be valuable for selected use cases in the future, such as becoming ESG compliant and ensuring traceability by means such as digital product passports.

## Takeaways

- 1** Embracing rapidly changing technologies tops most agendas, as executives appreciate the benefits and the disruptive potential of technology.
- 2** The most frequently mentioned disruptive technologies in supply chains were digital twins, AI, decision intelligence systems and advanced robotic systems.
- 3** Instead of using technology to incrementally improve ways of working, companies should encourage cultures of experimentation to unleash the power of technology to innovate and master disruptive trends.





# I Need for transformation



## Introduction

The companies surveyed are responding to disruptive trends by dramatically transforming their supply chains. They are overhauling business models, embedding circularity and getting closer to consumers. They are learning to better manage data, and they are increasing transparency and collaboration in their supply chains from end to end. Ultimately, those at the forefront of transformation are emerging with more adaptable and future-proof supply chains to better withstand disruptive trends.

## State of transformation

Some companies are further along than others, but most are making ambitious plans. 93% of Champions, for example, said that they are taking a holistic, end-to-end approach to transforming their supply chains. Large companies with more than 5,000 employees in most industries said that they too are taking an end-to-end strategic view, involving major technological changes. These transformations cover process design, system/tool implementation, and engaging the entire value chain, including supply chain partners and customers.

Champions and larger businesses are moving relatively quickly to overhaul their supply chains, but efforts by most other companies appear narrower in scope. These efforts tend to limit transformation to business units, with less consideration of external partners and without linking the overall business strategy to the supply chain strategy.

## Executive concerns

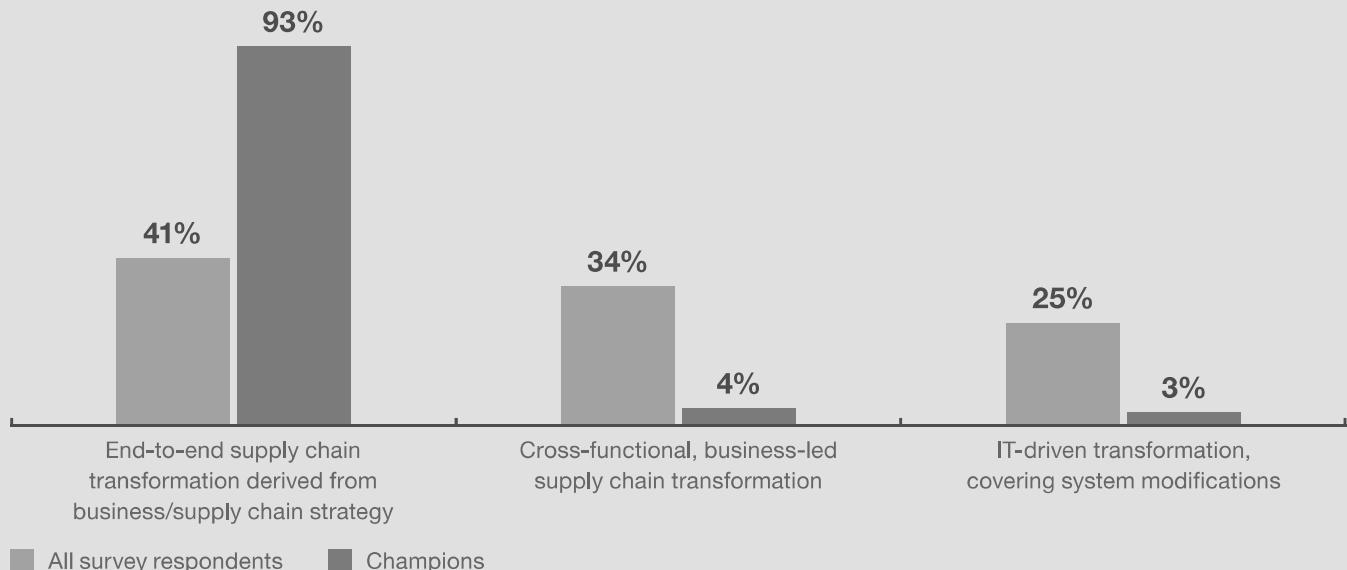
We asked executives what was holding back their transformation initiatives. They pointed to a lack of accountability, clear instructions and defined requirements as top challenges. They told us their transformation efforts lacked clarity related to targeted KPIs such as who was responsible for meeting them, and regarding how priorities should be interpreted. These challenges can leave staff pursuing conflicting goals.

Survey respondents also pointed to a mismatch between supply chain systems and changing business requirements. This hampers scalability, particularly when systems aren't built to cope with changing market requirements. Handling disruption requires transparency,

flexibility and system integration. Absent these factors, it is difficult to react quickly to supply chain disruption.

Slow progress in transformation is also blamed on incompatible IT infrastructure across business units, suggesting a need to standardise core technologies, or at least ensure their compatibility. Finally, a lack of effective change management is an issue that requires management attention. Executives said that staff and stakeholder engagement is poor, particularly related to adopting new systems and technologies. When people don't appreciate the benefits of new ways of working, they resist change, investment is wasted, and transformation efforts fail.

Fig. 18 State of transformation



Based on capabilities and technologies you have already planned or implemented, which statement best characterises your supply chain transformation? Base: 1,011 companies



## Transformation enablers

### **Set a clear supply chain vision with a realistic roadmap and drive continuous communication**

To transform successfully, companies need a clear vision, strategy and roadmap. It is important to establish a realistic roadmap that matches organisational capabilities, considering a workforce's capacity and the effort required to transform. Companies should define clear and measurable sustainability goals such as reducing carbon emissions and minimising waste.

Companies need to ensure that goals are specific, achievable and that deadlines are in place. Effective communication is essential to engage customers, employees and other stakeholders to make change happen. Companies should transparently communicate their goals, progress and challenges, as well as the benefits and impacts of their actions. This builds trust and gets workers on board.

### **Establish integrated end-to-end operating models**

Designing processes from an end-to-end user perspective and involving cross-functional stakeholders such as those in procurement and sales is essential for successful supply chain transformations. Our study shows that integrated planning and execution processes, including logistics and tax/customs, are viewed as an effective way to respond to market turmoil. More than 40% of companies surveyed think that integrated financial planning is a key future supply chain capability, reflecting a growing need to improve financial visibility across business functions and meet ESG targets.

Integrated operating models often mean changes in governance. New roles and responsibilities will be required, along with performance measures/KPIs and organisational modifications. 20% of companies surveyed said that they are considering restructuring their organisation and governance in the near future.

### **Harmonise IT infrastructure and master data**

This study shows that building heterogeneous IT and system infrastructure is one of the top challenges that companies face. To future-proof organisations and enable large scale transformations, companies must move towards shared data governance, while harmonising their ERP backbone to streamline processes and increase efficiency.

Companies should first define their corporate core by identifying essential activities. Clarity is needed on which processes and tools should be built inhouse to add the most value and which ones can be done externally. Companies that fix the basics first are better prepared to manage supply chain transformations and ensure business continuity. Champions are already embracing this business-led IT transformation approach, focused on the end user, and remaining flexible enough to meet future demands.

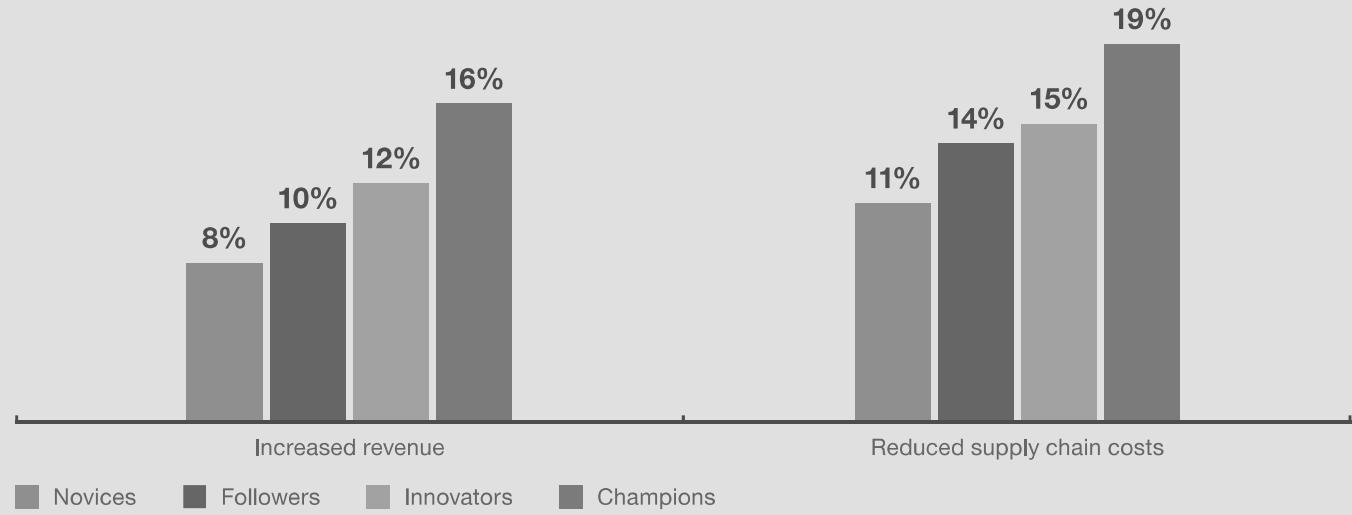
## Benefits

A fifth of companies expect their investments in capabilities and technologies to result in greater supply chain resilience, as they will be able to react faster to supply chain disruption. 18% anticipate decreased waste or carbon emissions due to ESG-driven and circular supply chain initiatives. Applying advanced capabilities and disruptive technologies ultimately allow companies to respond faster to customer needs, which enhances customer satisfaction. 14% of the companies surveyed expect increased customer satisfaction and loyalty.

Champions who have largely implemented priority capabilities and technologies expect a revenue increase of 16%. By increasing their capability levels, Champions are capitalising on opportunities such as improving forecast accuracy and delivery performance while being compliant with regulations and meeting cost targets.

Champions anticipate a 19% reduction in supply chain costs. They will have implemented capabilities and technologies such as low-touch order management and automated warehouse operations, using technologies such as advanced robotics and drones. Leaders of mature companies are well positioned to capitalise on investment in capabilities, and continue to invest to further drive down costs and increase revenue.

Fig. 19 Expected benefits



Based on the capabilities and technologies you have prioritised, what are the benefits you expect to gain from your investment?  
Base: 1,011 companies

## Takeaways

- 1** Champions and larger businesses are quickly overhauling their supply chains, but all companies are making ambitious transformation plans.
- 2** Supply chain leaders are taking a holistic, end-to-end supply chain approach – covering process design and system/tool implementation – and are actively driving change and fostering communication with partners and customers.
- 3** Investing in supply chain capabilities and adopting a business-led transformation has enormous long-term benefits including lower costs, increased revenue, enhanced customer focus, more resilience and greater mastery of emerging trends.



## Case study

### Philip Morris International

In 2016, Philip Morris International (PMI) committed to a smoke-free future. The multinational tobacco company has invested more than \$10.5 billion to develop products such as e-cigarettes, heated tobacco and nicotine patches.

Pivoting from a single-category company to a complex, multi-product business with new consumer channels required a dramatic supply chain overhaul. PMI could no longer solely rely on large distributors downstream. It had to get closer to consumers by building e-commerce operations and micro stores. It needed more Tier 2 and 3 suppliers, along with better oversight, communication and flexibility.

A large part of the transformation has been technological. Recognising that PMI's new business model called for a data-driven, standardised and centralised approach to enable accurate, faster and better decision-making, the company created Sync Hub to sense, forecast and plan for supply and demand.

Sync Hub provides detailed forecasting and closer integration between different parts of the supply chain. Connected to a custom inhouse scheduling tool, Sync Hub gives PMI comprehensive digital visibility over the entire planning and distribution process. It mitigates risks by simulating different scenarios to prevent downtime and avoid crises.

Sync Hub has enabled a shift from PMI's decentralised way of working to a more sophisticated and disciplined planning model. The standardised process is overseen by

a central team that works closely with each market. Local execution teams continue to report to their respective markets; but with full, digital visibility, they now work in a more synchronised way.

PMI introduced Sync Hub just before the pandemic struck. Covid-19 served as a stress test, which Sync Hub withstood. In 2020, PMI was able to respond quickly to changing market conditions, including supply chain disruption, backlogs and extended delivery times – making a difficult period far less disruptive than it might otherwise have been.

PMI's factory in Kharkiv, Ukraine serves as a good example. Until 2022, this factory was critical to the Ukrainian market, and served as an important export hub that supplied finished products and materials to many Eastern markets. Overnight, this changed as war broke out.

Given the factory's proximity to Ukraine's eastern border and the many people employed there, PMI regularly ran scenario planning. Sync Hub enabled the company to adjust to compensate for missed capacity, disrupted supply and alternative routes. Amid a war, PMI was able to respond quickly to protect large volumes of certain products, ensure supply to Ukrainian consumers, and continue product launches such as a new e-cigarette in Ukraine. This took place while keeping employees out of danger and evacuating many of them. Indeed, Sync Hub was used to provide an effective disaster response.

These crises highlighted the need for greater agility and resilience to face future challenges. In 2023, PMI initiated a Sync Hub "reload" to reflect learnings from the last few years and make the process and organisation future-proof.

One capability developed because of the Sync Hub reload is scenario planning – a group dedicated to running various demand and supply scenarios. They are focused on risk identification and mitigation. While this activity had been done in the past, it wasn't until the reload of Sync Hub that PMI saw the opportunity to not only make it a standard process within planning, but to create a department fully dedicated to it.

Ultimately, this integrated, flexible system – which puts real-time relevant data from across the supply chain at employees' fingertips – has improved efficiency, communication and advanced forecasting to support PMI's transformation to a smoke-free company.

#### Company snapshot:

PMI is a major multinational corporation with 70,000-plus employees – including more than 1,500 scientists, engineers and technicians dedicated to developing smoke-free products – and thousands of stakeholders across more than 90 markets around the world. In PMI's Q4 2023 results, net revenue for IQOS, a heated tobacco product, overtook those of the company's leading cigarette brand, Marlboro, for the first time. IQOS accounts for more than 50% of net revenue in 25 markets, suggesting the company has made significant strides towards becoming a smoke-free company.



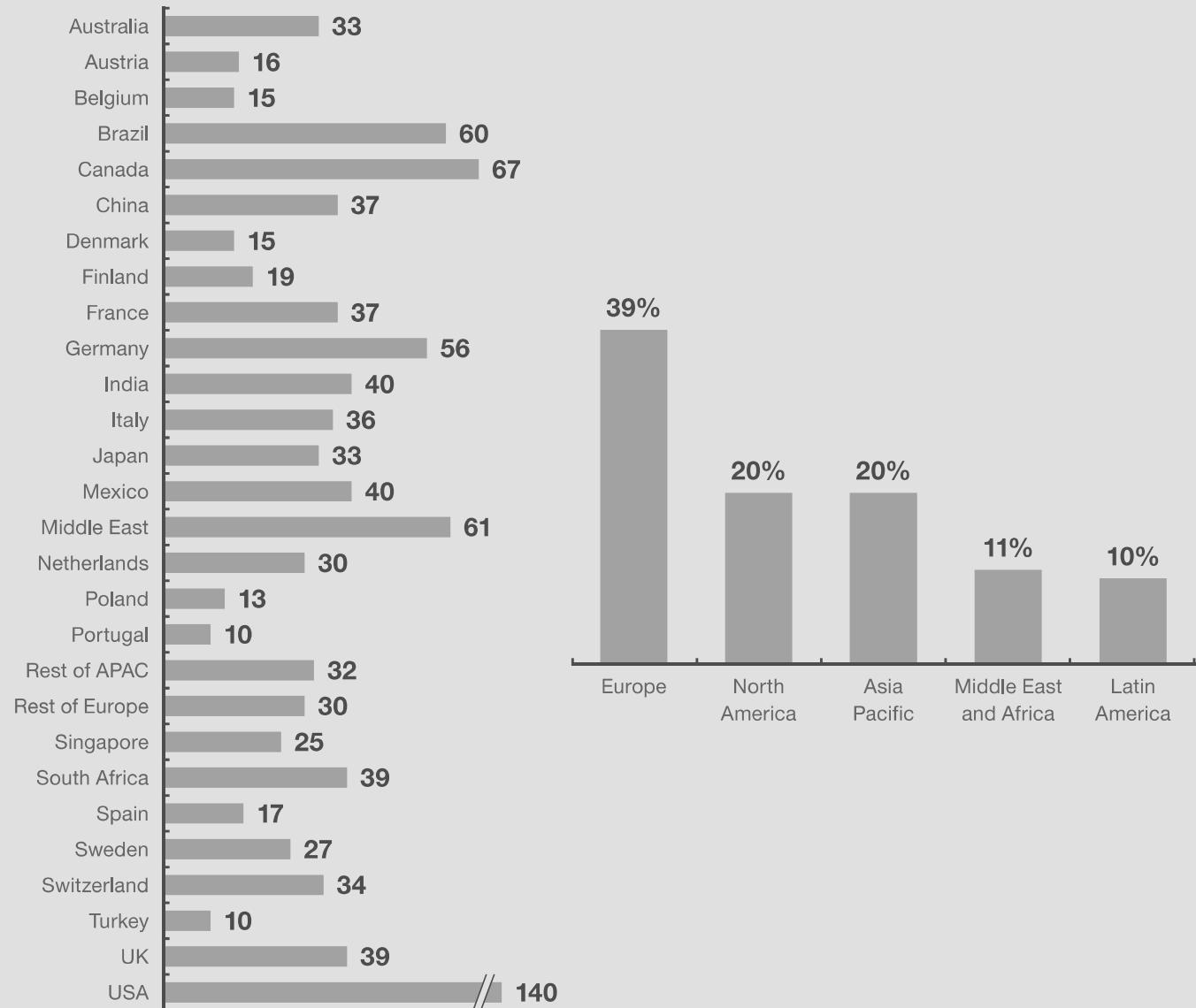
# About the survey



## Introduction

This PwC report is based on quantitative research consisting of interviews conducted between December 2023 and February 2024 with 1,011 senior executives from companies in 28 countries across Europe, the Middle East and Africa, the Americas, and Asia Pacific.

Fig. 20 Regional distribution



Please confirm the country in which the business or legal entity you are representing is located. Base: 1,011 companies

Fig. 21 Participating PwC territories

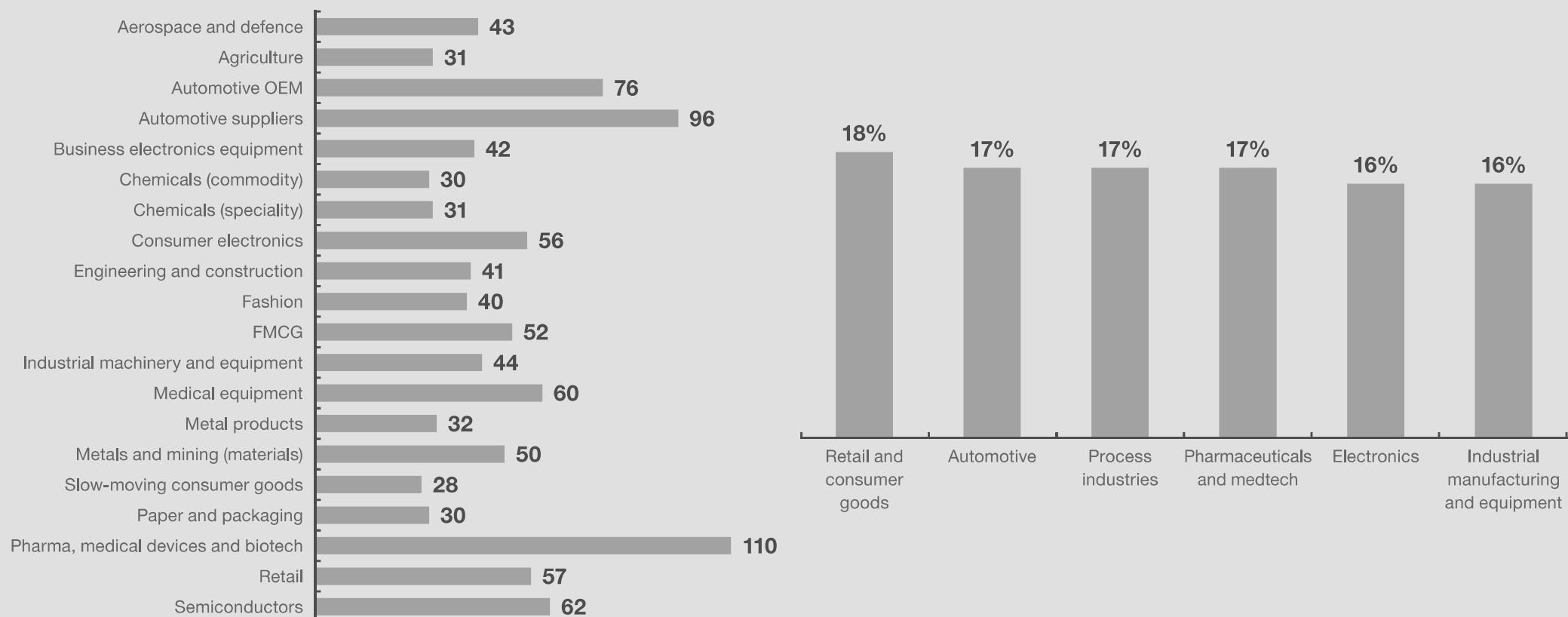
Australia
Austria
Belgium
Brazil
Canada
China
Denmark
Finland
France
Germany
India
Indonesia
Ireland
Italy
Japan
Mexico
Middle East <sup>1</sup>
Netherlands
Poland
Portugal
Singapore
South Africa
Spain
Sweden
Switzerland
Turkey
United Kingdom
USA



<sup>1</sup> Multiple territories included.

The majority of survey respondents in this study were senior executives with top-level responsibility in their company for operations and supply chains. Companies were surveyed across six key industry sectors.

**Fig. 22 Industry distribution**



Which industry sector best represents your company? Base: 1,011 companies

At PwC, we developed an index that ranks companies by supply chain maturity (see Figure 23). Based on their scores, we grouped the companies into one of four categories: Champions, Innovators, Followers and Novices. In this report, these terms refer specifically to the interviewed companies' level of supply chain maturity.

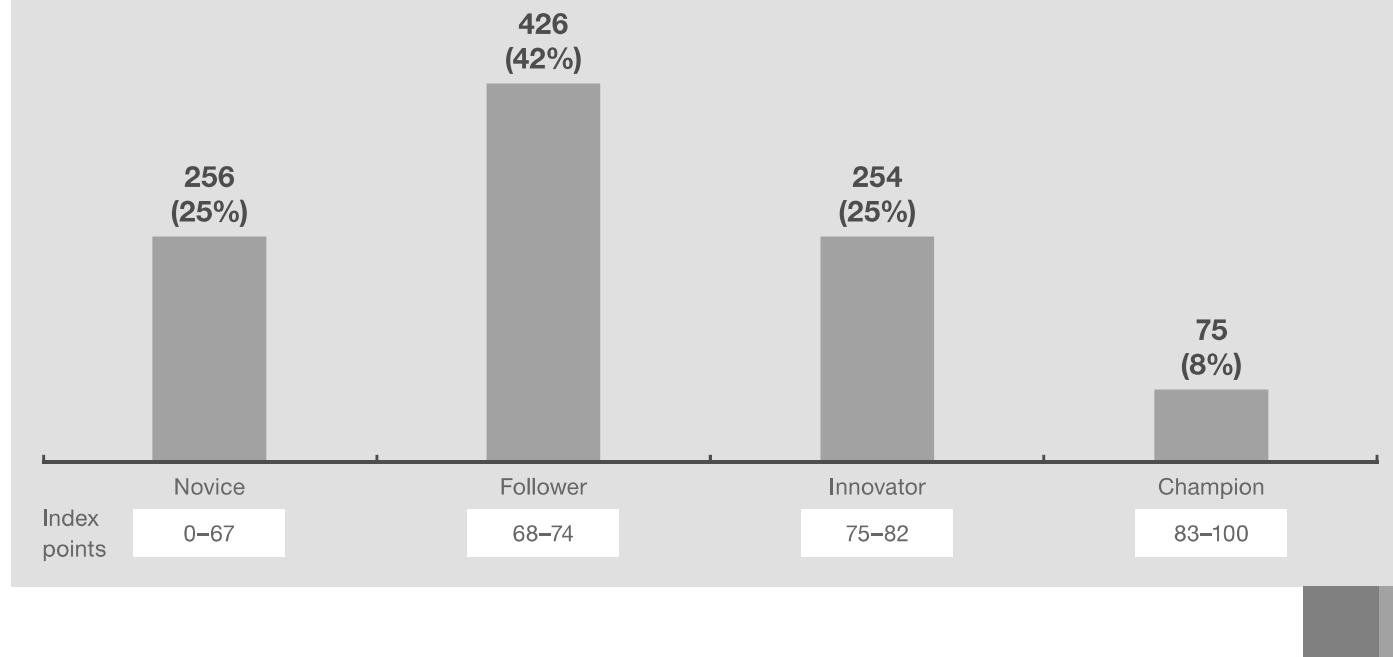
- **Champions** have reinvented supply chains to be adaptable, sustainable and cognitive by broadly implementing capabilities and technologies to master disruptive trends.
- **Innovators** are mid transformation, implementing advanced capabilities and applying selected technology use cases in an integrated fashion. They are on track to be future leaders.
- **Followers** are in the early stages of transformation. They have applied selected capabilities and new technologies, and have disruptive trends on their radar.
- **Novices** recognise disruption and acknowledge compliance challenges. While they may have taken some action in some areas of their supply chains, they haven't developed broader strategies.

To measure where particular companies fit within these groupings, we allocated a total of 100 points to different levels of maturity. A maximum of 4 points were awarded for adapting the supply chain to each trend, 4 points for the implementation of each advanced supply chain capability, 1 point for each applied technology, 4 points for applying an end-to-end transformation approach and 5 points for an end-to-end orchestrated supply chain. The index is cumulative, so the score rises with a business's

ability to master trends and with the breadth of its implementation of advanced supply chain capabilities and technologies.

PwC also supplemented this research with in-depth client case studies and interviews with executives from companies that are leading the way in particular aspects of the supply chain. Those results were used to create the company profiles included in this report.

Fig. 23 Maturity rating



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#### About us

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PwC Germany. More than 14,000 dedicated people at 20 locations. €2.93 billion in turnover. The leading auditing and consulting firm in Germany.

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