



Automotive supply chain

PURSUING LONG-TERM RESILIENCE

#GetTheFutureYouWant

Executive Summary

01

The nearshoring of automotive procurement adds resilience to the supply chain

According to our survey findings, the proportion of supply obtained from offshore locations has fallen by 22 percent over the past two years. This has contributed to an improvement in supply chain resilience, as evidenced by increased market confidence and a reduction in order backlogs. We expect this trend to accelerate, driven by regulatory and government policy, in particular that pertaining to the growing adoption of electric vehicles (EVs) and semiconductors.

02

While inventory building has boosted short-term resilience, it is not a feasible long-term strategy

Increases in inventory, funded by working capital, have been used by both OEMs and suppliers to inject resilience into the supply chain. Higher stock levels mean that manufacturing can continue without disruption, even if supply is interrupted.

However, suppliers are bearing most of the financial burden of such a short-term strategy, usually paying higher rates of interest than OEMs do, making it non-viable in the long term.

03

Sustainability efforts are faltering as automotive organizations fire-fight supply chain crises

Successive supply chain crises have sapped automakers' time and diverted focus and money away from sustainability initiatives. This is particularly true of suppliers, whose sustainability investments have dropped significantly (in

22%

the proportion of supply obtained from offshore locations has fallen by 22 percent over the past two years

Executive Summary

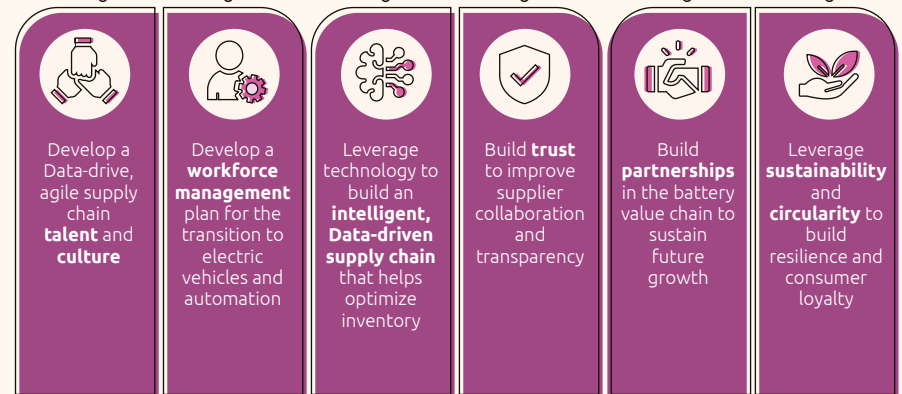
contrast, OEMs' investments have increased slightly). One in three automotive companies still lacks a comprehensive sustainability strategy, with many existing initiatives put on hold. A shortage of suppliers of recycled materials (and of the materials themselves) has delayed scaling of circular-economy initiatives.

04

A lack of trust, transparency, and data-driven intelligence is hampering supply chain management

OEMs and suppliers often seem locked into a vicious circle, in which lack of transparency feeds mutual mistrust and vice versa. Suppliers mistrust OEMs' manufacturing requirements data (largely owing to a perception that OEMs overorder), while OEMs lack confidence in suppliers' self-reported sustainability data. This general lack of transparency hampers business-critical activities such as risk management and sustainability initiatives, as well as exacerbating challenges in procurement and replenishment. Underlying all this is the lack of a mature data-driven intelligent supply chain.

HOW CAN SUPPLY CHAINS BE A SOURCE OF COMPETITIVE ADVANTAGE TO THE AUTOMOTIVE INDUSTRY?

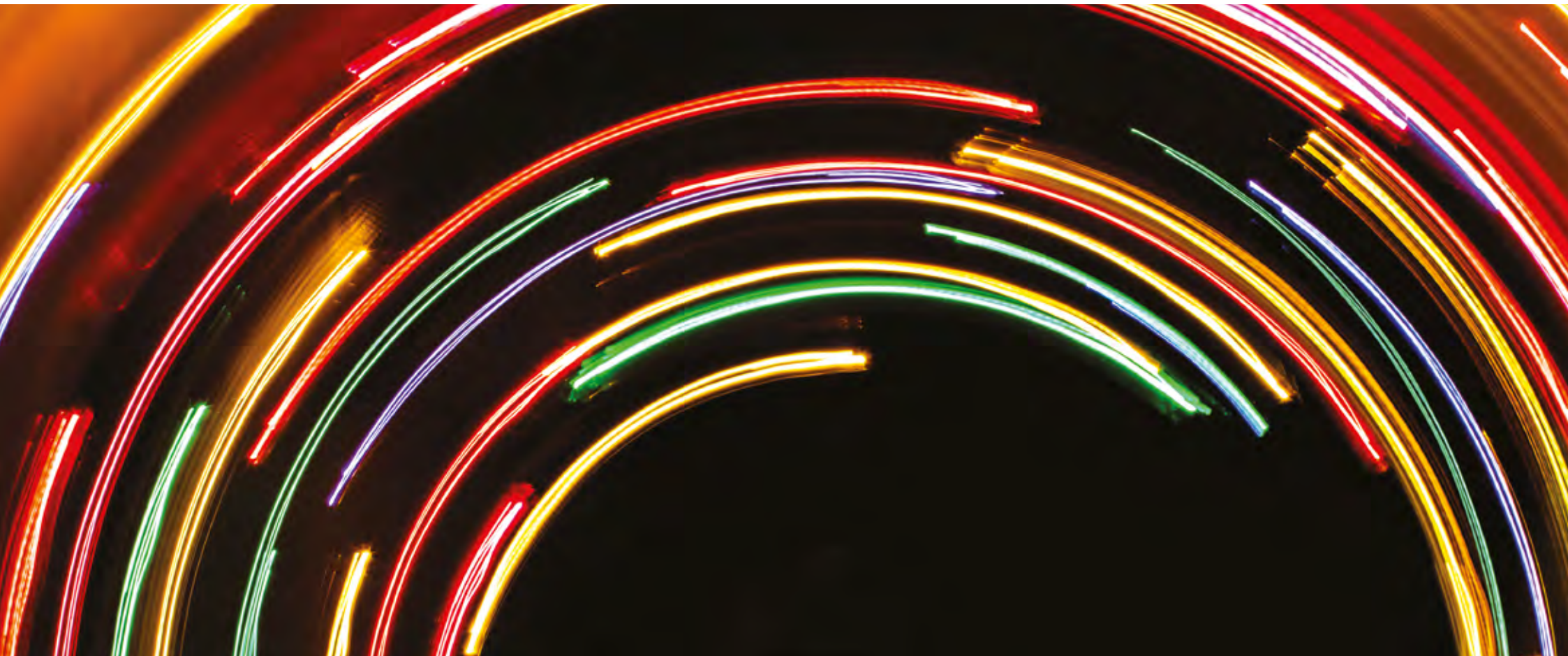




Who should read this report and why?

This report intends to offer actionable recommendations for automotive executives to assist them in creating resilient, connected, intelligent, and sustainable supply chains. It primarily caters to automotive supply chain leaders across supply chain strategy, inbound/outbound logistics, sourcing & procurement, IT, demand planning, sales and operations planning, and finance, among other supply chain functions. Given the importance of supply chains for automotive business, this report is also useful to automotive business leaders from general management, strategy, product, manufacturing, and sustainability executives for their supply chain initiatives.

This report is based on the findings of a comprehensive industry survey of 1,004 senior executives (director level and above) from leading global automotive organizations. These organizations are automotive OEMs with annual revenue above \$1 billion and automotive suppliers with annual revenue above \$500 million. Approximately 70% of surveyed executives belonged to supply chain functions, while the remaining 30% came from other relevant business functions. See Research Methodology at the end of the report for more details.



Introduction

When “just in time” is too late

Recent disruption to the global automotive supply chain has called into question the industry’s conventional wisdom, including the viability of the just-in-time (JIT) methodology. Originated by Toyota, JIT has long been a cornerstone of automotive supply chain philosophy, owing to the benefits it brings of reduced waste, lower warehousing costs, and the potential to free up working capital.

However, the volatile business landscape has also revealed the downside of JIT; for many organizations, the transition to an alternative approach is already underway. As James Rowan, CEO, President, and Director of Volvo Cars confirms:

“Supply chain architecture, in general, is changing. This just-in-time process that we’ve enjoyed for decades now, when there was frictionless trade across the world, that time has gone, and people are now rearchitecting the supply chain to make it more resilient.”

We see the solution as being in building a **resilient, connected, intelligent, and sustainable supply chain** – one that can adapt to the procurement of scarce resources, such as minerals for batteries and semiconductors. Given the industry’s growing complexity, however, this transformation is challenging. The automotive supply chain can span multiple regions and countries, rendering it vulnerable to global disruptions such as natural disasters, political instability, and trade disputes.

Introduction

Sustainability and the circular economy will be key components of the supply chain of the future. On its current trajectory, automotive is set to overshoot its carbon budget to meet the Paris Agreement by at least 75 percent.² This is likely to lead to increased regulatory pressure to adhere to sustainability.

This report is intended to guide automotive companies through the process of supply chain transformation. Drawing on the latest research, it explores the challenges of supply chain management in today's automotive industry and suggests strategies for building the supply chain of tomorrow.



“One of our primary strategies for our supply chain is to become more customer-centric. Another is ensuring that our processes remain agile. A big portion of our performance is going to be focused on the capability, skills, and competencies of the future for our people.”

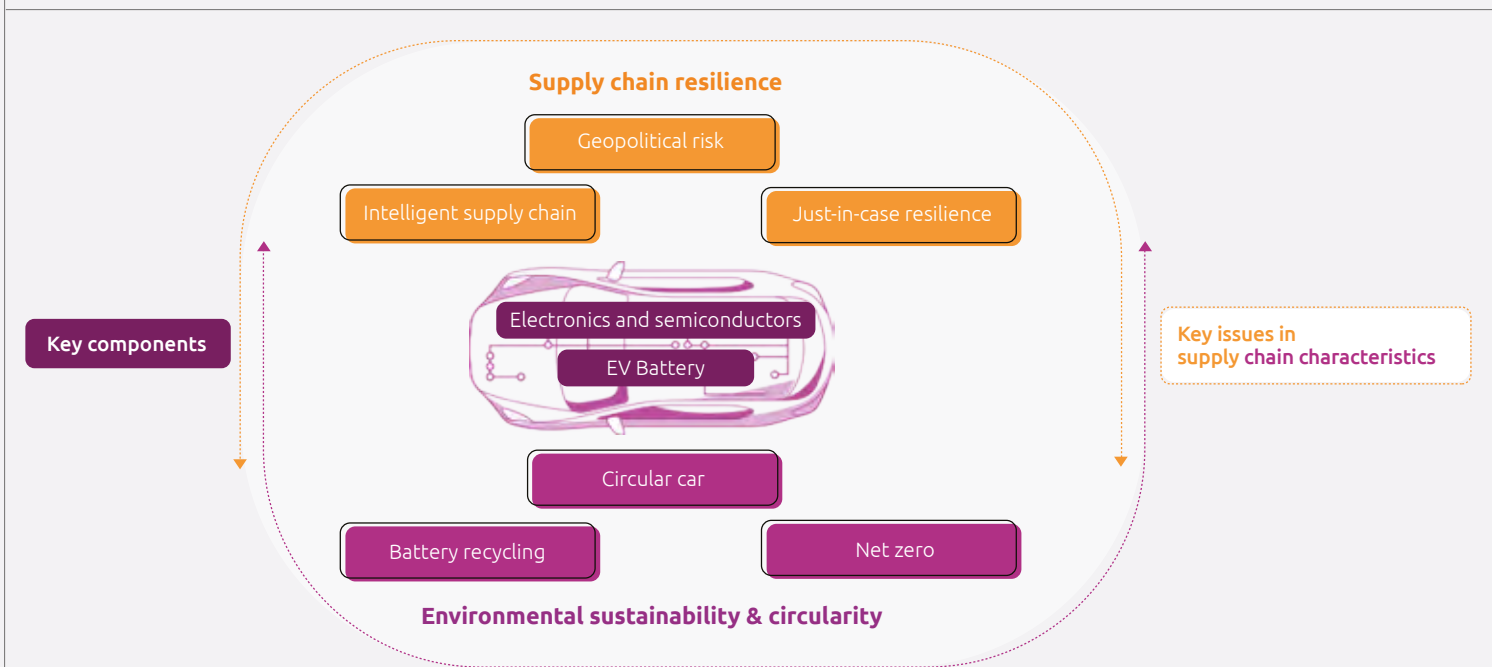
GEORGE KURIAN

Vice President Supply Chain and Logistics, Michelin

Introduction

FIGURE. 1

Key areas of focus for this research



Introduction

About our research

In June and July 2023, we conducted a survey of 1,004 industry leaders (director level and above) from 449 automotive original equipment manufacturers (OEMs) and suppliers across 10 countries (see Research Methodology). We also held in-depth interviews with 24 senior executives from market-leading automotive firms.

This report offers insights and recommendations supported by the findings of this research.

75%

the amount of overshoot the automotive industry is currently projected to make on its carbon budget to meet the Paris Agreement





01

NEARSHORING INJECTS RESILIENCE INTO SUPPLY CHAIN

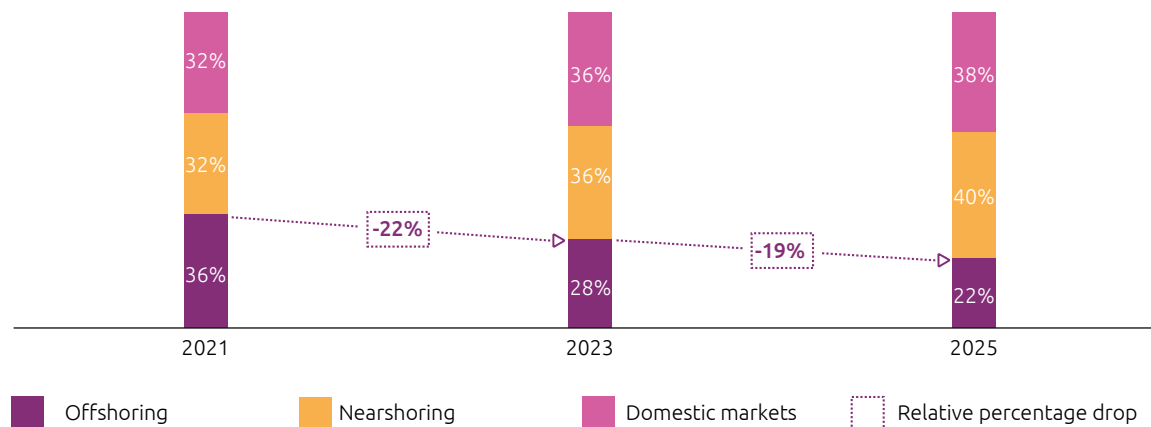
Value procured from offshore locations has fallen by 22 percent in the past two years

The automotive supply chain is currently undergoing deglobalization. Procurement from offshore locations has dropped by 8 percentage points in absolute terms since 2021. This is equivalent to a 22-percent drop in the proportion (by value) of procurement that relates to offshore locations. We expect a further decline of 19 percent over the next two years. This nearshoring fortifies supply chain resilience, as explained by a general manager at a European OEM: *"Nearshoring is a strategic goal for us. In view of political pressures and raw-material availability, at least 75 percent of the supply chain needs to be nearshored or moved to domestic markets in the long run."*⁴⁵

FIGURE. 2

Procurement from offshore locations has fallen by 22 percent over the past two years

DISTRIBUTION OF PROCUREMENT LOCATION, IN TERMS OF DOLLAR VALUE



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 592 respondents, primarily from the supply chain function.

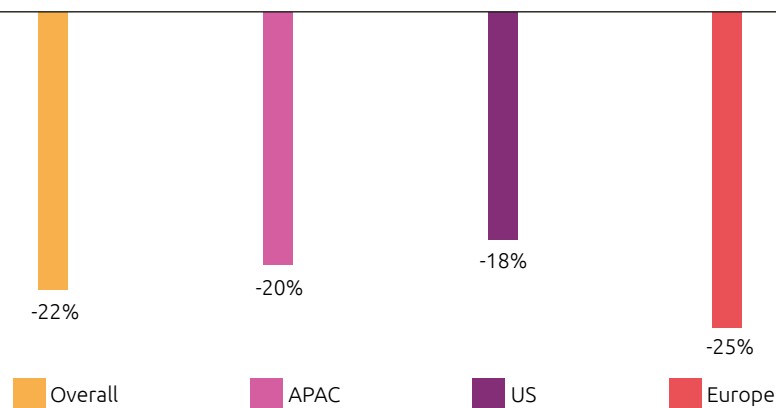
Note: **Procurement from nearshoring:** This involves a business relocating procurement to a geographically nearer country to that currently used. For example, for an organization with final consumers in Western Europe, nearshoring could mean procuring from Eastern Europe, rather than Asia, for example.

Europe has led this nearshoring trend, with a 25-percent reduction in offshore procurement in terms of dollar value, followed by Asia-Pacific and the US. This closely corroborates our perception of a shift across industries. According to the US Census Bureau, Chinese imports to the US fell by 24 percent through May 2023, while Mexico is now the US's leading trade partner.⁵ This shift can also be seen in automotive procurement from Mexico,⁶ which helped the country to attract foreign direct investment (FDI) worth \$2 billion in October 2022 alone.⁷ Mexico's Ministry of Economy stated that automotive part manufacturers were among the largest foreign investors in the country in 2022.

FIGURE. 3

Europe has reduced procurement from offshore locations by 25 percent, a greater reduction than other regions

PERCENTAGE REDUCTION OF OFFSHORING PROCUREMENT (IN DOLLAR VALUE), 2023 COMPARED TO 2021



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 592 respondents primarily from the supply chain function.

To shorten the automotive supply chain and create employment opportunities, the Japanese government has created a \$2.2 billion assistance package to facilitate Japanese manufacturers in moving production from China back to Japan.⁸

India has a similar initiative with its Production Linked Incentive (PLI) program, which has resulted in Bosch implementing its “Local for Local” strategy to increase its localization footprint, with an emphasis on electric powertrains.⁹

Federico Baiocco, Head of Global Supply Chain and S&OP, Iveco Group, adds: *“We are multi-sourcing our supply chain to build back-up solutions for disruptions. There are two targets: the availability of materials and avoiding dependency on one single supplier during a crisis.”*¹⁰

25%

the magnitude of reduction
of European procurement from
offshore locations



Several factors contribute to this sharp decline in offshoring

We see addressing regulations, improving transparency, and increasing reliability as the principal drivers of the nearshoring of procurement and supply chains (see Figure 4). Other reasons are the need to improve sustainability metrics and to increase circularity.

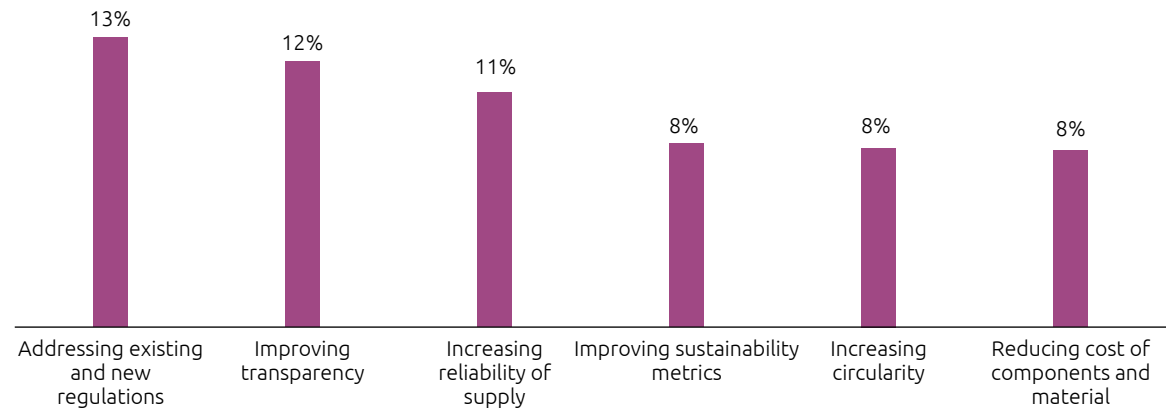
19%

The magnitude of reduction of procurement from offshore locations, expected over the next two years.

FIGURE. 4

Regulatory concerns, transparency, and reliability are the top drivers of nearshoring

PERCENTAGE OF RESPONDENTS WHO HAVE RANKED THE FOLLOWING AS THE TOP THREE REASONS FOR ADOPTING MORE LOCALIZATION



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 435 respondents primarily from the supply chain function.

Regulatory policy incentivizes reshoring while adding compliance costs

The contrast between new and existing regulations highlights the significance of government influence in supply chain decisions – specifically in terms of organizations implementing “de-risking” strategies.¹¹ For example:

- The United States-Mexico-Canada Agreement (USMCA)¹² states that, to be sold tariff-free, at least 75 percent of a vehicle’s components should be manufactured in North America. This has resulted in North American automotive organizations localizing, as explained by Ola Källenius, Chairman of the Management Board and CEO of Mercedes-Benz Group: *“By the middle of this decade, we will have Americanized (or, rather, ‘North-Americanized’) our supply chain for battery cells in the US. We have already sat down with each player and looked at where the raw materials are going to come from, where the refining capacity is, and so on.”*¹³
- The US Inflation Reduction Act (IRA) 2022¹⁴ provides tax credits for vehicles that source battery materials in North America to encourage onshore investment. For example, General Motors is investing \$50 million in Texas-based lithium technology start-up EnergyX as it expands into the mining sector.¹⁵

- The Indian government is supporting the country’s automotive industry in reshoring its supply chain to increase global competitiveness and reduce dependence on imports; it is also encouraging the semiconductor ecosystem in this respect via its Production Linked Incentive (PLI) program.¹⁶

Apart from these incentive-based regulations, new compliance-based and sustainability-oriented regulations will increase the cost of operating supply chains in lightly regulated countries that lack transparency and traceability:

- The EU’s Corporate Sustainability Due Diligence Directive (CSDDD) obliges organizations to carry out due diligence regarding human rights and environmental responsibility, right along the supply chain.¹⁷
- The EU’s new Circular Economy Action Plan for the automotive industry proposes that, in order to support the EU’s environmental and climate goals, automotive manufacturers will have to develop circular supply chains using recycled materials.¹⁸ Such circular-economy initiatives require reverse logistics, which globalized supply chains cannot readily support.
- The US’s Uyghur Forced Labor Prevention Act (UFLPA) dictates that goods mined, produced, or manufactured wholly or in part in Xinjiang or by an entity on the UFLPA



“We are multi-sourcing our supply chain to build back-up solutions for disruptions. There are two targets: the availability of materials and avoiding dependency on one single supplier during a crisis.”

FEDERICO BAIOTTO

Head of Global Supply Chain and S&OP, Iveco Group

Entity List are prohibited from being imported into the US. However, current automotive procurement generally lacks the level of transparency and traceability required to comply with this law.¹⁹

The due diligence required to comply with regulations of this type increases the overall compliance cost of procuring from offshore locations. Such regulation, therefore, encourages nearshoring or using domestic suppliers.

A shift to EVs and reshoring of semiconductors will accelerate nearshoring

The creation of new supply chains for electric vehicles (EVs) will lead to increased reshoring of sourcing and procurement. Nearly three out of five OEMs state that investment in battery and EV supply chains is primarily governed by regulation, political mandates, and geopolitical concerns, all of which are likely to accelerate reshoring. This acceleration is

best explained by Marc-Oliver Nandy, Director Global Supply Chain at Mercedes-Benz: *“The industry cannot nearshore overnight because companies already have an established supply base. However, they can make different sourcing and footprint decisions for the new products they plan to launch. That is why I expect the rate of nearshoring to increase in the coming years.”*²⁰



70%

of our survey respondents that they currently obtain a majority of semiconductors from China, Taiwan, Japan, and Korea



“The industry cannot nearshore overnight because companies already have an established supply base. However, they can make different sourcing and footprint decisions for the new products they plan to launch. That is why I expect the rate of nearshoring to increase in the coming years.”

MARC-OLIVER NANDY

Director Global Supply Chain
at Mercedes-Benz

Regulations such as the European Chips Act²¹ (ECA) and the US's CHIPS and Science Act²² aim to encourage localized semiconductor production in order to enhance supply chain resilience for national security reasons. These laws address the concentration of semiconductor supplies in China, Taiwan, Japan, and Korea, where 70 percent of our survey respondents currently obtain most of their semiconductors. The ECA is intended to double Europe's share of the semiconductor market from 10 to 20 percent by 2030. Companies are already responding to these laws. For example:

- German supplier Bosch has invested \$1.2 billion to set up a semiconductor and sensor factory in Germany.²³
- TSMC, a Taiwanese chip manufacturer, has also announced it will build two semiconductor production plants in Arizona, USA, by 2024, with an investment of about \$40 billion.²⁴
- Intel is investing €30 billion (US\$33 billion) in a chip manufacturing site in Germany as part of its expansion in Europe.²⁵

Semiconductor investments also take some time to reach full capacity and yields.

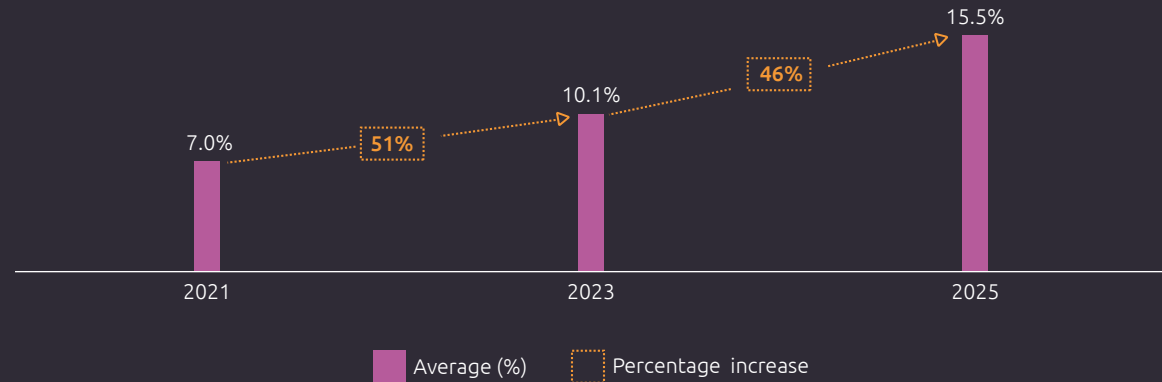
HOW HAVE AUTOMOTIVE SUPPLY CHAINS RESPONDED TO THE SEMICONDUCTOR SHORTAGE?

Semiconductor shortages were among the top two disruptive events in 2022 as cited by our survey respondents. This along with the increased adoption of advanced driver-assistance systems (ADAS) and autonomous driving as well as the move to “software-defined vehicles” will further increase this demand. Between 2021 and 2023, the average proportion of vehicle value attributed to semiconductors and sensors increased by 51 percent and is expected to increase by a further 46 percent between 2023 and 2025 (see Figure 5). Doug Parks, Executive Vice President of Global Product Development, Purchasing and Supply Chain at General Motors affirms this prediction: *“We see our semiconductor requirements more than doubling over the next several years as vehicles become technology platforms.”*²⁶

FIGURE 5

The average proportion of vehicle cost attributed to semiconductors and sensors has increased by more than half between 2021 and 2023

PERCENTAGE VALUE (IN TERMS OF OVERALL COST OF A VEHICLE) THAT IS ATTRIBUTED TO SEMICONDUCTORS AND SENSORS



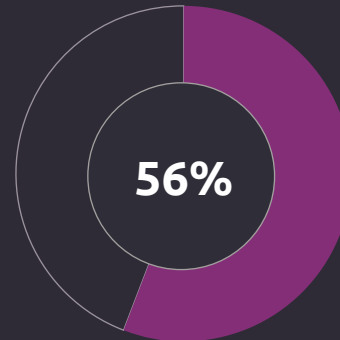
Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 132 OEM respondents primarily from product and manufacturing functions.

Eric Moreau, Vice President, Global Supply Chain and Industrial Strategy at Forvia Electronics comments: *“The demand for semiconductors is growing exponentially; today’s vehicles already use many more semiconductors than those made a few years back. We have a different strategy for the new generation of semiconductors, backed by significant investments.”*¹²⁷

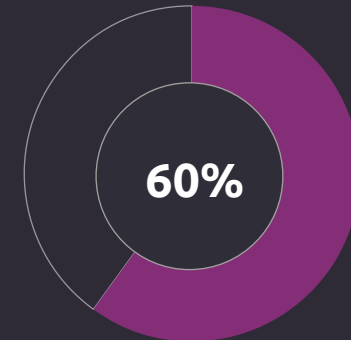
At present, 50 percent of the current supply of semiconductor components is still not considered sufficiently secure, with full stack computing platforms and microcontrollers being the least secure according to our survey. Figure 6 indicates take-up of the two strategies OEMs are adopting to achieve security: investing in semiconductor capacity and bringing software development in house.

FIGURE. 6

OEMs are moving away from tier-1 and -2 suppliers to achieve greater security of semiconductor supplies



Investing in secure semiconductor supply capacity as an alternative to traditional tier 1 and 2 suppliers



Bringing software development traditionally undertaken by tier-1 suppliers in house

Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 528 OEM respondents primarily from supply chain, general management, product, and manufacturing functions.

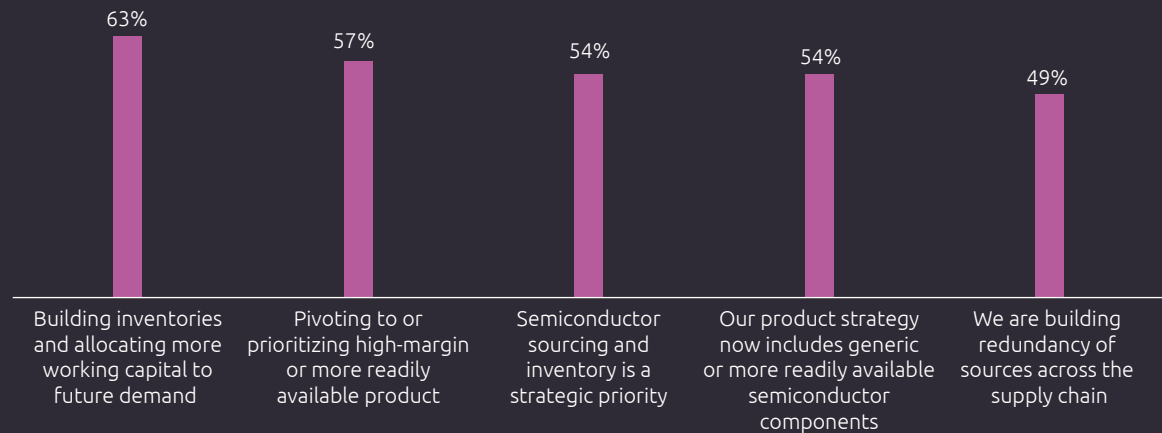
One of the most common strategies for addressing the issue, as mentioned by 63 percent of respondents, is allocating more working capital to increasing inventories of semiconductors (see Figure 7).



FIGURE 7

Building inventories is the most popular way to address semiconductor supply issues

PERCENTAGE OF OEM RESPONDENTS BY STRATEGIC APPROACH TO INCREASING SEMICONDUCTOR DEMAND



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 528 OEM respondents primarily from supply chain, general management, product, and manufacturing functions.



Despite the general emphasis on inventory, leading OEMs are developing more comprehensive semiconductor strategies. For example, Stellantis's Dare Forward 2030 plan involves securing long-term contracts worth €10 billion through 2030,²⁸ together with:

- 01** Full transparency on semiconductor content.

- 02** A systematic risk assessment to reduce legacy parts.

- 03** Long-term chip demand forecasting.

- 04** A green list to reduce chip diversity while controlling the long-term security of chip supply.

Product-based semiconductor strategies, such as generic substitutes and singular modular computation platforms, are the least scaled as they are dependent on the transition to a central computing architecture. This transformation of E/E (electronic/electrical) systems can reduce cost and improve generic supply and product design, but has yet to be fully implemented. Nevertheless, its effectiveness was the key reason Tesla was able to avoid most of the semiconductor shortage problems experienced by its peers.²⁹ Our research on automotive software covers this in depth.³⁰

Partly owing to the trend of reshoring, supply chain resilience has improved

There is evidence that automotive organizations have increased resilience across their supply chains. On average, our respondents believe that they would be able to avoid 60 percent of the revenue loss that occurred in 2022 if the same scenarios recurred today (Figure 8 shows a breakdown of the responses). Part of this confidence undoubtedly stems from new procurement strategies, such as nearshoring.

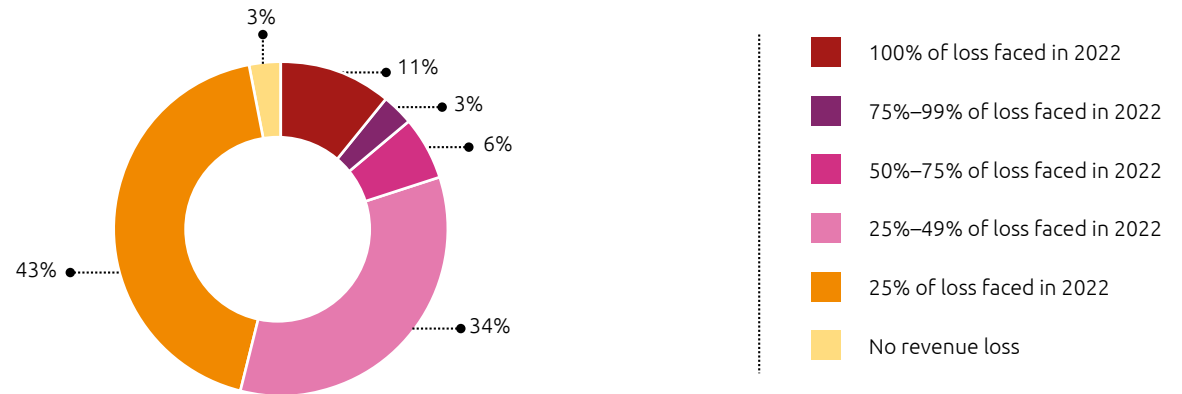
60%

the average amount of revenue loss saved by automotive organization, if the disruption of 2022 were to repeat again today

FIGURE. 8

If the disruptions of 2022 were repeated today, nearly half of automotive industry would see less than half the revenue loss

RESPONDENTS' INDICATION OF THE REVENUE LOSS THEY WOULD EXPERIENCE IF LAST YEAR'S SCENARIO WERE TO REPEAT



Source: Capgemini Research Institute, Automotive supply chain survey, June–July 2023; N = 863 respondents who faced revenue loss in 2022. Note: We reached a 60 percent average by using a midpoint average method.

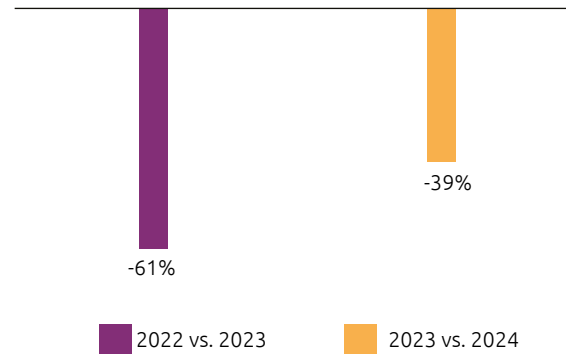
Automakers' improved confidence in their supply chains' resilience is supported by a 61-percent reduction in order backlogs, with further improvements expected (see Figure 9). Reasons for this reduction include reshoring, logistical improvements, and the removal of some bottlenecks – as well as increased inventory levels, a topic to which we turn to in the next section



FIGURE. 9

Improving supply chain resilience and working environment has contributed to a reduction in order backlogs

PERCENTAGE REDUCTION OF ORDER BACKLOG



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 843 respondents primarily from supply chain, general management, product, finance, and manufacturing functions.

Most organizations (especially OEMs) are now better prepared for long delivery lead times, and have built enough inventory to reduce their order backlogs substantially. Suppliers, in contrast, are still feeling the backlash. Our data supports this hypothesis: OEMs report a 70% reduction in order backlog, compared to a reduction of only 33% for suppliers.

61%

the amount of reduction of order backlog in 2023 compared to 2022



02

**BOOSTING INVENTORY:
ONLY A SHORT-TERM
SOLUTION**

Faced with sourcing and logistical challenges, the automotive industry has relied on additional working capital and inventory

Difficulties in sourcing parts are the most common cause of backlogs, with three in five respondents (61 percent) mentioning this issue. For two in five respondents (39 percent), inbound logistics was one of the top three disruptions in 2022; 16 percent of respondents named outbound logistics. As Masakazu Yoshimura, MD and CEO of Toyota Kirloskar Motor, which is joint venture between Toyota Motor Corporation and Kirloskar Group for manufacturing and selling of Toyota cars in India, explains: *“There is the semiconductor issue, logistics congestion, and content shortages. All these combined affect [the delivery time of vehicles]. No one could have predicted that kind of situation after COVID-19 ... There are shortages of gantry cranes at all major ports in the global logistics chain, and that is affecting the supply of components, regardless of whether it is semiconductors or normal components.”*³¹

“Increasing the total buffer inventory for critical parts as well as cars – including potentially tier 2 like components - by using working capital is a tactic used by OEMs to be more resilient in case a supplier misses a delivery. It does increase resilience but if used just by itself, it’s not a very scalable solution.”

HENRI-XAVIER BENOIST

SVP of Supply Chain
at Stellantis

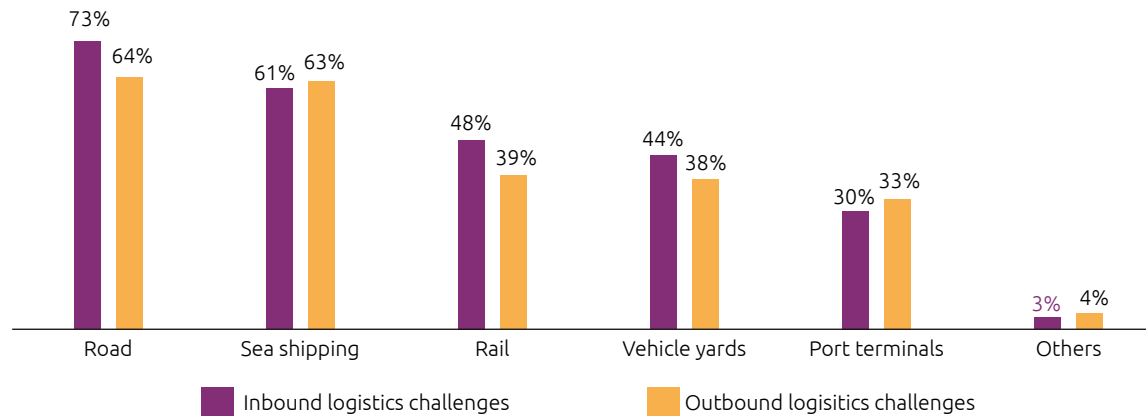
For the majority of companies, roads and sea shipping are the biggest factors in both inbound and outbound logistical challenges, although railways, vehicle yards, and port terminals are also significant issues (see Figure 10).



FIGURE. 10

Roads and shipping are the main drivers of the logistics challenge

PERCENTAGE OF RESPONDENTS THAT FACED LOGISITICS CHALLENGES IN THE FOLLOWING TRANSPORATION OR LOGISTICS MODES



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 578 respondents who faced inbound logistical challenges and N = 411 respondents who faced outbound logistical challenges.

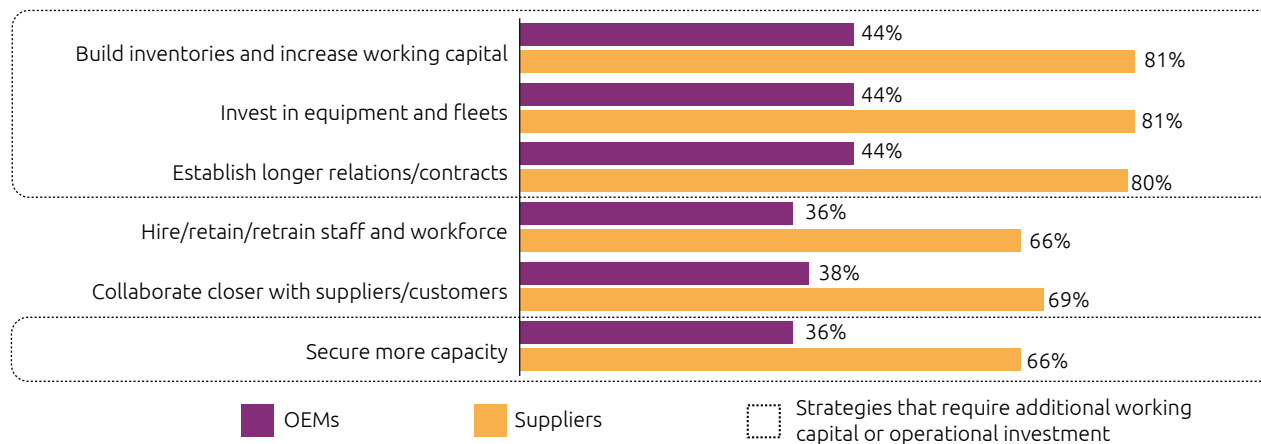
In Europe, 52 percent of organizations state that outbound logistics is a key challenge in fulfilling order backlogs, and 70 percent say the same for inbound logistics. Richard Palmer, outgoing CFO of Stellantis, comments: *“In Europe, the real issue continues to be outbound logistics – that’s still top of the list of our things to resolve.”*³²

To address this crisis, automotive OEMs and suppliers have been investing in equipment and fleets, trying to establish more long-term relationships and contracts, and building up inventories (see Figure 11). For some organizations, increasing inventory is a necessity in the short term, even though it involves tying up working capital. As a CEO of an OEM parts logistics organization explains: *“Strategic stocks are being increased by employing working capital. As transportation costs are high, increased stock and storage are a better alternative.”*³³

FIGURE. 11

Four of the top six strategies to address logistics challenges are based on operational investment and increasing working capital

PERCENTAGE OF EXECUTIVES ADOPTING THE FOLLOWING STRATEGIES TO MITIGATE LOGISTICS CHALLENGES



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 843 respondents primarily from supply chain, general management, product, finance, and manufacturing functions.

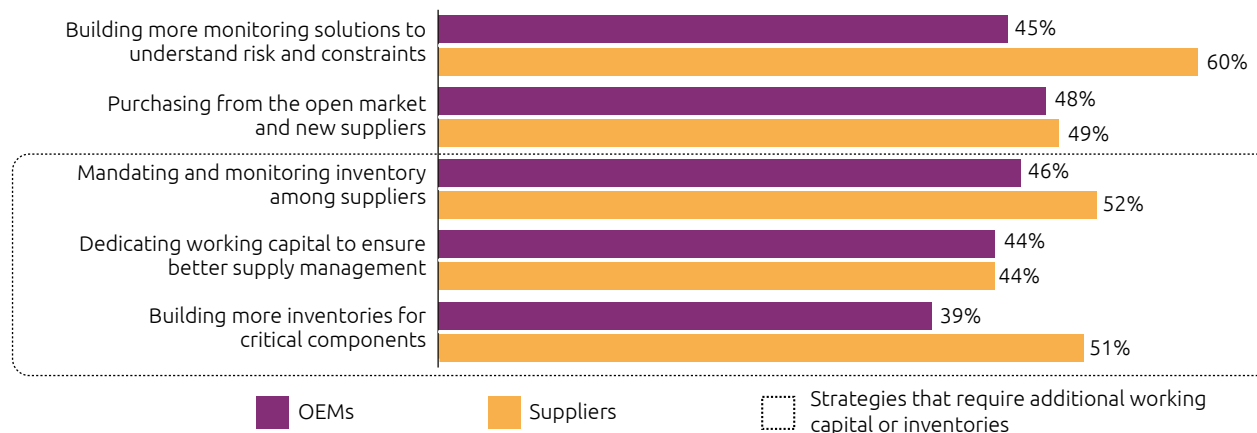
Building inventory is a short-term solution

Automotive organizations have been over-reliant on increasing their inventories to ride out the volatility of the past few years. They are now taking longer-term measures to rectify this reliance: three out of five suppliers, and a little less than half of OEM respondents, are working on monitoring-based solutions to increase their understanding of the risk and constraints to which their organizations are subject. Many, too, are venturing out into the open market to purchase from new suppliers. Nevertheless, strategies that require the deployment of additional working capital remain commonplace.

FIGURE. 12

Three of the top five short-term crisis-management strategies require additional working capital

PERCENTAGE OF EXECUTIVES ADOPTING THE FOLLOWING SHORT-TERM STRATEGIES TO IMPROVE RESILIENCE



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 1,004 respondents.

13%

the Weighted Average Cost of Capital (WACC) paid by automotive suppliers today

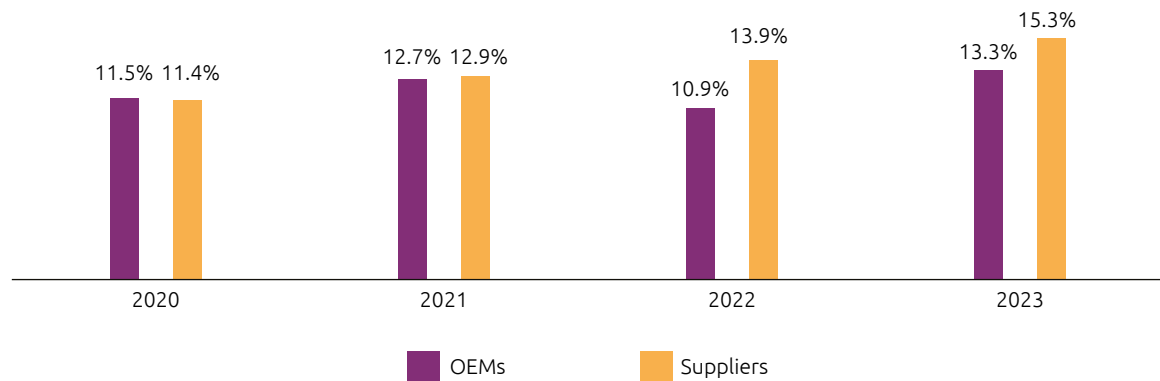
It is noticeable that suppliers are adopting most of these short-term strategies in greater numbers than are OEMs, putting the former under additional financial strain.

Published financial data suggests that these increases in inventory are part of a global trend (see Figure 13). However, in 2022, OEMs' inventories decreased, as the redundant stock was used to keep production going while the OEMs dealt with sourcing and logistics issues. Henri-Xavier Benoist, SVP of Supply Chain at Stellantis, explains: *"Increasing the total buffer inventory for critical parts as well as cars – including potentially tier 2 like components - by using working capital is a tactic used by OEMs to be more resilient in case a supplier misses a delivery. It does increase resilience but if used just by itself, it's not a very scalable solution."*³⁴

FIGURE. 13

Suppliers' inventory turnover is growing faster than that of their OEM counterparts

INVENTORY TURN/SALES, OEMS VS. SUPPLIERS



Source: New York University – Stern, financial datasets created and maintained by Prof. Aswath Damodaran, July 2023.



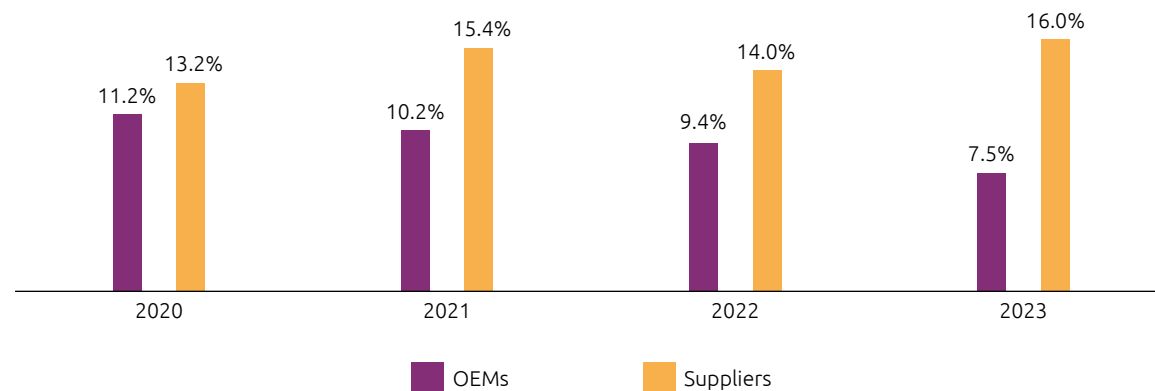
OEMs have been able to reduce their working capital requirements, maintaining a lean business model, while their supply chains have been drawing considerably on working capital. As Katja Dürrfeld, CFO at Continental, explains: *“The main driver for the decrease of the operating cashflow from €2.5 billion to €2.3 billion was strong working capital headwinds from high accounts receivables, as a result of delayed cash inflows from our customers at the end of this year. Inventories continue to stay at a high level owing to a combination of securing the supply chain and higher prices per unit.”*³⁵



FIGURE. 14

Suppliers are increasing working capital while OEMs are cutting down

WORKING CAPITAL/SALES, OEMS VS. SUPPLIERS



Source: New York University – Stern, Financial datasets created and maintained by Prof. Aswath Damodaran, July 2023.

Reliance on working capital is a risky strategy

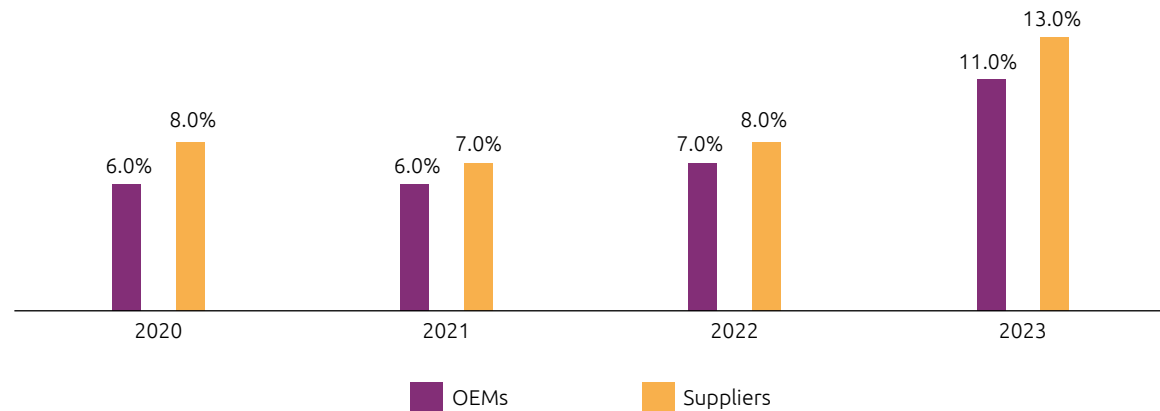
With the cost of capital escalating, increasing deployment of working capital is damaging the financial health of automotive organizations. The decision by the Federal Reserve (the Fed, the US's central bank) to increase interest rates to their highest level in 22 years, a common tactic worldwide, only reinforces this.³⁶ Costs are especially high for suppliers, who are three percentage points less profitable than their OEM counterparts and hence riskier³⁷ (see Figure 15). However, as seen above, it is mainly suppliers who are obliged to adopt strategies based on working capital to address volatility.

Brooke Kaltz, director of corporate procurement at The Shyft Group, which is an American automobile design company, says: *“Coming out of COVID-19, companies that survived the financial crunch got some relief due to pent-up demand. However, since last year the high cost of capital and borrowing money has impacted supplier stability and intensified their exposure to financial risk.”*³⁸

FIGURE. 15

Suppliers pay more than their OEM counterparts for working capital

COST OF CAPITAL/SALES (WACC), OEMS VS. SUPPLIERS



Source: New York University – Stern, financial datasets created and maintained by Prof. Aswath Damodaran, July 2023.

Holding excessive inventory risks a variety of negative effects on the operational and financial well-being of automotive organizations. These include product obsolescence, the costs of warehousing and insurance, the opportunity cost of tying up funds, and the high interest associated with raising additional funds, for suppliers in particular. Clearly, the automotive industry urgently needs to reduce its reliance on high inventory levels and find ways of achieving true, long-term resilience in its supply chain at less extreme cost.

Long-term supply chain resilience will be linked to sustainability

As governments come under growing pressure to meet the goals of the Paris Agreement, regulation will play a significant role in ensuring the economic viability of automotive supply chains. On the basis of its current trajectory, the industry looks set to overshoot its carbon budget by at least 75 percent.³⁹ Tighter regulation is to be expected, and non-compliance could lead to supply chain interruptions.

Organizations that prioritize sustainability in their business operations – and across their supply chains – will be

better positioned to comply with emerging regulations. Sustainability initiatives such as seeking to harness renewable power can also address energy-price volatility - named by nearly half of our respondents as one of the top three disruptive events in 2022.

Another area of concern for the long-term resilience of the automotive supply chain are the growing resource needs associated with EVs. The International Energy Agency (IEA) states that clean energy's share of total demand for minerals will rise over the next two decades to over 40 percent in the case of copper and rare earth elements; 60-70 percent for nickel and cobalt; and almost 90 percent for lithium.⁴⁰ EV manufacturing will account for a significant proportion of that demand.

75%

the amount of overshoot, the automotive industry is currently projected to make on its carbon budget to meet the Paris Agreement



“Coming out of COVID-19, companies that survived the financial crunch got some relief due to pent-up demand. However, since last year the high cost of capital and borrowing money has impacted supplier stability and intensified their exposure to financial risk.”

BROOKE KALTZ

Director of corporate procurement
at The Shyft Group

40%

the rise in clean energy's share of total demand for minerals over the next two decades, in the case of copper and rare earth elements as per the International Energy Agency (IEA)

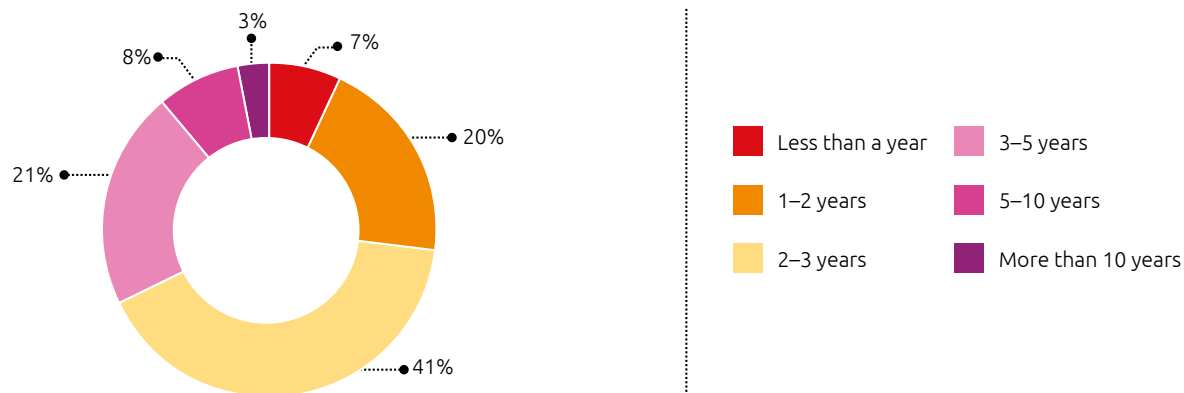
Currently, there is a significant gap between the demand and supply of lithium, a key raw material in battery production. Lithium demand for EVs increased from 8 kt in 2016 to 77 kt in 2022 and is expected to increase further, widening the gap.⁴¹

In order to meet the growing demand associated with EV batteries, lithium production needs to increase from 345,000 tonnes in 2020 to 2 million tonnes in 2030.⁴² Our survey also highlights this issue: OEMs, on average, have only secured three years' worth of battery raw materials (see Figure 16).

FIGURE. 16

On average, OEMs have secured only three years of battery raw materials

AVERAGE FUTURE SUPPLY OF BATTERY RAW MATERIALS SECURED



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 736 respondents primarily from supply chain, general management, product, manufacturing, and sustainability functions. Note: we reached a 3-year average by using a midpoint average method.

A considerable amount of investment is required to create new sources of battery raw materials – but, according to the IEA, new sources will bring sustainability challenges:

“Over 50 percent of today’s lithium and copper production is concentrated in areas with high water stress levels.”⁴³

Finding ways to satisfy mineral demand sustainably will be essential to long-term supply chain resilience.

Recycled EV batteries can meet demand for battery raw materials to some extent but, given the relatively young age of EV fleets and the existence of better second-life options for batteries, not completely. However, more generally, cross-industry circular supply chain provisions will also help. Regulations (such as those promulgated by the EU) on recycling batteries and sourcing compliance are likely to be extended to require battery raw material supply chains to be sustainable and circular.

The rise of battery reuse, recycling, and circular supply chains will improve resilience because fewer virgin raw materials will be needed, reducing exposure to supply chain disruptions and to volatile materials prices.

“Over 50 percent of today’s lithium and copper production is concentrated in areas with high water stress levels.”

-International Energy Agency (IEA)



03

SUSTAINABILITY EFFORTS ARE FALTERING AMID SUPPLY CHAIN CRISES

Sustainability is not a top factor in supply chain decision-making

As we have seen, companies have been struggling to address volatility and geopolitical concerns that threaten to disrupt production. Consequently, attention has been diverted away from supply chain sustainability: only 37 percent of respondents in our survey say their organization considers sustainability, carbon footprint, and environmental risk when making supply chain decisions (see Figure 17).

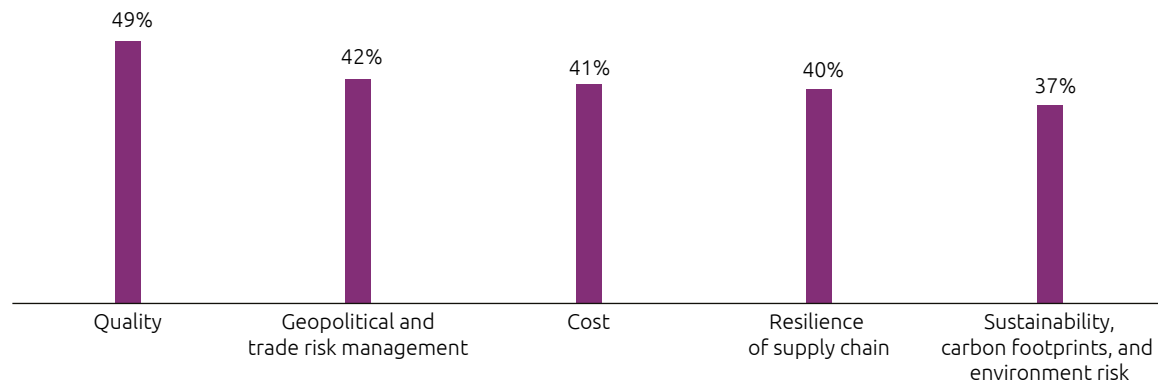
Only **37%**

of respondents in our survey say their organization considers sustainability, carbon footprint, and environmental risk when making supply chain decisions

FIGURE. 17

Sustainability ranks fifth out of 11 factors when making supply chain decisions

PERCENTAGE OF RESPONDENTS WHO MAKE SUPPLY CHAIN DECISION USING THE FOLLOWING FACTORS



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 1,004 respondents.

A few organizations are, however, embedding sustainability as a key element of their supply chain procurement strategies. For instance, Volkswagen is seeking to “improve [its] supply situation, increase product quality and boost innovativeness and sustainability.”⁴⁴

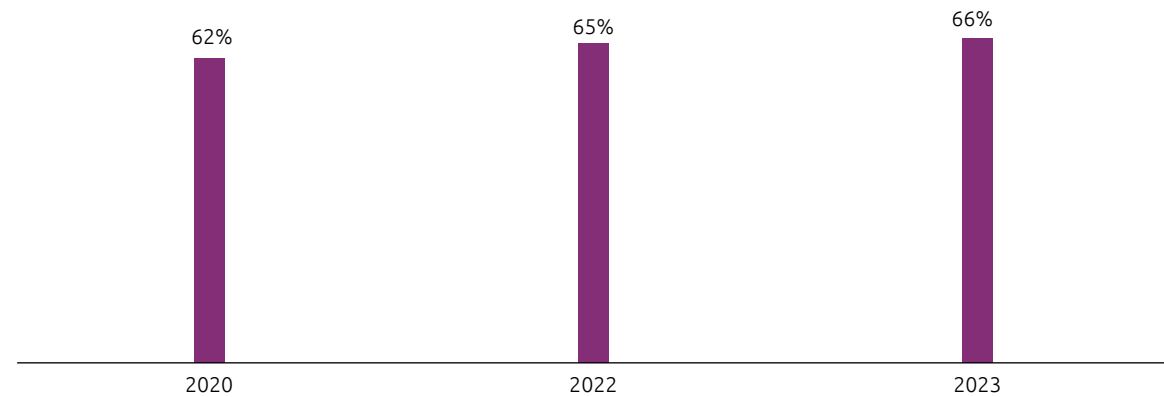
Sustainability strategies are stagnating

In recent years, the industry has shown little improvement with regard to sustainable supply chain strategy. In fact, one-third of our respondents say their companies still lack a comprehensive strategy (Figure 18), a worrying finding since, without such a strategy, they have little chance of meeting environmental goals.

FIGURE. 18

One in three respondents lacks a comprehensive sustainability strategy for their supply chain

PERCENTAGE OF RESPONDENTS WHO STATE THAT THEY HAVE A COMPREHENSIVE SUSTAINABILITY STRATEGY IN PLACE FOR THEIR SUPPLY CHAIN



Sources: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 196 respondents primarily from the sustainability, general management, and product management functions; Sustainability in Automotive Executive Survey, July-August 2022, N = 1,080 respondents; The Automotive Industry in the Era of Sustainability, Executive Survey, November-December 2019, N = 503 respondents.

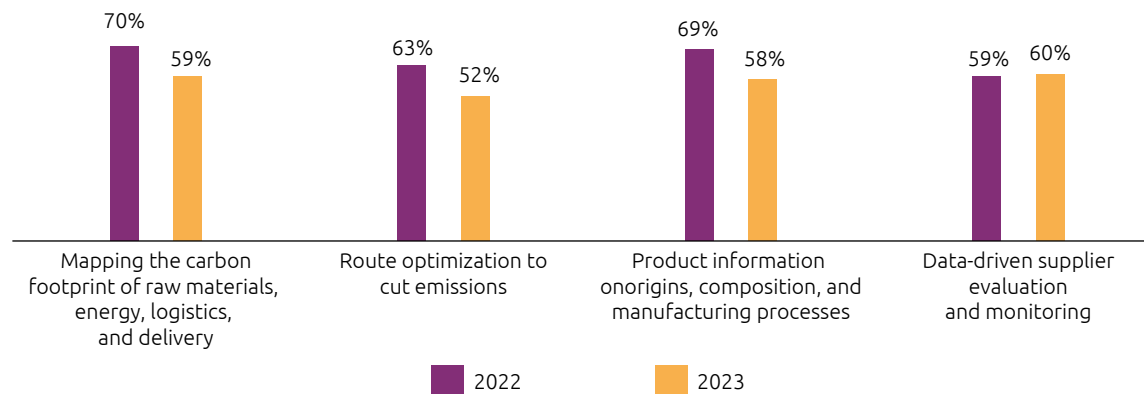


Compared to 2022, our respondents report a reduction in deployment of several types of sustainability initiatives (Figure 19), probably owing in part to changing logistics modes and supplier bases. The need to maintain continuity of operations will take priority over, for example, initiatives to measure carbon footprints, cut emissions through route optimization, or increase traceability.

FIGURE. 19

There is a noticeable decline in implementation of sustainability initiatives

PERCENTAGE OF RESPONDENTS WHO ARE FULLY OR PARTIALLY DEPLOYING THE FOLLOWING SUPPLY CHAIN SUSTAINABILITY INITIATIVES, 2023 VS. 2022



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 196 respondents primarily from the sustainability, general management, and product management functions; Intelligent Supply Chain Research, August-September 2022, N = 120 respondents primarily from the automotive industry.

Overall, the maturity of sustainability implementation is low. Currently, fewer than half of organizations have deployed such initiatives across some regions or product lines, while only 13 percent are actively scaling them globally (see Figure 20).

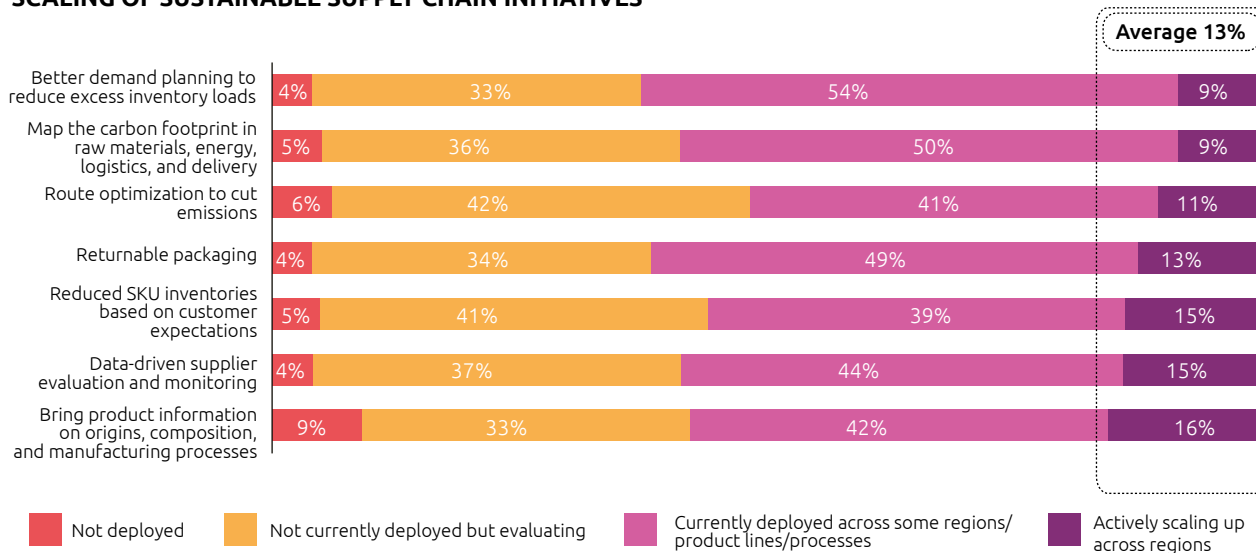
Only **13%**

of all sustainable supply chain initiatives have been scaled by organizations on average

FIGURE. 20

Sustainable supply chain initiatives have been scaled by only 13% of organizations on average.

SCALING OF SUSTAINABLE SUPPLY CHAIN INITIATIVES



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 196 respondents primarily from the sustainability, general management, and product management functions.

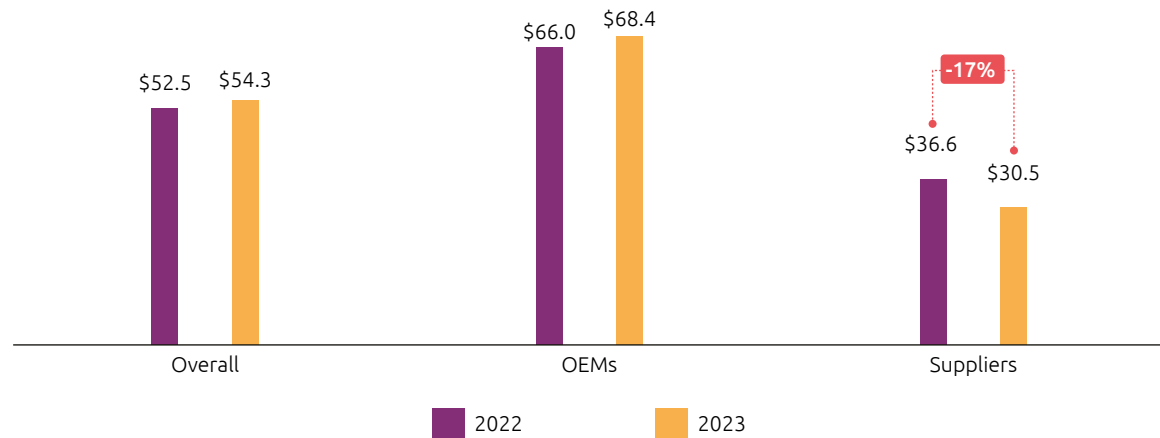
Sustainability investments are stagnating, with automotive suppliers showing a 17-percent year-on-year drop

Investment in supply chain sustainability has increased very slightly overall. This increase is mainly confined to OEMs; suppliers show a significant decline (see Figure 21). Suppliers have cut their sustainability budgets under the financial strain of utilizing working capital to increase inventory, and of undertaking operational investments to build resilient supply chains. Marc-Oliver Nandy, Director Global Supply Chain at Mercedes-Benz AG, explains: *“When the multi-crisis hit the industry, with COVID-19, the semiconductor crisis, and the Ukraine war, there were a lot of budget restrictions. And, as the industry navigated the supply chain crisis, regaining resilience was the focus topic. However, there is no way around green logistics in the long run.”*⁴⁵

FIGURE. 21

Automotive suppliers report a major reduction in sustainability investments

AVERAGE YEARLY INVESTMENTS FOR SUPPLY CHAIN SUSTAINABILITY (in USD millions)



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 635 respondents, primarily from the finance and supply chain functions; Sustainability in Automotive, Executive Survey, July-August 2022, N = 1,080 respondents.



Our research on investment trends shows that sustainability is frequently seen as a cost center, rather than a value center. It also shows fear of a downturn has exacerbated wariness of funding sustainability investments.⁴⁶

Circularity initiatives are encountering obstacles

In the context of an evolving economy, circular approaches can help to create resilient and sustainable supply chains that make optimal use of limited resources. In our research,

73 percent of companies reported higher rates of revenue growth after adopting sustainable design principles.⁴⁷ However, automotive organizations have experienced difficulty in implementing large-scale circular initiatives.

In our 2022 research on sustainability in the automotive industry, we found that, despite being among organizations' top priorities, circularity initiatives had failed to scale, achieving only 29 percent deployment. Furthermore, while 73 percent of executives agreed that participation in the circular economy is necessary to achieve long-term financial and competitive goals, only 53 percent followed a circular economy strategy.⁴⁸

73%

of companies reported higher rates of revenue growth after adopting sustainable design principles.

The alarming general lack of progress on circularity in the automotive supply chain is reflected in the low current levels of recycling: currently, the average proportion of recycled material that goes into a closed loop stands at just 19.5 percent. The percentage of recycled material (excluding batteries) used in final products has grown only marginally, from 12.7 percent in 2021 to 17.5 percent in 2023.

As these figures confirm, the automotive industry's recycling efforts are limited, and must be scaled to meet climate

goals and build a robust supply chain. Dominik Schedl, Supply Chain Manager at Indie Semiconductor - a US-based automotive semiconductor and software solution provider - points out that certain steps are easier for larger players:

"You can recycle up to 90 percent of battery materials, provided it is done on a large scale. Not everyone is in a position to recycle batteries the way you can on large manufacturing projects."⁴⁹

19.5%

the average proportion of recycled material that goes into a closed loop today.

29%

of organizations have scaled circular initiatives, despite being on top of their priority

73%

of executives agreed that participation in the circular economy is necessary to achieve long-term financial and competitive goals

53%

followed a circular economy strategy.

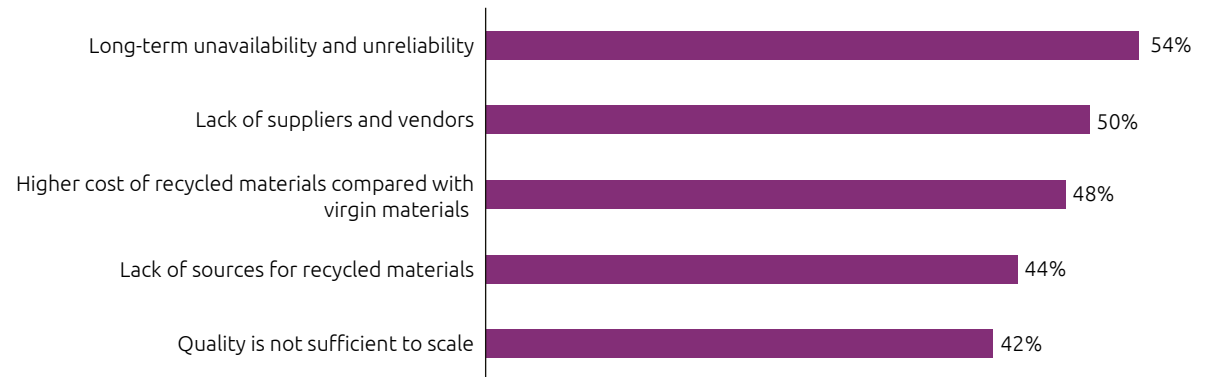


Our survey found a number of factors are limiting recycling, with lack of suppliers and reliable materials most often mentioned (see Figure 22). Wulf-Peter Schmidt, Director Sustainability, Advanced Regulation & Product Conformity, Europe at Ford, comments: *“Given the nature of the product, the automotive industry has high potential for recyclability and circularity. But all lifecycle stakeholders need to keep improving and innovating to have a stable and secure supply of high-quality recycled-content material that meets a given specification.”*⁵⁰

FIGURE. 22

Long-term unavailability and reliability of recyclable materials is limiting recycling

PERCENTAGE OF RESPONDENTS STATING THE FOLLOWING CHALLENGES IN USING RECYCLED MATERIALS



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 111 respondents primarily from manufacturing function.

A scarcity of vendors and long-term unavailability and unreliability of parts are hindering progress in putting materials back into the loop. Quality is also an issue. Maureen Kiline, Vice President, Public Affairs & Sustainability at Pirelli Tire North America, comments: *“At Pirelli, we include some recycled materials in our tires. There are a lot of companies working on carbon black recovered from tires but, unfortunately, the quality of the material is not nearly as good as virgin material.”*⁵¹

With regulation tightening in relation to climate risks, along with customer and investor pressures, the auto industry must resolve its sustainability issues. Stricter regulations, such as the Supply Chain Due Diligence Act in the EU and regulations for sustainable and circular battery supply chains,⁵² mean organizations will need to intensify their focus on circularity. They will also have to ensure that environmental and social standards are observed across their value chains.



“At Pirelli, we include some recycled materials in our tires. There are a lot of companies working on carbon black recovered from tires but, unfortunately, the quality of the material is not nearly as good as virgin material.”

MAUREEN KILINE

Vice President,
Public Affairs & Sustainability at
Pirelli Tire North America



04

**A LACK OF TRUST,
TRANSPARENCY, AND DATA-
DRIVEN INTELLIGENCE IS
HAMPERING SUPPLY CHAIN
MANAGEMENT**

Trust issues are preventing information sharing and risk monitoring

Since at least the mid-2000s, lack of trust between OEMs and suppliers has been a key issue.⁵³ Recent research in the US indicates that, from 2020 to 2022, only Honda and Nissan showed any improvement in supplier relations.⁵⁴ The general deterioration in relationships suggests that supply chain volatility and COVID-19 have eroded trust. The result is an environment that stymies information sharing and transparency:

- More than seven in ten (71 percent) of our survey respondents state that a lack of trust between OEMs and suppliers prevents sharing of information.
- Only 45 percent of our supplier respondents believe OEMs regard suppliers as equal partners. In China, only 25 percent of suppliers believe this.

71%

our survey respondents state that a lack of trust between OEMs and suppliers prevents sharing of information.

45%

of our supplier respondents believe OEMs regard suppliers as equal partners.



Less than half of suppliers trust OEMs' manufacturing capacity requirement data

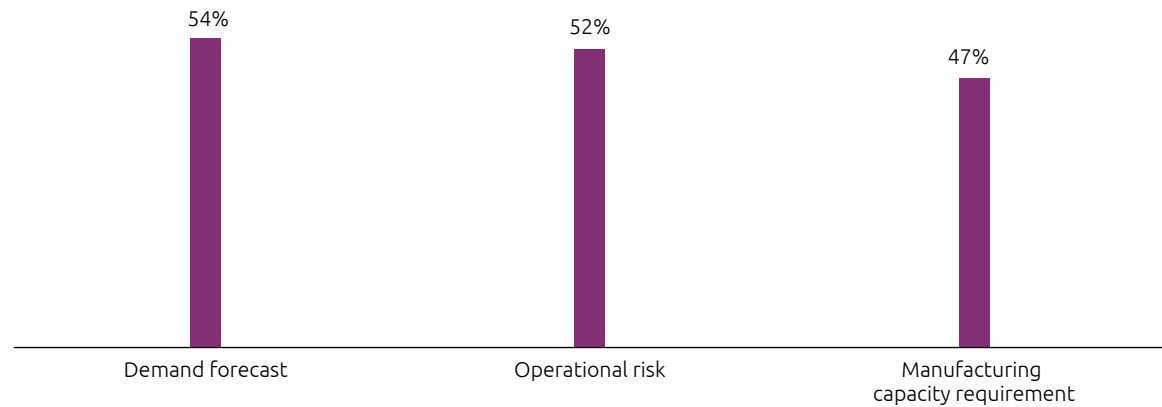
Suppliers trust little of the data they receive. A critical area is manufacturing capacity requirements, where data is trusted by less than half (47 percent) (see Figure 23).



FIGURE. 23

Less than half of suppliers trust the manufacturing capacity data they receive from OEMs

PERCENTAGE OF SUPPLIER RESPONDENTS WHO TRUST THE FOLLOWING DATA



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 266 supplier respondents who collect these data points.

More than three in five (64 percent) of our supplier respondents agree that OEMs overstate their production goals (see Figure 24). Ismael Moreno, Material Planning and Logistics Director Europe, Cooper Standard, explains: *“Suppliers have lost trust in the demands received from OEMs because of multiple cases of artificially high demands.”*⁵⁵ The underlying OEM practice of overordering is owing to a lack of proper forecasting tools, together with a conservative approach to securing manufacturing capacity.

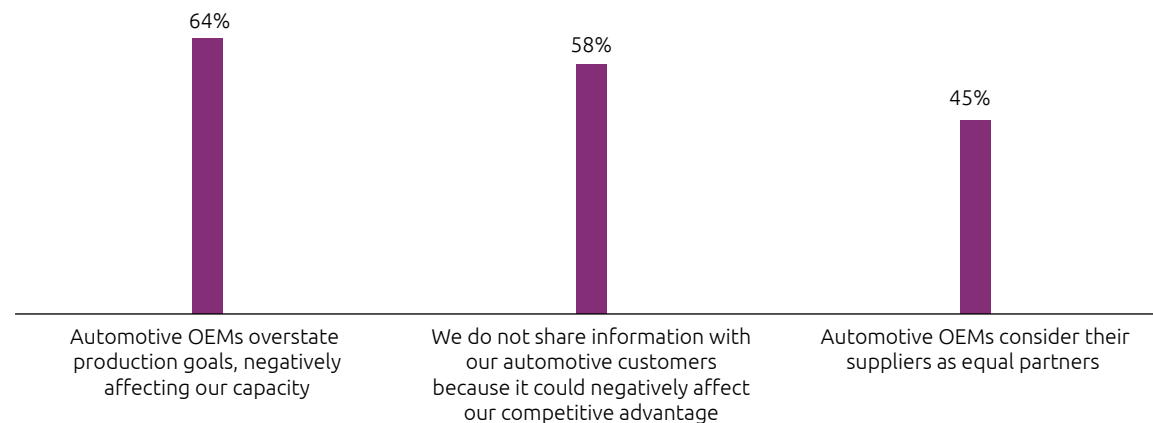
64%

of our supplier respondents agree that OEMs habitually overstate their production goals

FIGURE. 24

More than three in five respondents from suppliers say that OEMs overstate their production goals

PERCENTAGE OF SUPPLIERS WHO AGREE WITH THE FOLLOWING STATEMENTS



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 801 respondents, primarily from the supply chain, general management, product management, and manufacturing functions.

Environmental and climate risk is the most monitored risk in supply chains, yet sustainability data is the least trusted data

The lack of trust goes both ways. Carbon footprint and sustainability (including water and power usage, waste, landfill, etc.) data is trusted by only half (or 54 percent and 57 percent, respectively) of our OEM respondents. This lack of trust critically affects supply chain decisions and initiatives around net zero and sustainable supply chains:

- Almost two out of five automotive organizations (37 percent) use data on sustainability, carbon footprint, and environmental risk to make overall automotive business supply chain decisions.
- Environmental and climate risk is the most tracked supply chain risk – rightly so, with extreme weather and resource shortages being critical risks for disruption of supply chains (Figure 25).



"Suppliers have lost trust in the demands received from OEMs because of multiple cases of artificially high demands."

ISMAEL MORENO

Material Planning and Logistics Director
Europe, Cooper Standard

Yet only 38 percent of OEM supply chain professionals trust carbon footprint data, while 46 percent trust sustainability data. Debarjo Chakraborti, Director at Stellantis Japan, says: *“The carbon footprint data exchanged between OEMs and suppliers is unreliable because manufacturers themselves have not fully integrated data across the supply chain, and because the data flow is not good. Regional differences, plus various irregularities and anomalies, cause these data issues.”*⁵⁶ The challenge here is compounded by the fact that less than half (46 percent) of respondents audit their supply chain for sustainability.

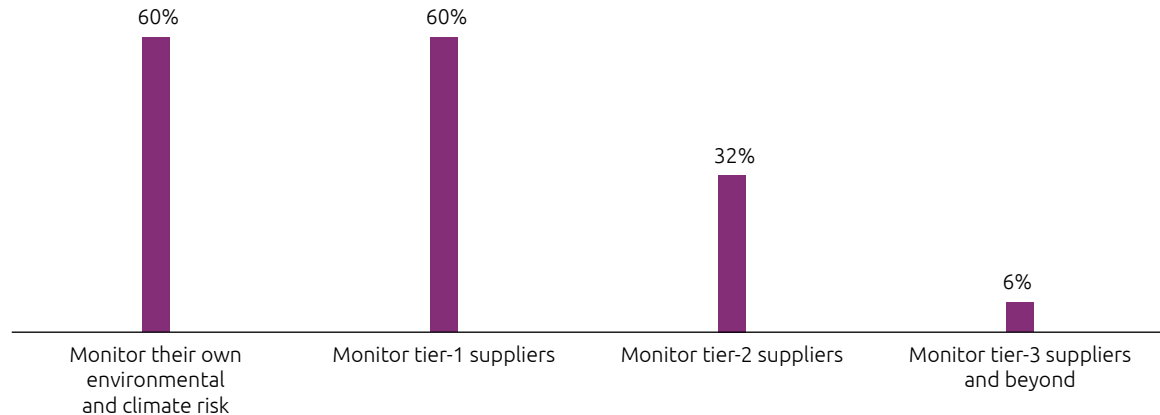
Only **38%**

of OEM supply chain professionals trust carbon footprint data.

FIGURE. 25

Environmental and climate risk monitoring decreases as we go down the supplier tiers

PERCENTAGE OF RESPONDENTS WHO MONITOR THEIR RISK AND THEIR SUPPLIERS' (GROUPED BY TIER)



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 905 respondents primarily from the supply chain, general management, product management, and manufacturing functions.

Supply chain transparency is low, and gets lower in higher tiers

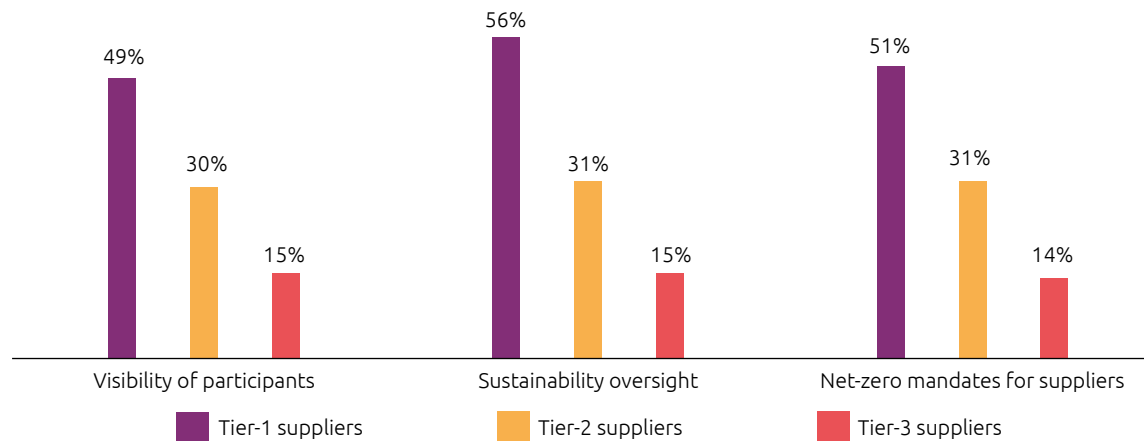
Lack of trust among suppliers and OEMs is a major factor in poor supply chain transparency, which is recognized by the industry as a serious matter. Eric Moreau, Vice President, Global Supply Chain & Industrial Strategy at Forvia Electronics, says: *“The first lesson from the semiconductor crisis is that we need to be transparent with our suppliers; the second is about being agile and knowing how to make decisions quickly, using forecasting.”*⁵⁷

To ensure ethical and sustainable practices throughout the supply chain, a company needs to be able to verify that its suppliers comply with social and environmental standards. Our research reveals a lack of visibility in the automotive supply chain – a lack that gets more acute as tiers get more remote (see Figure 26).

FIGURE. 26

Visibility and sustainability oversight is missing in tier-3 suppliers and beyond

PERCENTAGE OF SUPPLIER BASE, GROUPED BY TIER, HAVING THE FOLLOWING



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 692 respondents primarily from the supply chain and sustainability functions.

Lack of visibility limits the effectiveness of monitoring and managing critical business parameters such as inventory levels. It becomes difficult to assess and manage risks and to respond to supply chain disruptions. Consequences may include production delays, increased costs and lead times, financial losses, decline in customer satisfaction, and reputational damage.

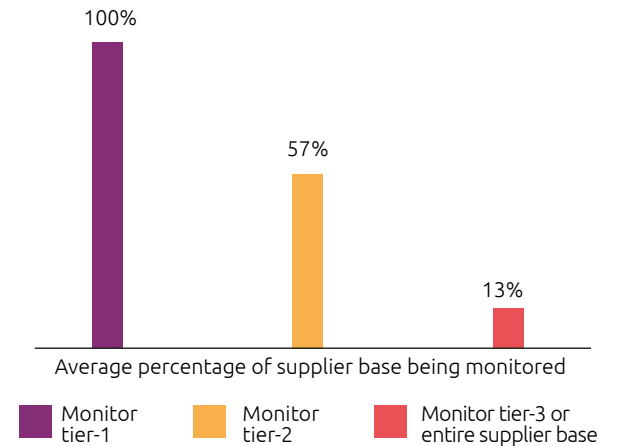
Unfortunately, only one in three suppliers in our survey collects supply chain disruption data from their suppliers and passes it on to their immediate customers; 17 percent of suppliers do so for inventory levels. Given this scarcity of data, it is unsurprising that many companies make little attempt to monitor risk in their overall supply chains (Figure 27).

Better information flows – including flows of real-time data, even from suppliers on more remote tiers – will improve risk monitoring and reduce the risk of unexpected disruptions. Maureen Kline, Vice President of Public Affairs and Sustainability at Pirelli Tire North America, says: *“There is a big move toward digitizing the supply chain. A lot more data can then be analyzed, giving companies a better understanding of the supply chain and its risks. But transparent communication is also required to get ahead of those risks.”*¹⁵⁸

FIGURE. 27

Risk monitoring of the supply chain is low overall and does not extend beyond immediate suppliers

PERCENTAGE OF SUPPLIER BASE WHOSE RISK IS BEING MONITORED



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 905 respondents primarily from the supply chain, general management, product management, and manufacturing functions.

CATENA-X: THE FIRST OPEN AND COLLABORATIVE DATA ECOSYSTEM FOR AUTOMOTIVE SUPPLY CHAIN

The remedy for lack of visibility and poor information flows is a data-driven supply chain. The aim is to create a cross-company data value chain, building systemic coverage to help companies reach resilience and sustainability goals. Thanks to Catena-X, that is a real prospect.

Data-driven decision-making requires provision of internal and external data points. In particular, external data points beyond tier-1 and tier-2 suppliers are very hard to collect accurately in real time. With the broad participation of companies in standardized, open, and trusted data ecosystems such as Catena-X, this issue can be resolved.



US auto manufacturer Ford has engaged with Catena-X to increase sustainability transparency:⁵⁹ *“Catena-X will establish a digital twin for our products, from which we can draw insights into the carbon-emission hot spots in our supply chain. Suppliers will only have to focus on one reporting requirement, rather than report separately to multiple OEMs with different reporting formats and requirements,”*⁶⁰ assures Wulf-Peter Schmidt, Director Sustainability, Advanced Regulation and Product Conformity, Europe at Ford.

13%

the average percentage of Tier-3 supplier base being monitored for risk



“Catena-X will establish a digital twin for our products, from which we can draw insights into the carbon-emission hot spots in our supply chain. Suppliers will only have to focus on one reporting requirement, rather than report separately to multiple OEMs with different reporting formats and requirements.”

WULF-PETER SCHMIDT

Director Sustainability, Advanced Regulation and Product Conformity, Europe at Ford



Current data-driven supply chain initiatives lack maturity and investment

The lack of digital integration, both within the supply chain function and externally, prevents collaboration, reduces visibility, and fosters uncertainty, resulting in a weakened ability to build trust. The lack of data-driven intelligence in supply chains also encourages the tendency to tie up working capital in extra inventory to provide resilience – as we have seen, a problematic tactic.

Only half of our survey respondents (53 percent) state that they have a mature intelligent supply chain to enable data-driven decisions (see Figure 28). For those that do not, there are consequences for a range of functions and operations, including forecasting and scenario planning, inventory management, and risk assessment. Intelligent supply chains possess an agility that is necessary to respond to new and upcoming challenges; without this, it is more difficult to integrate newer technologies such as artificial intelligence (AI) and data analytics.

A good example of what is possible is BMW's RiskHub. BMW established RiskHub to address supply chain challenges, utilizing AI and data analytics to analyze external data sources to detect threats of natural disasters and financial risk. BMW aims to procure components close to production sites, maintain local teams in key purchasing markets, and prioritize a resilient supply chain strategy.⁶¹

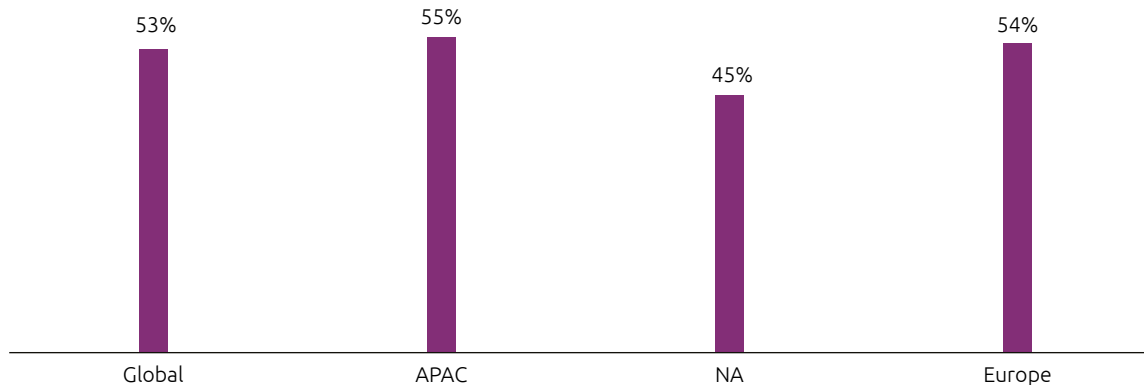
53%

state that they have a mature intelligent supply chain to enable data-driven decisions

FIGURE. 28

Only half of respondents have a mature intelligent supply chain to enable data-driven decision-making

PERCENTAGE OF RESPONDENTS THAT STATE THAT THEY HAVE A MATURE INTELLIGENT SUPPLY CHAIN ENABLING DATA-DRIVEN DECISION-MAKING



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 655 respondents primarily from the supply chain and IT functions.

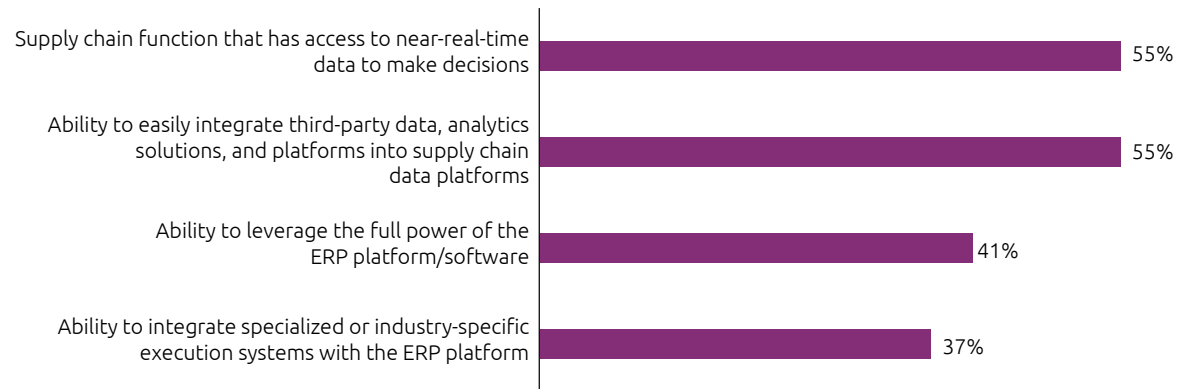
Despite examples of good practices, many automotive supply chains today lack key features and capabilities required to provide trust and transparency. Only a little more than half (55 percent) of survey respondents have access to real-time data to make decisions, impeding agility in responding to changing circumstances and emergencies. About the same percentage can integrate third-party data and analytics solutions (see Figure 29).

For the rest, there are proven measures to provide these essential capabilities. Beau Dietz, Business Unit Manager – Heavy Duty Engine Platform (HDEP) Assembly and ePowertrain Manufacturing, Daimler Truck, says: *“Integrating key data sources with platforms like Tableau or Power BI is a good starting point. Leveraging AI, adds a new analytics dimension; making it possible to uncover missing data sources and gain a forward-looking perspective. A good AI system can do things like assess a supplier performance and suggest alternative transportation methods to ensure timely delivery. AI can also consider multiple real-time factors like traffic conditions or driver availability to make proactive scheduling decisions and secure the supply chain.”*⁶²

FIGURE. 29

Automotive supply chains lack the adoption of key intelligent features and capabilities

PERCENTAGE OF RESPONDENTS WITH THE FOLLOWING INTELLIGENT FEATURES AND CAPABILITIES



Source: Capgemini Research Institute, Automotive supply chain survey, June-July 2023; N = 655 respondents primarily from the supply chain and IT functions.



“Integrating key data sources with platforms like Tableau or Power BI is a good starting point. Leveraging AI, adds a new analytics dimension; making it possible to uncover missing data sources and gain a forward-looking perspective. A good AI system can do things like assess supplier performance and suggest alternative transportation methods to ensure timely delivery. AI can also consider multiple real-time factors like traffic conditions or driver availability to make proactive scheduling decisions and secure the supply chain.”

BEAU DIETZ

Business Unit Manager – Heavy Duty Engine Platform (HDEP) Assembly and ePowertrain Manufacturing, Daimler Truck



05

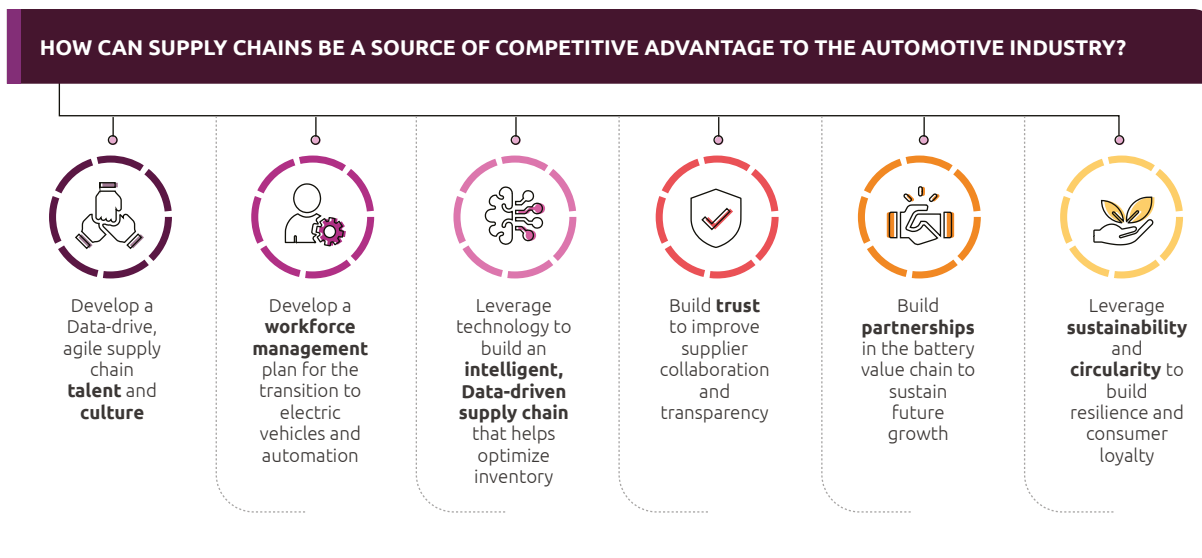
**HOW CAN THE
AUTOMOTIVE SUPPLY CHAIN
BECOME A SOURCE OF
COMPETITIVE ADVANTAGE?**

As shown above, challenges to automotive supply chains are often interrelated. To build a supply chain that can deliver a competitive edge, structural, cultural, and technological changes are required (Figure 30).



FIGURE. 30

Structural, cultural, and technological changes are needed to make the supply chain a source of competitive advantage.



Source: Capgemini Research Institute.

1. Leverage technology to build an intelligent, data-driven supply chain to help optimize inventory

OEMs' practice of adding safety margins onto orders adversely affects supplier trust, reducing the competitiveness of the overall supply chain. Issues include excess inventory, suboptimal working capital deployment, and poor financial health.

Underlying all these problems is one cause: the lack of mature forecasting tools. Our survey shows that only 55 percent of respondents have access to near-real-time data, while a similar proportion are unable to integrate third-party platforms. *"The trust between OEMs and their suppliers can be strengthened by transparency in the supply chain and appropriate tools and platforms that offer this transparency,"* confirms Marc-Oliver Nandy, Director Global Supply Chain at Mercedes-Benz AG.⁶³

Modern technologies, such as predictive analytics and machine learning (ML), can monitor and deliver insights into risks.

Mercedes-Benz and Microsoft have partnered to create a data platform called MO360, which is expected to improve production efficiency across the OEM's 30 worldwide manufacturing plants by a projected 20 percent between

2022 and 2025. A digital twin of the supply chain will identify potential bottlenecks.⁶⁵ AI is a critical part of this solution, as explained by a CEO of an OEM logistics company: *"Integration of AI will enable us to forecast demand for thousands of parts, including both fast movers and also low-volume parts like custom interiors with a specific color."*⁶⁶

2. Build trust to foster transparency and more effective supplier collaboration

A supply chain director of a North American OEM states: *"My strongest recommendation for supply chain management is to build collaboration and partnership. And the second most critical is to build trust."*⁶⁷

To address these issues, automotive organizations should establish supplier relations policies laying out common working rules and ethical guidelines. These policies should cover:

- I. **Isolation of operational and risk information from vendor-selection processes.** Operational information (such as inventory, underused capacity, and bottlenecks) should not be used in supplier negotiations. This information should be considered privileged, with access controlled and siloed among negotiating and operating teams.

55%

of respondents have access to near-real-time data.

II. Transparency and disclosure. Organizations should strive to make operational and forecasting information available to their suppliers. Every effort should be made to disclose how forecasting conclusions are reached, and to explain the safety buffer and contingency provisions expected from suppliers.

Federico Baiocco, Head of Global Supply Chain and S&OP, Iveco Group, notes that information should flow in both directions: *“We need to increase the amount of data that we provide to our suppliers, as well as the data our suppliers provide to us, including long-term forecasting, production data, scheduling, stocktaking, etc.”*⁶⁸

III. Conflict resolution and arbitration. Management should define and streamline formal processes for dealing with supplier grievances and dispute resolution. These processes, including their implementation and governance, should be rules-based and available for everyone to view.⁶⁹

IV. Timely communication. Giving suppliers clear, up-to-date information will help them navigate change, including major upheavals such as the technology transition to EVs. Defining and publicizing the communications policy is, once again, the key.



“Long-term agreements with suppliers should be made, with definitions of capacity allocated and delivery arrangements. Today’s longer lead times make this long-term collaboration vital for reaching strategic targets.”

DOMINIK SCHEDL

Supply Chain Manager at Indie Semiconductor

Once trust has been established, it becomes possible to build long-term capacity and resilience. Effective collaboration and strong ecosystems then enable transparency and visibility, facilitating better forecasting and risk management.

Dominik Schedl, Supply Chain Manager at Indie Semiconductor - explains: *“Long-term agreements with suppliers should be made, with definitions of capacity allocated and delivery arrangements. Today’s longer lead times make this long-term collaboration vital for reaching strategic targets.”*⁷⁰

3. Create strong partnerships throughout the battery value chain to sustain future growth

Nearly three in five respondents say their companies are investing directly in mining operations to secure raw materials for battery manufacturing. However, several dimensions of this field are challenging. First, new battery chemistry is under development, casting doubt on demand levels for future materials. Second, massive upfront investment is required. Third, these investments have long lead times. According to the IEA: *“Lithium mines that started operations between 2010 and 2019 took an average of 16.5 years to develop.”*⁷¹ Fourthly, the complexity, scale, and



“We need to increase the amount of data that we provide to our suppliers, as well as the data our suppliers provide to us, including long-term forecasting, production data, scheduling, stocktaking, etc.”

FEDERICO BAIOTTO

Head of Global Supply Chain and S&OP,
Iveco Group

the need for expertise in the field of mining and chemical refinement will raise the overheads of scaling such a strategy.

Given these considerations, a collaborative approach could well produce better outcomes. Automotive organizations should build a wide range of partnerships to develop battery resources through joint investments and long-term secured contracts. Investment can be optimized by balancing different materials, sources, and regions.

4. Implement a comprehensive workforce management plan, focusing on automation and transition to EVs

The workforce management approach must be tailored to shifting requirements, particularly those associated with the transition to EVs and with ongoing automation. To ensure that the automotive workforce is able to migrate effectively, companies should take the following steps:

I. Assess how technology transformation will affect the workforce

This impact does not always have to be in terms of redundancies; there could also be a dramatic shift in the

nature of a role. Organizations should ask which job families are affected, how severe the impact is, and what future roles will be required.

II. Define new roles and set up an upskilling process

Organizations should identify roles that underpin core competencies and long-term strategies. Upskilling will ensure these competencies are nurtured in house.

III. Train leaders to communicate change effectively

Excellent communication skills can ensure smooth transitions for both organization and workforce. The choice of communication channel is also important: In-person meetings that cascade down the organization structure can foster a perception that leadership is accessible.

5. Develop a data-driven and agile supply chain culture, and the talent to support it

Changing organizational culture requires considerable time and effort. Most supply chain functions are experience-based but this system can break down in the face of unprecedented challenges or volatility.

To be sufficiently agile to build a competitive advantage, companies require data-driven decision-making. As George Kurian, Vice-President Supply Chain and Logistics, Michelin NA, says: *"Agility is important because success is not about being better than the competition, but about being faster than the competition. And that's vital because no one truly knows where we're going."*⁷²

Building a data-driven culture requires the following steps:

I.

Appoint and empower change agents to drive data-driven culture

These carefully selected employees can demonstrate the usage of new skills, technologies, and capabilities as a template for others to follow.

II.

Empower employees at all levels with tools and skills to implement data-driven decision-making

Self-service tools can make data available to everyone. Employees need to be able to create and understand dashboards, plot simple regression models, and use data-driven storytelling.

III.

Use collaboration tools to increase transparency

Tools such as integrated business planning (IBP) solutions can overcome both internal siloes between supply chain functions and external ones between suppliers and customers. This increases the sharing of both information and expertise.

IV.

Design new KPIs focused on behaviors rather than successes or failures.

KPIs – and related incentives – can foster innovation and encourage supply chain professionals to develop new behaviors, with the emphasis on risk-taking and adapting to new situations and technologies.

6. Harness sustainability and circularity to build resilience and consumer loyalty

By integrating sustainability and circularity into their supply chain strategies, businesses can create more resilient and future-proof operations, with fewer concerns about resource availability. More than half (56%) of our survey respondents report improved operational efficiency from recycling vehicle parts.

Leading OEMs are already taking steps to realize these benefits. For example:

- Renault is replacing its traditional auto manufacturing plant in Flins, France with recycling and reconditioning activities. This program is expected to decrease the time required to prepare a used car for resale from 21 to eight days.⁷³
- BMW Group Plant Dingolfing will use heat produced from regional biomass and its own waste wood to meet about 50 percent of its processes' hot-water requirements from 2025.⁷⁴

Circular economy principles can be applied to existing products, but should be applied as early as possible – and certainly during the pre-use phase of a vehicle's lifecycle. Circularity and sustainability generally have knock-on benefits for the supply chain and the business as a whole.

Many OEMs recognize the need for an all-embracing approach to circularity and sustainability. Renault, for instance, has announced a circular economy initiative called The Future is NEUTRAL⁷⁵ with the long-term objective of increasing the proportion of recycled materials in the production of new vehicles. The initiative targets all automotive players. The aim is to reach a business portfolio turnover of more than €2.3 billion and an operating margin of more than 10 percent by 2030.

New business models can make circularity easier. Consider, for example, the product-as-a-service model, where the OEM retains ownership of the vehicle, and the customer typically subscribes and then pays per use. Compared with traditional models, this gives the OEM more opportunity to optimize vehicles' first lives and facilitate their next lives.

56%

of our survey respondents report improved operational efficiency from recycling vehicle parts.



“Agility is important because success is not about being better than the competition, but about being faster than the competition. And that’s vital because no one truly knows where we’re going.”

GEORGE KURIAN

Vice-President Supply Chain and Logistics, Michelin NA

Conclusion

The automotive supply chain has seen unprecedented upheavals in the past few years. It has struggled to cope with unforeseen disruption, from the pandemic to recent geopolitical shocks. To deal with these upheavals, automotive companies need to re-invent their whole supply chain model, and the organization and technology platforms that underlie it. The future supply chain needs to be intelligent and data-driven to tackle the many challenges the industry

will face in the years to come. Importantly, the supply chain also needs to incorporate circularity – a difficult challenge. Automakers will prosper if their supply chain functions can build trust, collaborate effectively, and become more agile while embracing sustainability. A resilient, connected, intelligent, and sustainable supply chain could become an automaker's biggest competitive advantage.

Research methodology

Our research project set out to explore the state of supply chain management in the automotive industry and to provide insights into strategies that can be applied to establish a resilient, connected, intelligent, and sustainable supply chain. We examined automotive organizations' supply chain strategies, initiatives, challenges, governance, and investments, together with the impact, significance, and criticality of these initiatives.

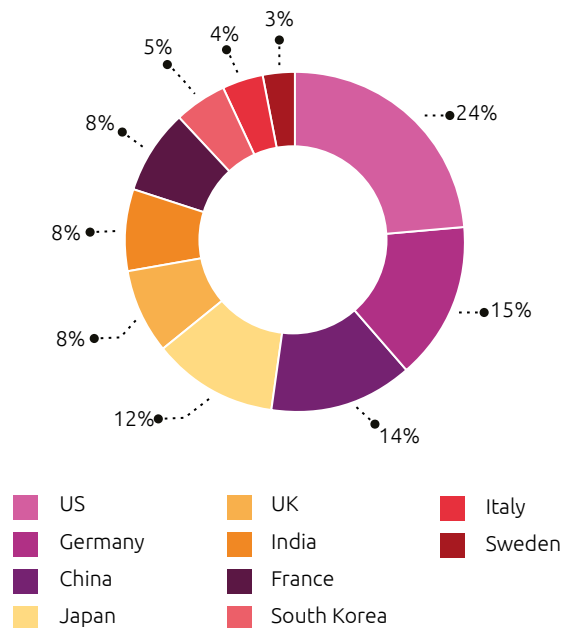
The main research tools were an executive survey, described below, plus a series of 24 in-depth interviews with senior industry executives from OEMs and suppliers.

Executive survey

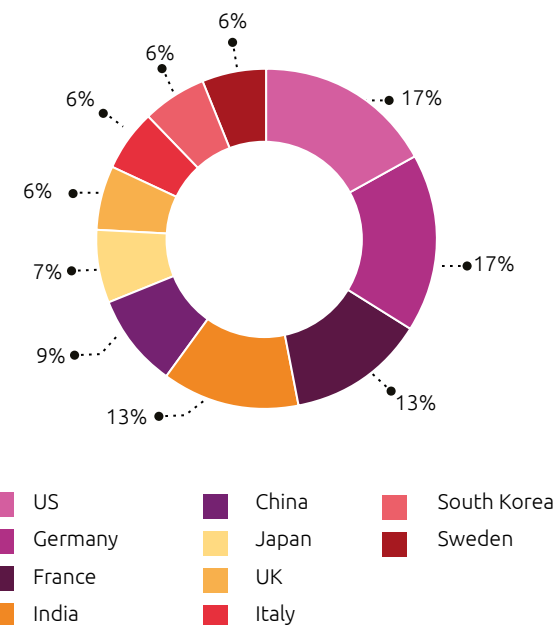
During June–July 2023, we surveyed 1,004 senior executives (director level and above) across 449 global automotive organizations. These organizations are either OEMs with annual revenues of more than \$1 billion or suppliers with revenues of more than \$500 million.

The distribution of respondents and their organizations is as follows.

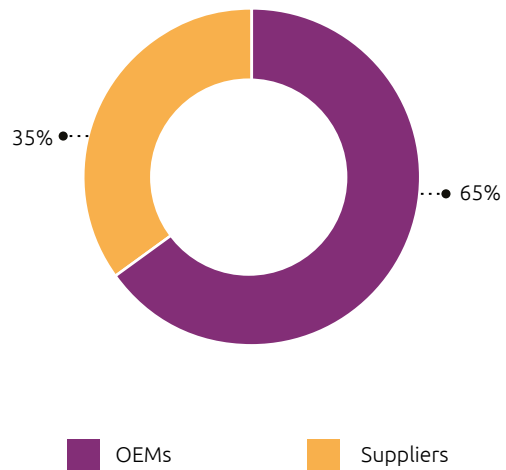
ORGANIZATIONS BY COUNTRY
(global headquarters of the organization)



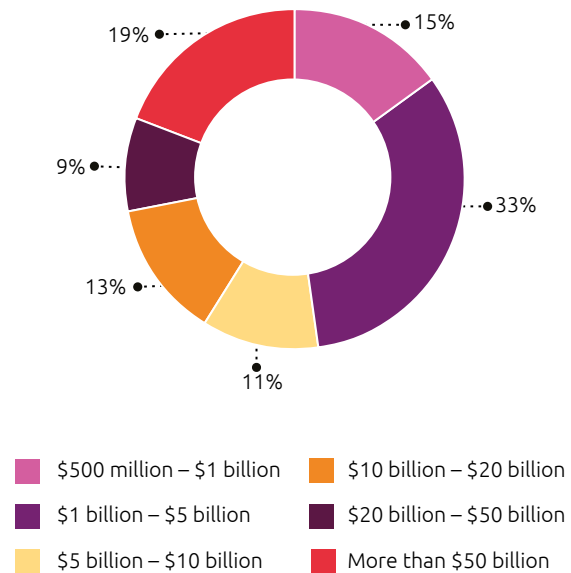
ORGANIZATIONS BY COUNTRY
(by respondent's primary location)



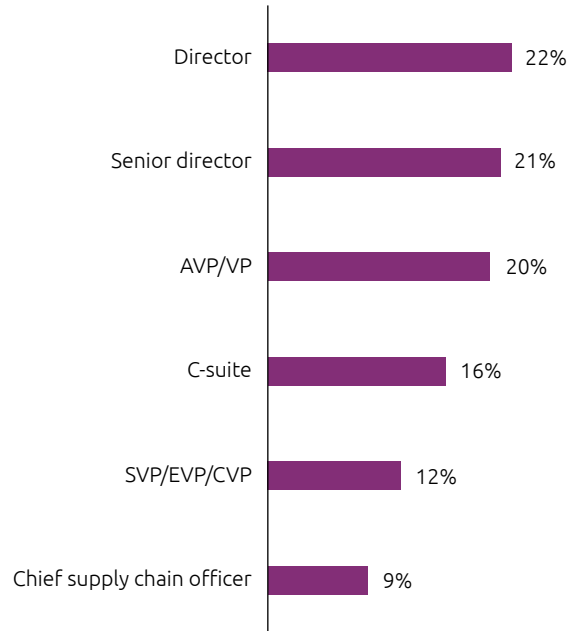
ORGANIZATIONS BY SECTOR



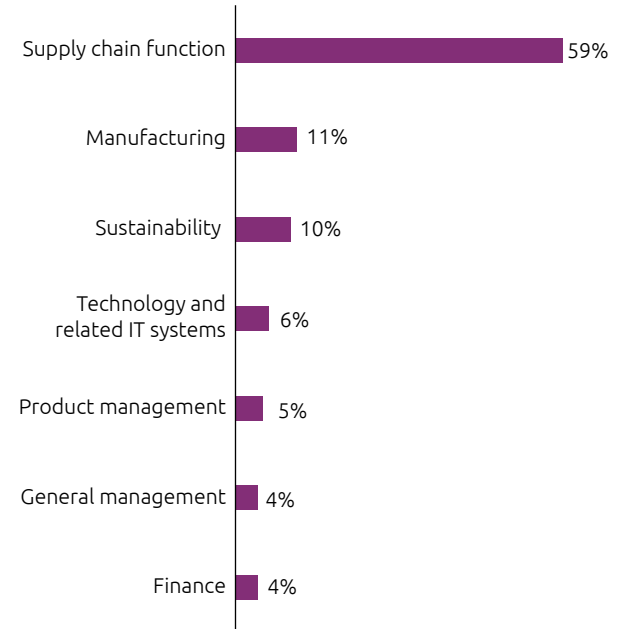
ORGANIZATIONS BY ANNUAL REVENUE



EXECUTIVES BY TITLE



EXECUTIVES BY FUNCTION



References

1. Volvo Car AB (publ.), Q2 2022 Earnings Call, July 20, 2022.
2. Polestar, Joined in climate action: the Pathway Report, February 2022.
3. Capgemini Research Institute, expert in-depth interviews, May–July 2023.
4. Capgemini Research Institute, expert in-depth interviews, May–July 2023.
5. The Washington Post, “U.S. companies are buying less from China as relations remain tense,” August 2023.
6. Bloomberg Linea, “Nearshoring will make Mexico ‘the motor’ of the US electric vehicle industry,” November 2022.
7. Mexico Business, “Nearshoring brought US\$2 billion in October,” November 2022.
8. Manufacturing Digital, “Reshore: manufacturers come home to strengthen supply chain,” August 2022.
9. Mobility Outlook, “Bosch Drafts New Script For India Localisation Drive,” December 2022.
10. Capgemini Research Institute, expert in-depth interviews, May–July 2023.
11. CNBC, “‘We are not decoupling:’ G-7 leaders agree on approach to ‘de-risk’ from China,” May 2023.
12. United States-Mexico-Canada Agreement, November 2018.
13. Mercedes-Benz Group AG, 2022 Earnings Call, February 17, 2023.
14. US IRA, August 2022.
15. Reuters, “General Motors moves deeper into mining with EnergyX lithium investment,” April 12, 2023.
16. Ministry of Heavy Industries, “Government notifies PLI scheme for automobile and auto components,” September 2021.
17. EU, Corporate sustainability due diligence directive, February 2022.
18. EU, A new circular economy action plan, March 2020.
19. US Government, Uyghur Forced Labor Prevention Act, December 2021
20. Capgemini Research Institute, expert in-depth interviews, May–July 2023.
21. EU, European Chips Act, February 2022.
22. US Government, CHIPS and Science Act, August 2022.
23. TechCrunch, “Bosch opens \$1.2 billion chip plant in Germany,” June 2021.
24. BBC, “Taiwanese chip giant invests \$40bn in US plant,” December 2022.
25. Euronews, “Intel to build €30 billion chip plant in Germany,” July 2023.
26. General Motors, “GlobalFoundries and GM announce long-term direct supply agreement for U.S. production of semiconductor chips,” February 9, 2023.
27. Capgemini Research Institute, expert in-depth interviews, May–July 2023.

28. Stellantis press release, "Stellantis implements multifaceted semiconductor strategy to ensure supply security, drive innovation," July 2023.
29. Clean Technica, "How Tesla reworked its software to survive the semiconductor chip shortage," August 2022.
30. Capgemini Research Institute, Next Destination: Software, July 2021.
31. Live Mint, "Supply chain woes a hurdle for Hycross: Toyota's Yoshimura," November 2022.
32. Autocar, "Stellantis logistics problems limit European sales rebound," May 2023.
33. Capgemini Research Institute, expert in-depth Interviews, May–July 2023.
34. Capgemini Research Institute, expert in-depth Interviews, May–July 2023.
35. Continental Aktiengesellschaft, 2022 earnings call, March 8, 2023.
36. The Guardian, "Fed raises interest rates to 22-year high as it continues to fight inflation," July 2023.
37. New York University – Stern, Financial datasets created and maintained by Prof. Aswath Damodaran, July 2023.
38. Polestar, Joined in climate action: the Pathway Report, February 2022.
39. Polestar, Joined in climate action: the Pathway Report, February 2022.
40. IEA, "The role of critical minerals in clean energy transitions," May 2021.
41. IEA, Overall supply and demand of lithium for batteries by sector, 2016-2022, April 2023.
42. New Age Metals Inc, "Lithium Supply And Demand: How To Fill The Gap?" January 2022.
43. IEA, "Critical minerals," May 2021.
44. Volkswagen Group, Annual Report, 2022.
45. Capgemini Research Institute, expert in-depth Interviews, May–July 2023.
46. Capgemini Research Institute, "Advancing through headwinds: Where are organizations investing?" January 2023.
47. Capgemini Research Institute, "Why sustainable product design is the need of the hour," September 2022.
48. Capgemini Research Institute, Sustainability in Automotive, October 2022.
49. Capgemini Research Institute, expert in-depth interviews, May–July 2023.
50. Capgemini Research Institute, expert in-depth interviews, May–July 2023.
51. Capgemini Research Institute, expert in-depth interviews, May–July 2023.
52. Council of EU, "Council adopts new regulation on batteries and waste batteries," July 2023.

53. Harvard Business Review, “Building deep supplier relationships,” December 2004.
54. Plante Moran, “Auto supplier and OEM relationships: Insights from the 2022 WRI® Study,” June 2022.
55. Capgemini Research Institute, expert in-depth interviews, May–July 2023.
56. Capgemini Research Institute, expert In-depth Interviews, May–July 2023.
57. Capgemini Research Institute, expert in-depth interviews, May–July 2023.
58. Capgemini Research Institute, expert in-depth interviews, May–July 2023.
59. Ford, Integrated Sustainability and Financial Report, 2023.
60. Capgemini Research Institute, expert in-depth Interview, May–July 2023.
61. Cips, “BMW creates RiskHub in response to ‘fragile supply chains,’” March 15, 2023.
62. Capgemini Research Institute, Expert In-depth Interview, May–July 2023
63. Capgemini Research Institute, expert in-depth interviews, May–July 2023.
64. Capgemini Research Institute, expert in-depth interviews, May–July 2023.
65. Reuters, “Mercedes-Benz and Microsoft collaborate on supply chain data platform,” October 12, 2022
66. Capgemini Research Institute, expert in-depth interviews, May–July 2023.
67. Capgemini Research Institute, expert in-depth interviews, May–July 2023.
68. Capgemini Research Institute, Intelligent Supply Chain, December 2022.
69. Plante Moran, “Auto supplier and OEM relationships: Insights from the 2022 WRI® Study,” June 2022.
70. Capgemini Research Institute, Automotive supply chain research: expert in-depth interview, May–July 2023.
71. IEA, Critical minerals, May 2021.
72. Capgemini Research Institute, expert in-depth interviews, May–July 2023.
73. Automotive News Europe, “Renault sees \$1.1b in revenue from recycling, refurbishing business by 2030,” December 2021.
74. BMW Group, “Plant Dingolfing relies on locally produced heat from regional biomass to reduce CO2,” July 2023
75. Automotive World, “Renault Group: The Future Is NEUTRAL: The circular economy is stepping into a new era,” October 2022.

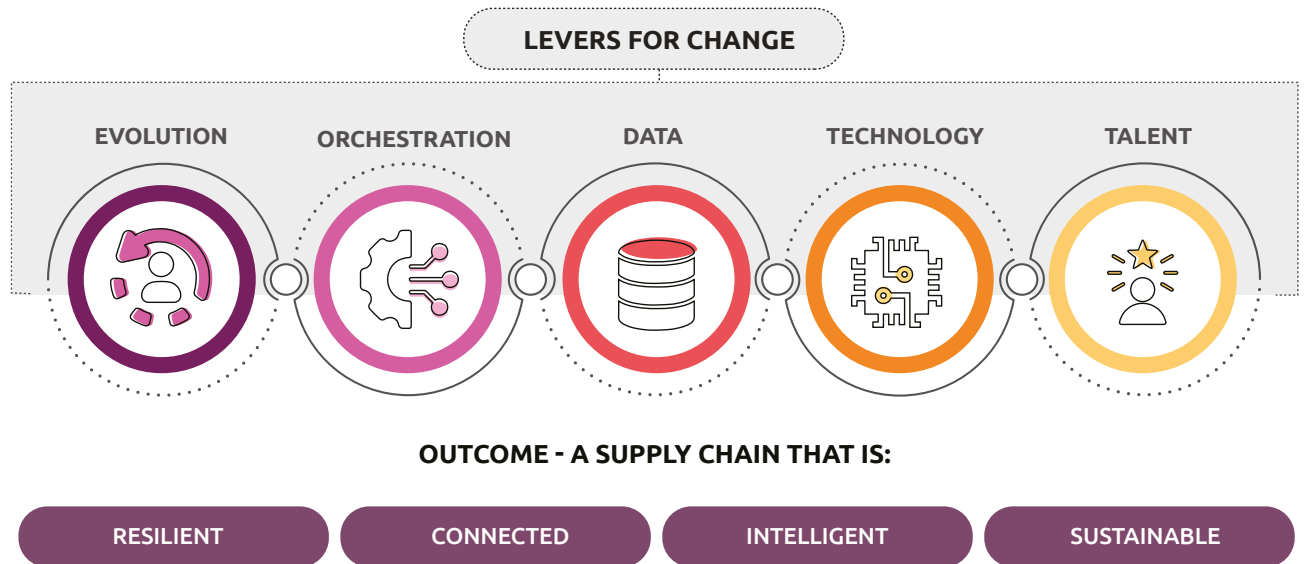
Capgemini is here to guide your supply chain transformation

Capgemini supports automotive clients globally in transforming their supply chains to cope with ongoing disruption around resilient automotive supply chains.

Engineering and IT expertise complements this deep experience of automotive supply chain management; we know how to integrate IT and OT. Strong partnerships and platforms mean we can provide solutions across the supply chain. We do so within an end-to-end transformation framework that applies five levers for change (see Figure).

These capabilities are vital to our clients on their journey toward a resilient automotive supply chain. Along the way, they rethink planning, embrace transparent collaboration, and innovate in areas such as forecasting and logistics and building a data-driven culture enhancing performance and decision-making.

FIVE LEVERS TO TRANSFORM THE SUPPLY CHAIN



Key contributors



Alexandre Audoin

Executive Vice President,
Group Automotive
alexandre.a.audoin@capgemini.com



Jean-Marie Lapeyre

Chief technology and innovation officer,
Group Automotive
jean-marie.lapeyre@capgemini.com



Fabienne Lefever

Vice President,
Capgemini Engineering
fabienne.lefever@capgemini.com



Sven Dahlmeier

Senior Director,
Capgemini Invent
sven.dahlmeier@capgemini.com



Roshan Batheri

Senior Director,
Group Automotive
roshan.batheri@capgemini.com



Emmanuelle Bischoffe-Cluzel

Director,
Capgemini Invent
emmanuelle.bischoffe-cluzel@capgemini.com



Jerome Buvat

Head of
Capgemini Research Institute
jerome.buvat@capgemini.com



Subrahmanyam KVJ

Senior Director,
Capgemini Research Institute
subrahmanyam.kvj@capgemini.com



Amol Khadikar

Program Manager,
Capgemini Research Institute
amol.khadikar@capgemini.com



Shahul Nath

Manager,
Capgemini Research Institute
shahul.nath@capgemini.com



Navya Atmakuri

Consultant,
Capgemini Research Institute
navya.atmakuri@capgemini.com



Mridul Agarwal

Consultant,
Capgemini Research Institute
mridul.agarwal-d@frog.co

The authors would like to especially thank all industry experts and executives who participated in this research.

The authors would also like to thank for their contribution to this research Ralph Schneider-Maul, Markus Winkler, Idriss Elasri, Sebastian Tschödrich, Siegfried Adam, Pascal Feillard, Clément Falquet, Philipp Lesch, Michael Cook, Shiv Tasker, Ashish Sharma, Clément Chenut, Matthias Eisenschmid, Tilo Klüh, Gilles Bacquet, Tobias Obladen, Sonali A. Nimkar, Sreekanth Patcha, Praveen Cadpakar, Vamshi Rachakonda, Andy Howard, Giovanni Olocco, Arumugam Pakkijaraj, Baljeet Yadav, Somkalpa Laha, Milind Dumbre, Vaibhav More, D Guruprasath, Mariam Belasfar, Maryem Sahnoun, Manish Saha, Suparna Banerjee, Ashwani Kumar, and Punam Chavan.

About the Capgemini Research Institute

The Capgemini Research Institute is Capgemini's in-house think tank on all things digital. The Institute publishes research on the impact of digital technologies on large traditional businesses. The team draws on the worldwide network of Capgemini experts and works closely with academic and technology partners. The Institute has dedicated research centers in India, Singapore, the UK, and the US. It was recently ranked number one in the world by independent analysts for the quality of its research.

Visit us at www.capgemini.com/researchinstitute/

For more information, please contact:

Global contact

ALEXANDRE AUDOIN

Capgemini Group
alexandre.a.audoin@capgemini.com

VIRGINIE TOUSSAINT

Global Marketing – Capgemini Engineering
virginie.toussaint@capgemini.com

SEBASTIAN TSCHOEDRICH

Capgemini Invent
sebastian.tschoedrich@capgemini.com

France

Arnaud Bouchard
arnaud.bouchard@capgemini.com

Nordics

Caroline Segerstéen Runervik
sergersteen-runervik@capgemini.com

Belgium

Evy Nerinckx
evy.nerinckx@capgemini.com

ROSHAN BATHERI

Capgemini Group
roshan.batheri@capgemini.com

GILLES BACQUET

Capgemini Engineering
gilles.bacquet@capgemini.com

India

Anuraag Bharadwaj
anuraag.bharadwaj@capgemini.com

Spain

Yoann Groleau
yoann.groleau@capgemini.com

UK

Robert Pears
robert.pears@capgemini.com

JEAN-MARIE LAPEYRE

Capgemini Group
jean-marie.lapeyre@capgemini.com

PASCAL FEILLARD

Capgemini Engineering
pascal.feillard@capgemini.com

Italy

Gerardo Ciccone
gerardo.ciccone@capgemini.com

Germany

Ralf Blessmann
ralf.blessmann@capgemini.com

Japan

Yonoshin Mori
yonoshin.mori@capgemini.com

RUTH PETERS

Global marketing – Capgemini Group
ruth.peters@capgemini.com

EMMANUELLE BISCHOFFE-CLUZEL

Director, Invent
emmanuelle.bischoffe-cluzel@capgemini.com

North America

Andy Howard
andy.howard@capgemini.com

China

Chu Yan
yan.chu@capgemini.com

More Capgemini Research Institute Publications



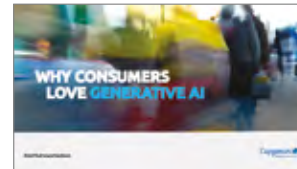
A World In Balance: Why Sustainability Ambition Is Not Translating To Action



Data for Net Zero: Why data is key to bridging the gap between net zero ambition and action



Sustainability in automotive: from ambition to action



Creative and generative ai



Harnessing the value of generative AI: Top use cases across industries



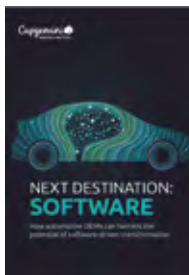
Digital twins: adding intelligence to the real world



Advancing through headwinds: Where are organizations investing?



Intelligent supply chain



Next destination: Software



Circular economy for a sustainable future



Conversations for tomorrow: Sustainability and climate tech



**Remodeling the future
Industry execs agree: new energy models are key to survival**

Subscribe to latest research from The Capgemini Research Institute



Receive copies of our reports by scanning the QR code or visiting

<https://www.capgemini.com/capgemini-research-institute-subscription/>

Capgemini Research Institute

Fields marked with an * are required

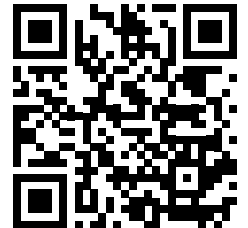
First Name *

Last Name *

Email *

By submitting this form, I understand that my data will be processed by Capgemini as indicated above and described in the [Terms of use](#) *

Submit





About Capgemini

Capgemini is a global leader in partnering with companies to transform and manage their business by harnessing the power of technology. The Group is guided every day by its purpose of unleashing human energy through technology for an inclusive and sustainable future. It is a responsible and diverse organization of nearly 350,000 team members in more than 50 countries. With its strong 55-year heritage and deep industry expertise, Capgemini is trusted by its clients to address the entire breadth of their business needs, from strategy and design to operations, fueled by the fast evolving and innovative world of cloud, data, AI, connectivity, software, digital engineering, and platforms. The Group reported in 2022 global revenues of €22 billion.

Get the Future You Want | www.capgemini.com