



SUSTAINABILITY IN AUTOMOTIVE

FROM AMBITION TO ACTION

#GetTheFutureYouWant

Introduction

"We can develop and make great vehicles, sustain and grow a strong business, and protect our planet at the same time – in fact, those ideals complement each other." This is the recently expressed opinion of Bob Holycross, Vice President, Chief Sustainability at Ford. However, the extent to which the rest of his industry shares Holycross's vision (and, more importantly, is committed to implementing it) is questionable.



Our research on sustainability in the automotive industry (published March 2020), found that:

01

sustainability is a strategic issue for the automotive industry and the key aspect of organizational purpose;

02

the implementation of sustainability initiatives is fragmented and is frequently marked by a lack of focus across the value chain and a lack of central governance;

03

an estimated \$50 billion is required over the next five years to meet long-term sustainability targets, in addition to the current investment in electric vehicles (EVs), autonomous vehicles (AVs), and digital mobility services.

Introduction

Since then, sustainability has begun to arouse the interest of automotive original equipment manufacturers (OEMs) and suppliers. Rising climate concerns, more widely and strictly enforced regulations, and stakeholder pressure are pushing the automotive industry into the new era of sustainability and leading organizations are focusing on sustainability goals:

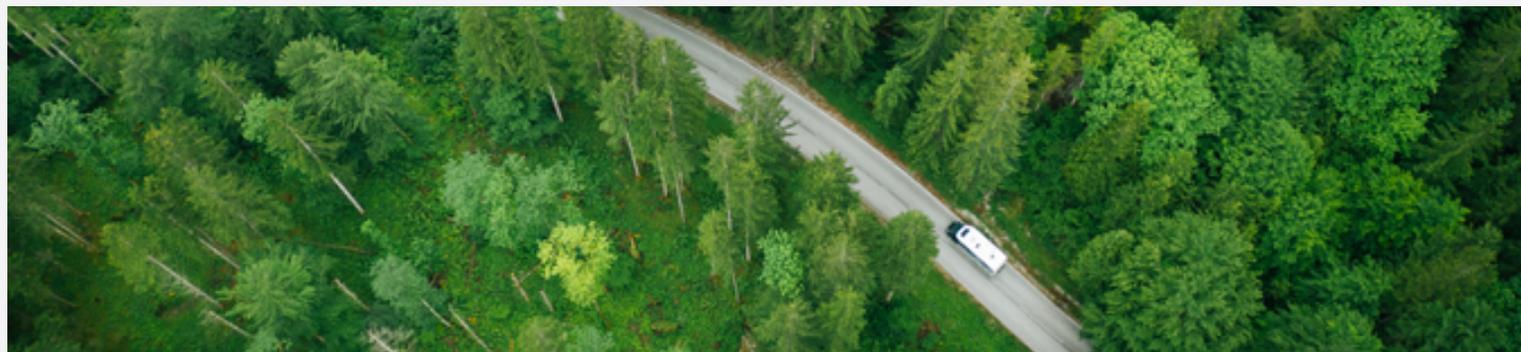
- **net zero targets** are front of mind for automotive manufacturers, who are aggressively cutting manufacturing and tailpipe emissions. **Volvo**, for example, plans to reach net zero emissions by 2040 by eliminating fuel-powered vehicles from its range²
- **electrification** of vehicle fleets has accelerated, despite pandemic-related disruption
 - ▶ **GM** has increased investment in EV and AV development to more than \$35 billion for 2020-25³
 - ▶ **Honda** has pledged to increase the ratio of EVs and fuel-cell vehicles (FCVs) to overall unit sales in all major markets of electrification to 40 percent by 2030; 80 percent by 2035; and then to 100 percent globally by 2040⁴

EV adoption is being powered by generous government subsidies, which, in Germany for instance, allow consumers to receive up to €6,000 (\$5,880) in subsidies for vehicles priced under €40,000 (covering more than 15 percent of the overall price).⁵ Some of these subsidies will be phased out in the coming years, and automotive organizations will have to find ways to competitively price EVs to keep up consumer interest. The US Congress has recently passed the Inflation Reduction Act, which provides up to \$7,500 in subsidies for EVs assembled in North America.⁶ Strict regulations, such as those recently passed by the EU, which require automotive OEMs to phase out Internal Combustion Engine (ICE) vehicle sales by 2035, have been another shot in the arm for the EV segment⁷. However, transitioning to EVs alone is unlikely to decarbonize the automotive sector to a large extent as several considerations with regards to charging infrastructure, and sustainable mining of minerals and metals will need to be taken into account too.

Introduction

- **Sustainable manufacturing:** Sustainable auto manufacturing entails minimizing production waste and the environmental impact of vehicle production. For instance, **Ford** has committed to sourcing 100 percent carbon-free electricity for its operations by 2035.
- **Sustainable supply chain:** **Faurecia** entered into an agreement with Veolia to develop innovative compounds using recycled plastics for automotive interior modules, including side panels, door panels, and center consoles. The program aims to achieve 30 percent recycled content by 2025.

While leading automotive organizations' sustainability initiatives are gathering pace, we wanted to understand whether current efforts will be sufficient for organizations to meet their goals. To this end, we conducted a survey of more than 1,000 automotive executives, across nine countries and all major functions – from Strategy, Sustainability, Manufacturing, Supply chain, to Marketing, Sales, and Aftersales. We also interviewed 20 automotive experts from a diverse range of countries and functions. More details of the Research Methodology are in the Appendix.



Introduction

In this research, we explore the following questions:

- 01 How much progress have automotive organizations made on sustainability in the last 2-3 years?
- 02 What are the challenges behind the slowdown in implementation of sustainability initiatives?
- 03 What advantages do 'Sustainability Leaders' have over 'Laggards'?
- 04 How can automotive organizations go from ambition to action, and accelerate their transitions to sustainability?



Executive Summary



The automotive industry has shown little progress on sustainability in the past three years:

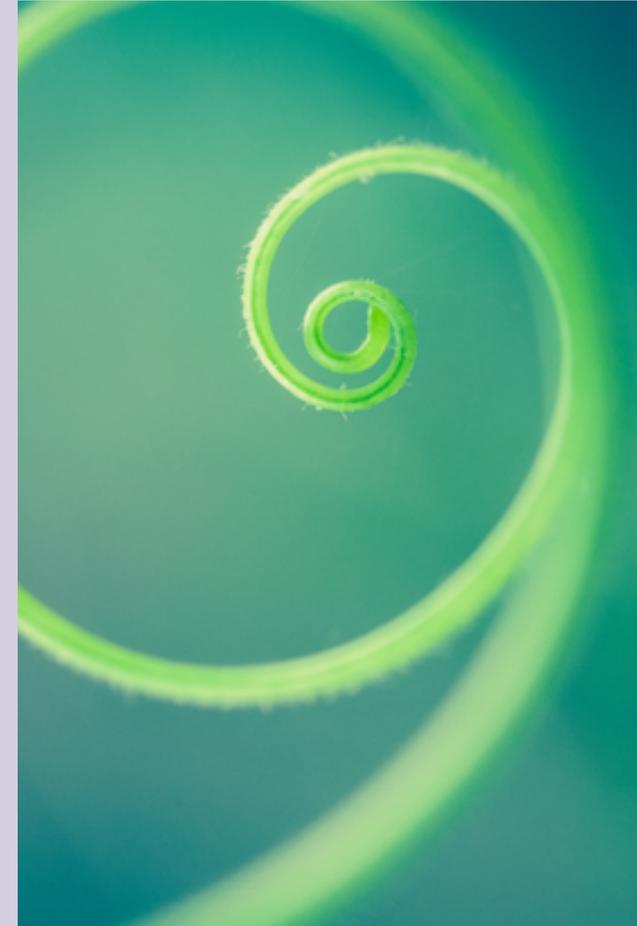
- **Given this slow progress, the industry is not on track to meet the Paris Agreement target:**
 - ▶ Organizational investment as a proportion of revenue has fallen from 1.22 percent in 2019 to 0.85 percent currently; larger organizations are curtailing their spend to a greater extent than are smaller organizations
- **Implementation levels for top sustainability initiatives have either improved only marginally or fallen since 2019**
 - ▶ Deployment has improved only for initiatives on sustainable supply chain and environmentally responsible sourcing of metals
- **Less than 10 percent of automotive organizations are both advanced in their sustainability strategies and have high implementation levels for top initiatives – we call these ‘Sustainability Leaders:**
 - ▶ Sixty-two percent of organizations fall into the Laggards category, who are neither advanced in terms of their sustainability strategy, nor in terms of implementation.

Executive Summary



Several challenges are causing implementation to stagnate:

- **Linking sustainability with day-to-day activities is the biggest hurdle to implementation:**
 - ▶ 73 percent of executives agree that the adoption of sustainability practices in their day-to-day activities and processes has increased only marginally or remained the same in the last 2-3 years
- **Poor integration of key sustainability KPIs into performance management is hampering implementation, especially as we move down the organizational hierarchy:**
 - ▶ Only 10 percent of organizations have aligned performance objectives with key sustainability goals for non-managerial employees
- **Difficulty in collecting, managing, and analyzing sustainability data is one of the top three challenges:**
 - ▶ Only 12 percent of executives say that their organization has full-scale deployment of a platform for measuring, monitoring, and reporting sustainability initiatives



Executive Summary

+ However, a small group of 'Sustainability Leaders' reaps larger benefits:

- **On average, Leaders have already realized 9% improvement, in their emissions since 2018, compared to 5% for the industry:**
 - ▶ Leaders are further expected to meet the Paris Agreement target by reducing their greenhouse gas (GHG) emissions by 35 percent by 2030, compared to an average projected reduction of 19 percent across the automotive industry
- **Leaders also enjoy a stronger employer 'brand' and have seen an 18-percent (versus 10-percent for the rest) boost to their attractiveness to talent owing to their recent sustainability initiatives**



Executive Summary



To accelerate the maturity of sustainability initiatives and prepare to meet regulatory targets, the industry must:

fast-track product and service evolution for the sustainability era:

- Foster innovation in battery and vehicle tech to decarbonize vehicle fleet faster
- create new services and business models to induce mobility-behavior change and build monetization opportunities
- ensure sustainability of EV batteries from sourcing to end-of-life

establish new sustainability processes and enhance traditional ones:

- Integrate sustainability practices into day-to-day activities

- incorporate sustainable design principles to minimize vehicles' environmental footprint
- procure resources in an environmentally responsible manner
- adopt new tools for managing the transition to net zero

put people at the heart of the sustainable transition:

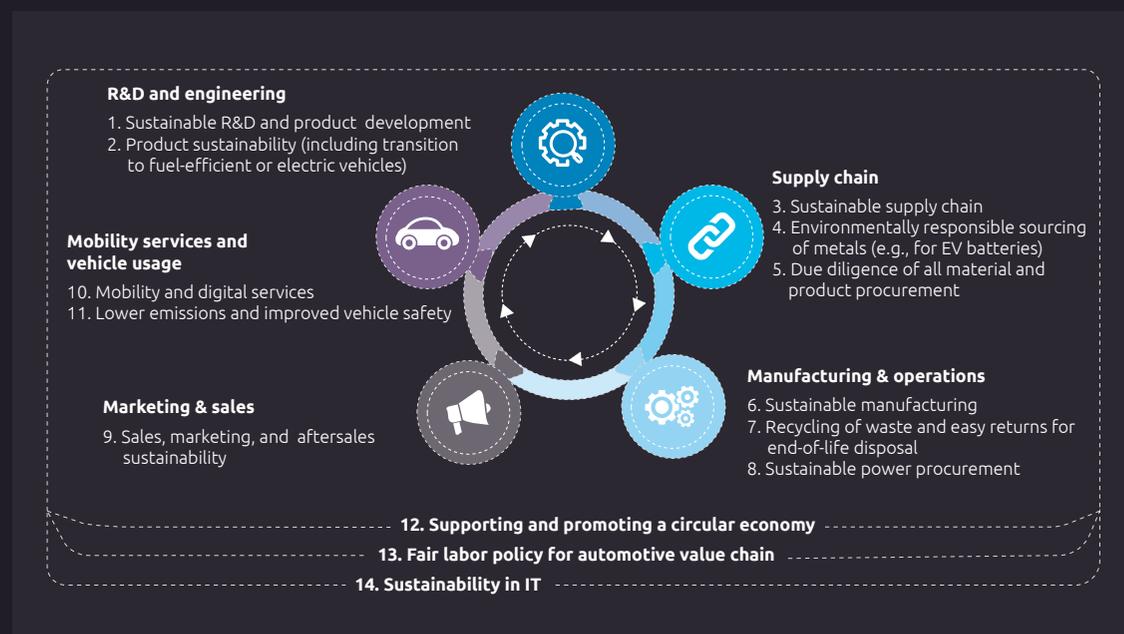
- align organizational objectives with sustainability goals
- upskill the workforce for sustainable practices
- create a culture of collaboration as part of a systemic approach to sustainability

+ What do we mean by sustainability in automotive?

According to the UN, sustainability equates to meeting the needs of the present without compromising the capacity of future generations to meet their needs.⁸ In the automotive industry sustainability includes a comprehensive rethinking of industry standards, introducing and refining environmentally and socially conscious operations, processes, products, and services. We identified 14 elements that the industry is pursuing in the field of sustainability. These elements occur throughout the automotive value chain, from R&D to mobility services. In this research, we have focused on the environmental sustainability aspect of Environmental, Social and Governance (ESG).

Figure.1

Sustainability across the automotive value-chain



Sustainability initiatives in automotive

01

- Sustainable R&D involves designing products to reduce environmental impact and optimizing the use of natural resources by ensuring their recyclability.

02

- Product sustainability involves moving to fuel-efficient or electric vehicles and biodegradable components.

03

- Sustainable supply chain includes adoption of environmentally conscious operations in logistics, distribution, warehousing and inventory management, etc.

04

- Environmentally responsible sourcing of metals, materials and products ensures the mining, extraction and production are implemented with minimum effects to the environment, mitigating long-term impact.

05

- Due diligence of all material and product procurement involves ensuring that all processes and procedures are compatible with human and environmental guidelines and are independently verified.

06

- Sustainable manufacturing involves implementing maintenance, quality, and production processes to reduce waste and improve recyclability and reuse of materials.

07

- Recycling of waste and easy returns for end-of-life disposal involves the consumer being given options to return their vehicles and parts for responsible disposal.

08

- Sustainable power procurement includes activities such as building or leasing renewable energy assets.

09

- Sales, marketing, and after-sales sustainability includes initiatives such as retrofitting to improve emissions and improving efficiencies on older models and refurbishing old components or vehicles.

10

- Mobility and digital services examples include encouraging ride sharing, subscription models, and connected services.

11

- Lower emissions and improved vehicle safety ensuring that the lifetime emissions are accounted during any sustainability initiatives

12

- Circular economy is an industrial or economic system that maximizes the use of resources by being restorative and regenerative by design and intention. It favours re-use of materials instead of the traditional manufacturing cycle of "take-make-use-dispose."

13

- Fair labor policy components include freedom of association and unionizing, work safety, and child labor.

14

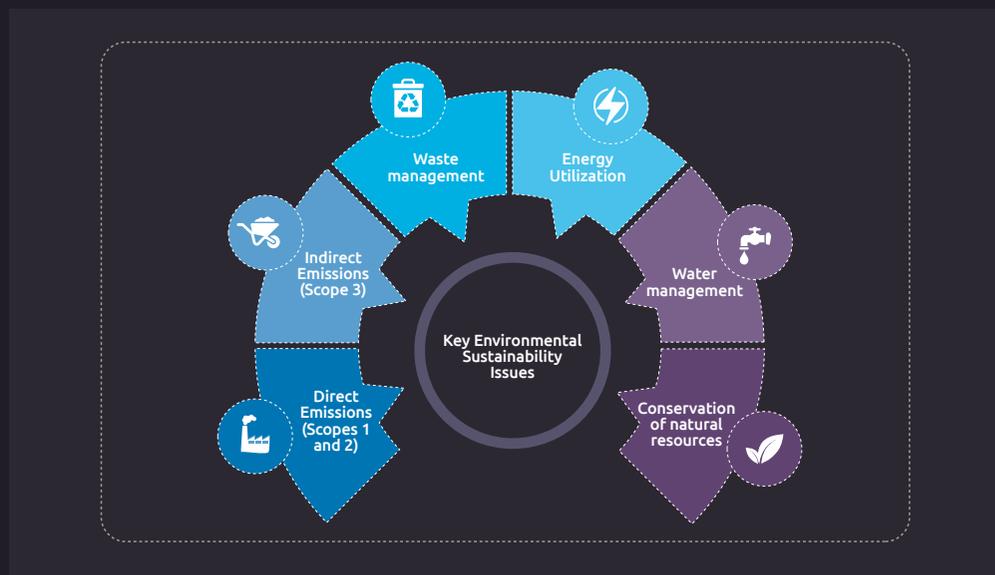
- Sustainability in IT examples include energy consumption in data centers.

Source: Capgemini Research Institute, *The automotive industry in the era of sustainability*, March 2020.

From an environmental sustainability front, we are focusing on the following sustainability issues in our report:

Figure.2

Key issues in environmental sustainability



Emissions: According to the GHG Protocol Corporate Standard, a company's GHG emissions are classified into three "scopes"

Scope 1. Emissions that result directly from the activities of an organization, such as fuel combustion from facilities and vehicles owned or controlled by the organization

Scope 2. Indirect emissions that result from the generation of purchased electricity, steam, heating, and cooling

Scope 3 – upstream emissions. Emissions from other indirect sources in an organization's value chain, such as purchased goods and services, distribution, and transportation

Scope 3 – downstream emissions. Emissions from other indirect sources in an organization's value chain, such as the use of sold products, and end-of-life treatment of sold products

Waste treatment- Includes collection, transportation, processing, and disposal of waste. Waste prevention, recycling, reuse, and recovery are important waste-management strategies that ease the burden on landfills, conserve natural resources, and save energy.¹⁰

Energy utilization- Includes energy optimization, sustainable power procurement, etc.

Water utilization - Using water in a way that meets current ecological, social, and economic needs without compromising society's ability to meet those needs in the future.

Conservation of natural resources – Which includes environmentally responsible sourcing of metals, materials, and products, and due diligence on all material and product procurement.¹¹



The State of Sustainability in the Automotive Industry



Which of the following defines 'sustainability' at your organization?

- 70%** | of organizations focus on overall emission-reduction across their value chain (including scope 1/2/3 emissions) from sourcing to end-of-life
- 57%** | of organizations go beyond ESG compliance and make sustainability a business driver
- 55%** | of organizations focus on emission-reduction by transitioning to an EV fleet

Organizations' primary sustainability goals

- 49%** Achieving net zero emissions in operations
- 28%** Achieving carbon-neutral operations
- 22%** Reducing carbon emissions (e.g., using renewable energy sources, remanufacturing)

35%

Share of organizations planning to achieve this target by 2040

57%

64%

57% of organizations believe there is broad alignment with their suppliers on the definition of sustainability

60% Share of organizations with a dedicated governance body to oversee efforts to meet sustainability objectives





01

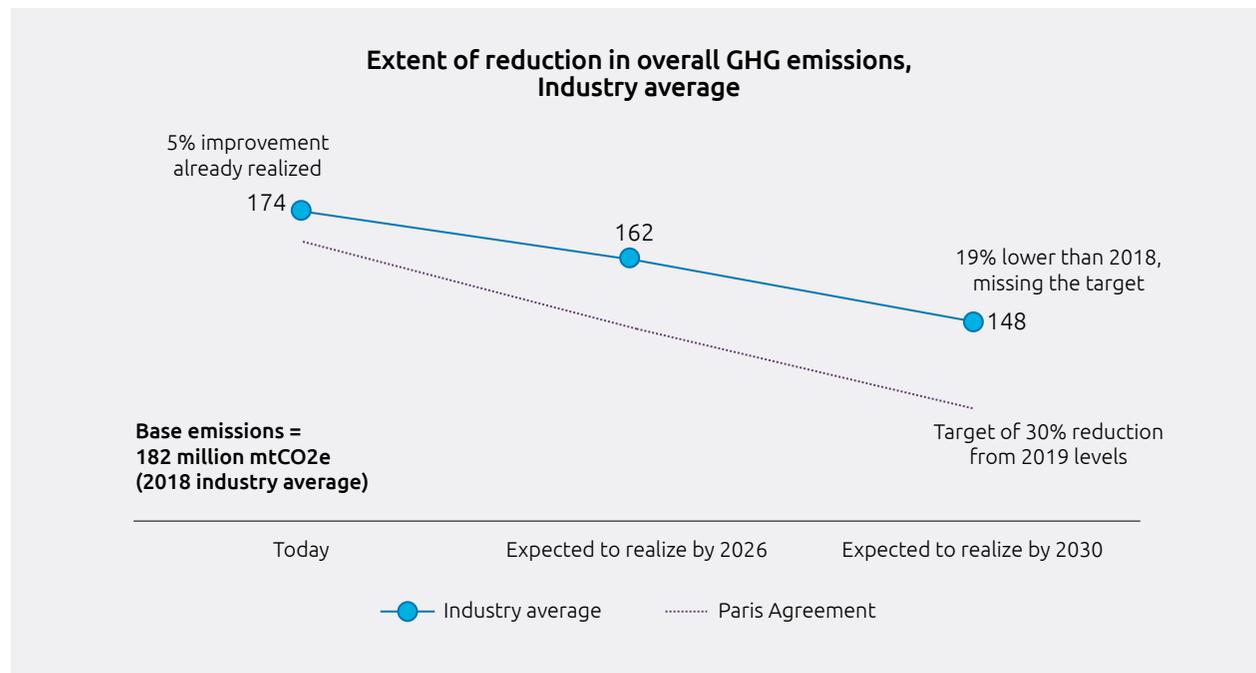
**SINCE 2019
AUTOMOTIVE HAS
SHOWN LITTLE
PROGRESS ON
SUSTAINABILITY**

+ Automotive is falling short of Paris Agreement target

Governments have set aggressive emissions-reduction targets in a bid to spur industry to more concerted efforts. Directives such as The European Green Deal and The Paris Agreement are pushing the automotive industry to pursue more sustainable solutions to meet carbon-neutral targets. At the current level of maturity, the industry will be unable to reduce emissions sufficiently to meet the Paris Agreement target (see Figure 3).

Figure.3

Automotive industry not expected to meet Paris Agreement target



Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=183 automotive organizations, CDP, Bloomberg New Energy Outlook 2021.

Emission numbers are in million mtCO₂e. Industry average = Average of all emissions, including Scope 1, Scope 2, and Scope 3 of 20 large global OEMs for years 2018 and 2021 sourced from CDP (disclosed by OEMs). More on the Methodology in the Appendix.

+ Investment in sustainability initiatives is declining

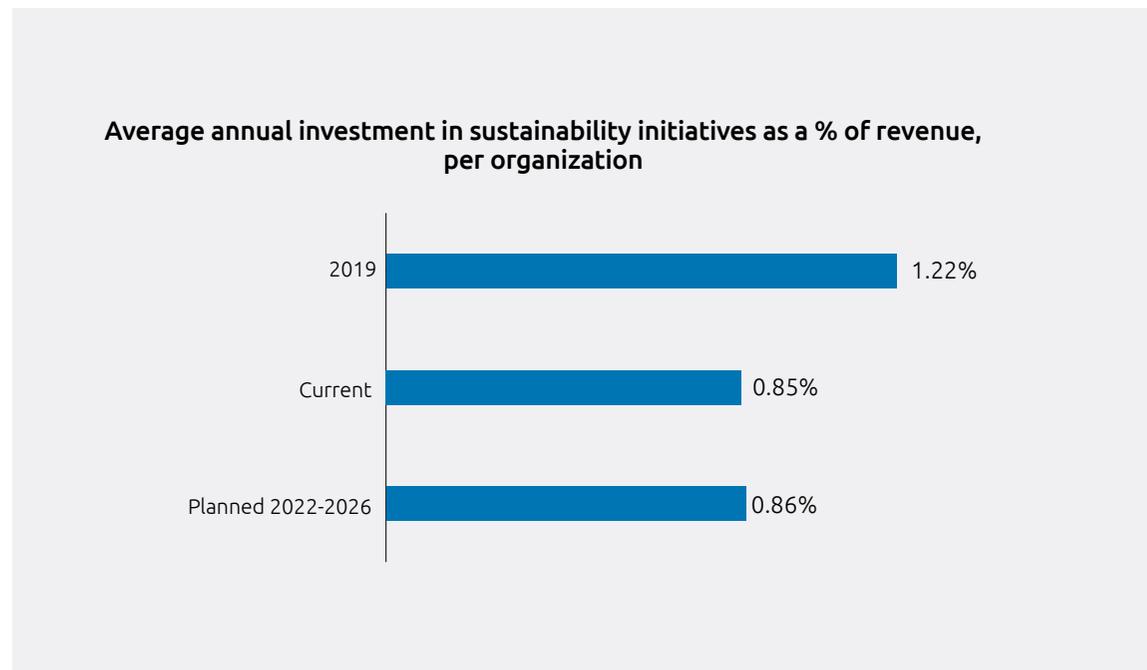
According to our 2019 research, on average, organizations were investing 1.22 percent of their revenue in sustainability initiatives. Our current data shows that this proportion has fallen to 0.85 percent. Moreover, organizations are not planning to increase their spend significantly (see Figure 4).

1.22% vs 0.85%

Average annual investment as a % of revenue in sustainability initiatives in 2019 vs. 2022, per organization.

Figure.4

Yearly investment in sustainability is declining



*Does not include large investments towards EV R&D/design/production/sales and service, etc.

Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=321 executives. Capgemini Research Institute, The automotive industry in the era of sustainability, 2020.

Figure.5

Decline in investment is greater for larger organizations

“Larger organizations are curtailing their spend (as a share of revenue) to a greater extent than the smaller organizations”

Vice President of Safety and Sustainability strategy at a global automotive organization adds: **“A lot of OEMs cannot invest money without showing returns. We have to be very cautious of the projects and initiatives we undertake in order to understand whether they are saving or generating money.”**

A sustainability director of an automotive supplier organization comments: **“In the past few years, investors have been criticized for labeling things as ‘green,’ ‘green investment’ or ‘green initiatives’, when, in reality, very little has been done. Furthermore, these pricing pressures, coupled with supply shortages post-COVID-19 might have led to this investment gap.”**

Interestingly, when we analyzed the evolution of organization investment by size, we found that the larger organizations are curtailing their spend (as a share of revenue) to a greater extent than are the smaller organizations (see Figure 5).

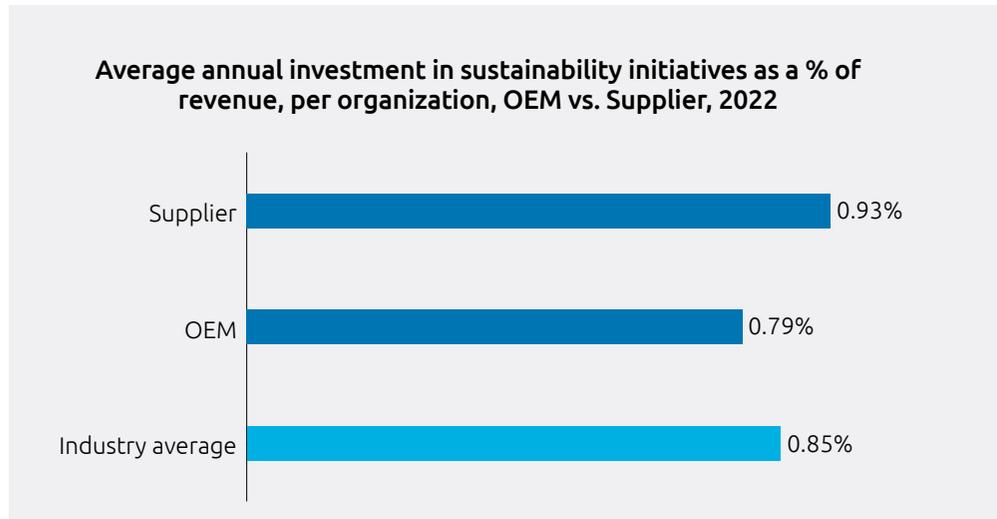


Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=321 executives.
Capgemini Research Institute, *The automotive industry in the era of sustainability*, 2020.

Further, we also found that suppliers invest more (as a share of revenue) than OEMs to meet their sustainability goals (see figure 6).

Figure.6

Suppliers invest more than OEMs in meeting sustainability targets



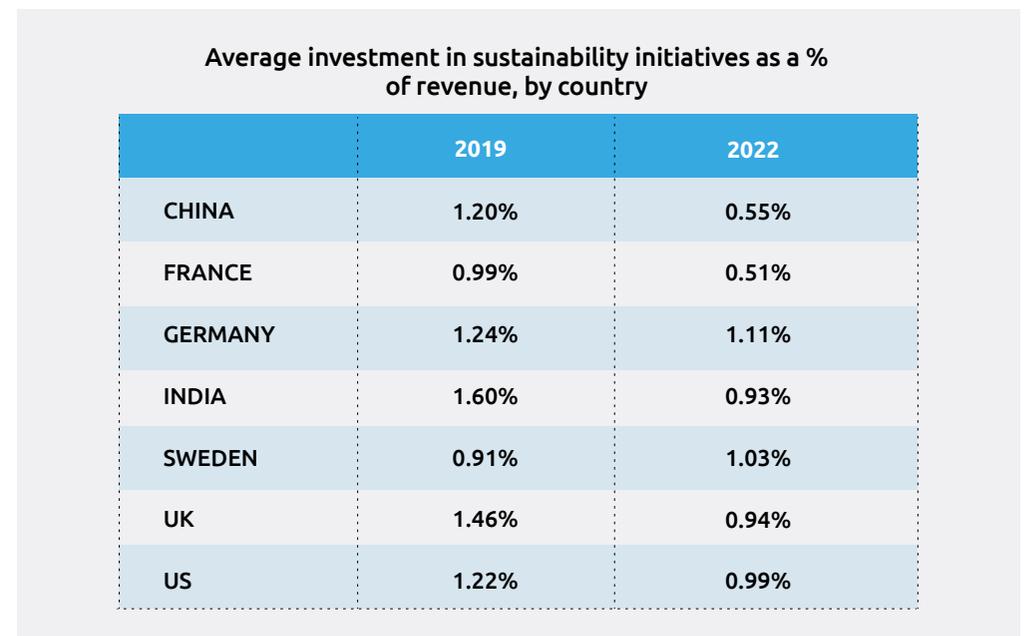
Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=321 executives.

The larger question remains whether the industry can realistically expect to meet its ambitious targets with current and projected levels of investment. In light of ever tightening regulations and rising social expectations, current allocations look insufficient to meet the demands being made of organizations.

Finally, by country, we found that the investments in sustainability initiatives have declined across almost all regions (see table below).

Figure.7

In the past three years, investment in sustainability has declined for most countries



Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=321 executives; Capgemini Research Institute, The automotive industry in the era of sustainability, 2020.

“A lot of OEMs cannot invest money without showing returns. We have to be very cautious of the projects and initiatives we undertake in order to understand whether they are saving or generating money.”

Vice President, Safety and Sustainability strategy at a global automotive organization

+ Organizations have only marginally advanced their sustainability strategies since 2019

The share of organizations with a comprehensive sustainability strategy with well-defined goals has improved by only 3 percentage points compared to 2019 (see Figure 8).

Figure.8

Automotive industry's maturity in sustainability strategy has improved marginally since 2019



Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=1,080 executives.
Capgemini Research Institute, The automotive industry in the era of sustainability, 2020.

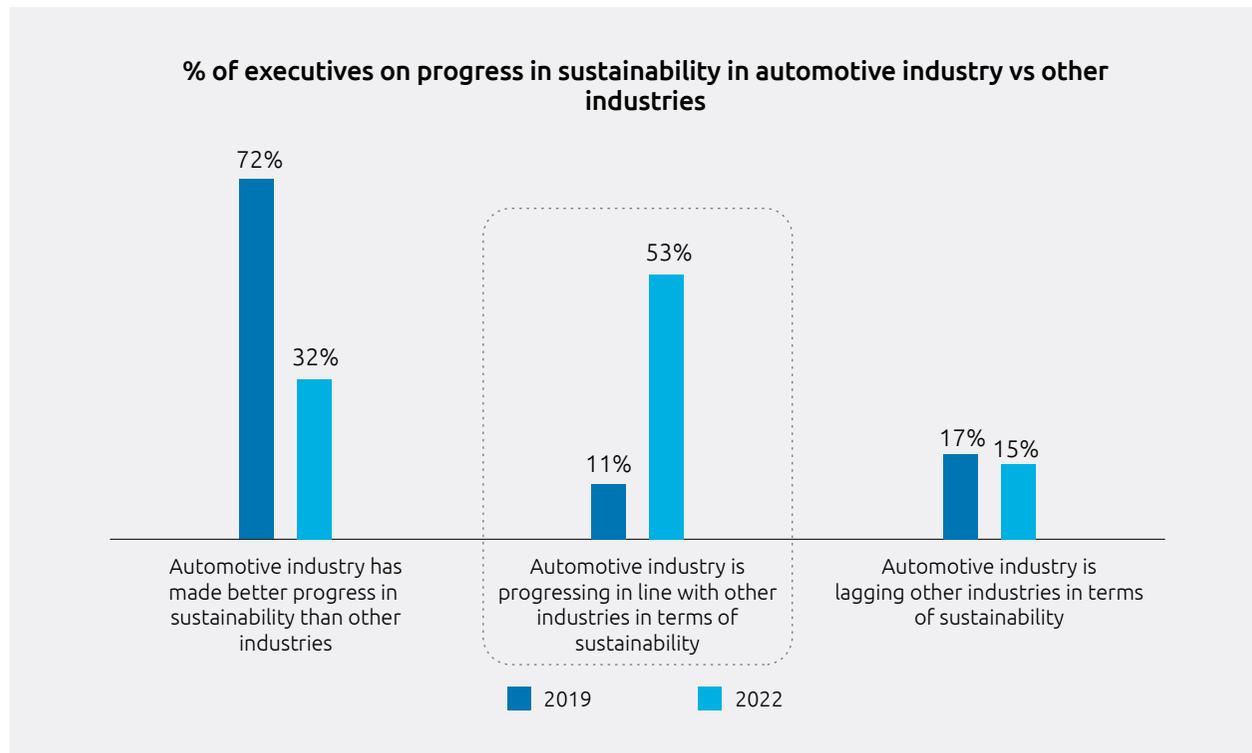
Figure.9

A majority of automotive organizations believe that they are progressing in line with other industries

Further, automotive organizations' assessments of their own sustainability maturity is becoming more realistic. In our 2019 research, 72 percent of organizations believed that automotive had made more progress on sustainability than other industries. However, at present, only 32 percent think this (see Figure 9). By country, we found that 46 percent of respondents from organizations based in South Korea agreed that they have made better progress in sustainability than other industries, whereas only 28 percent from Japan, Sweden, and Germany felt the same.

72% VS 32%

Share of automotive organizations who believe that they have made better progress in sustainability than other industries, 2019 vs. 2022.



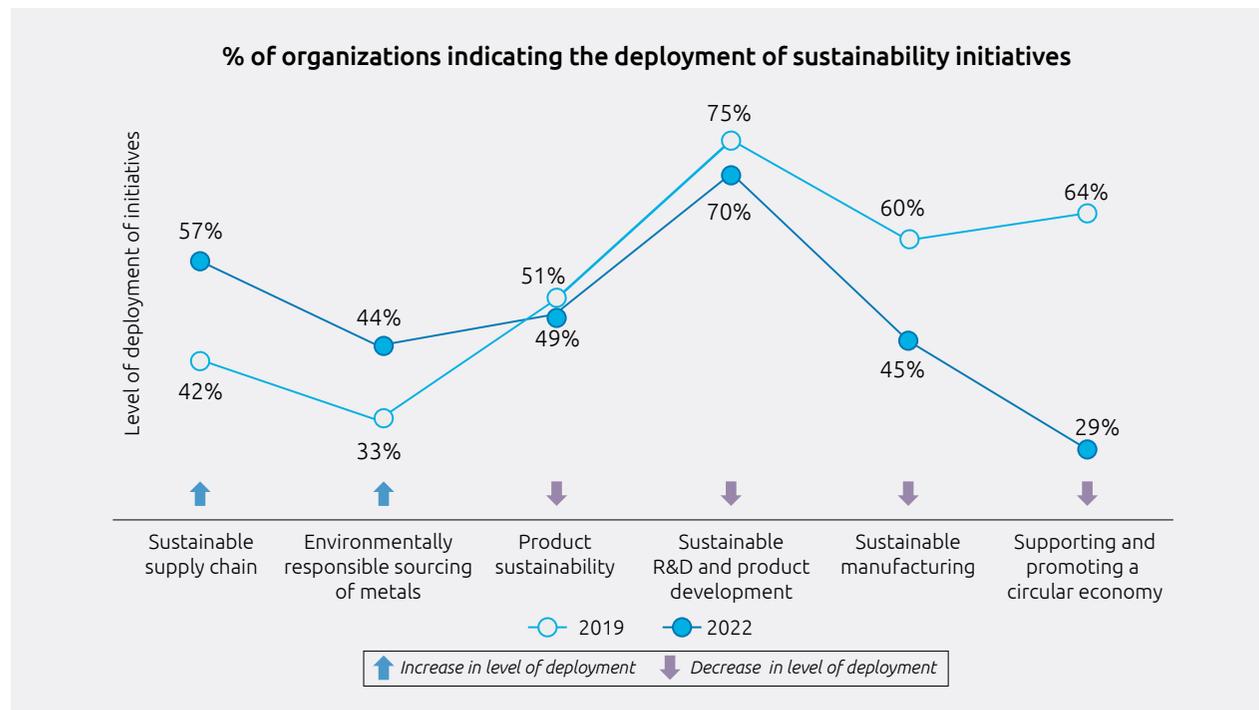
Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=1,080 executives ; Capgemini Research Institute, *The automotive industry in the era of sustainability, 2020.*

+ Implementation of top sustainability initiatives has declined

The growing significance accorded to sustainability does not seem to translate into faster implementation. We found that, for the top automotive sustainability initiatives, there is only limited improvement and, in some areas, a reduction in implementation (see Figure 10):

Figure.10

Deployment of sustainability initiatives has improved in only a few priority areas



For definitions of sustainability initiatives in the chart, please refer page 11.

Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=1,080 executives; Capgemini Research Institute, *The automotive industry in the era of sustainability*, 2020.

Analyzing this trend across countries, we find a huge gap between planning and deployment levels. Certain countries (such as Germany, US, France) were deploying initiatives in areas of sustainable manufacturing to a large extent in 2019, and may have curtailed their implementation, changing their areas of focus (see Figure 11).

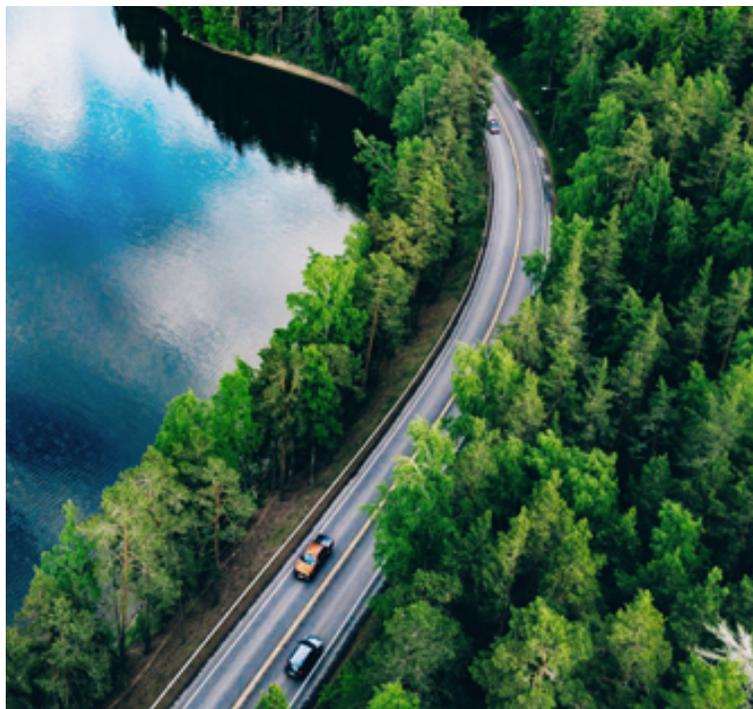


Figure.11

Across countries, there is a high level of misalignment between priority and implementation of sustainability initiatives in manufacturing



Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=1,080 executives.

“In the past few years, investors have been criticized for labeling things as ‘green,’ ‘green investment’ or ‘green initiatives,’ in reality, there has been very little that has been done. Furthermore, these pricing pressures, coupled with supply shortages post-COVID-19 might have led to this investment gap.”

A sustainability director of an automotive supplier organization

Figure.12

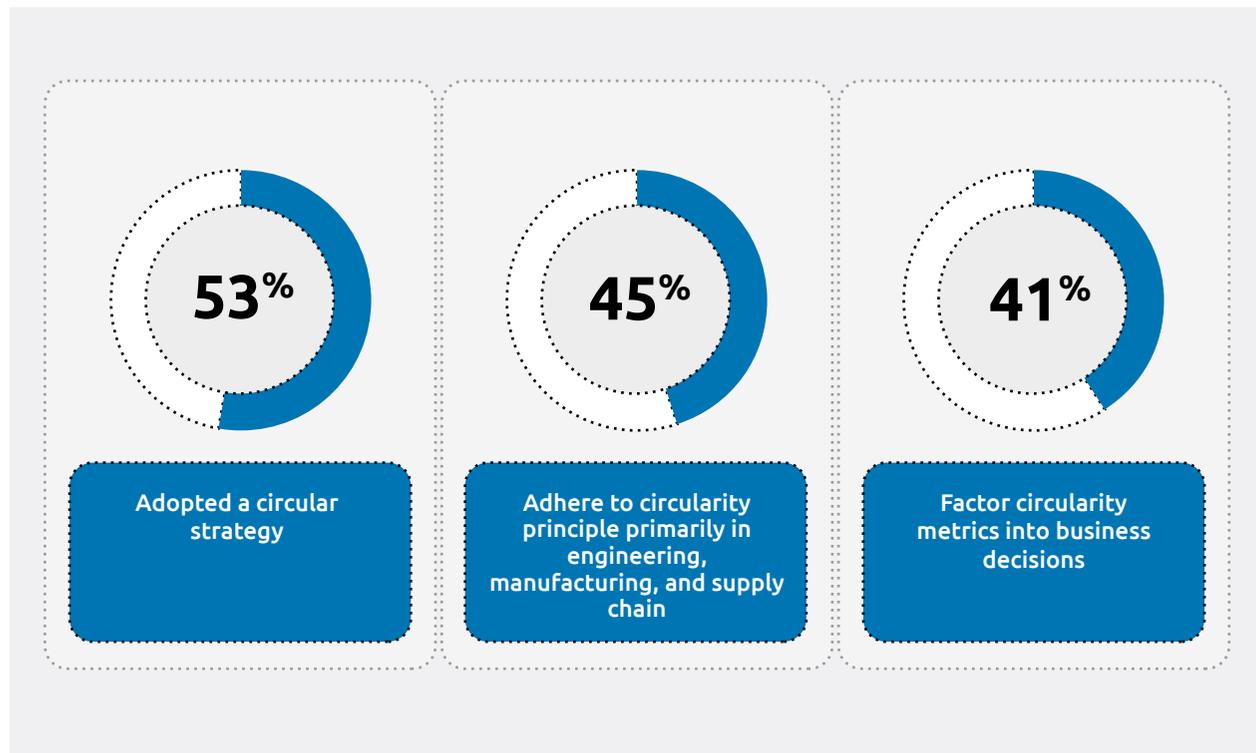
Only 41% of organizations have integrated circularity metrics into decisions

+ Deployment of circular-economy initiatives has fallen

While 73 percent of executives agree that a contribution to the circular economy is necessary to achieve long-term financial and competitive goals, only 53 percent attest to having a circular-economy strategy (see Figure 12).

73%

of executives agree that a contribution to the circular economy is necessary to achieve long-term financial and competitive goals.



Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=1,080 executives.

Figure.13

Highest share of organizations from Japan and South Korea have a circular economy strategy in place

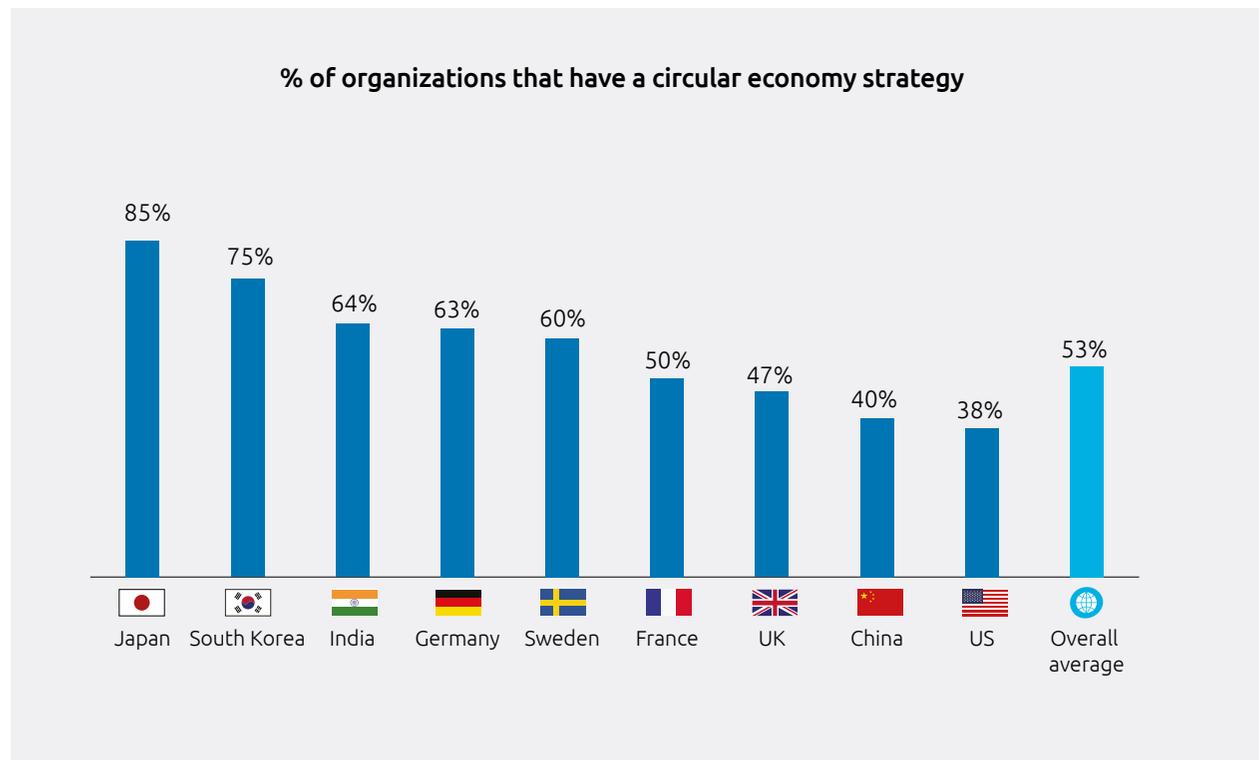
For a country-on-country comparison, 85% of organizations from Japan have a circular strategy, compared with only 38% from the US (see Figure 13). Similarly, South Korea, Japan, and Germany strongly adhere to circularity principles in manufacturing, engineering, and supply chain. Countries such as Japan and South Korea are characterized by a higher landfill cost owing to scarcity of space which, in turn, makes reusing and recycling of materials economically more attractive.

85%

of organizations from Japan have a circular strategy.

38%

of organizations from the US have such a strategy.



Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=162 organizations.

Head of Innovation & Digital Transformation at a global automotive organization mentions the difficulties in implementing circularity due to lack of proper tools: ***“The automotive industry might have overestimated the potential of closed-loop recycling. However, we have realized the importance of a wider range of tools and technologies, and we have become more realistic.”*** Suppliers also look to OEMs to support their circularity initiatives. Dr. Saul Reichman,

Global Director, Innovation & Corporate Venturing at Maxion Wheels, adds: ***“By and large, the automotive industry is still taking a “wait and see” approach towards circularity and carbon neutrality. OEMs and suppliers will not achieve transformative change by acting alone or being constrained to their business boundaries. Instead, a collaborative approach encompassing cross-value chain partnerships across the entire ecosystem is needed to drive down total lifecycle carbon emissions.”***

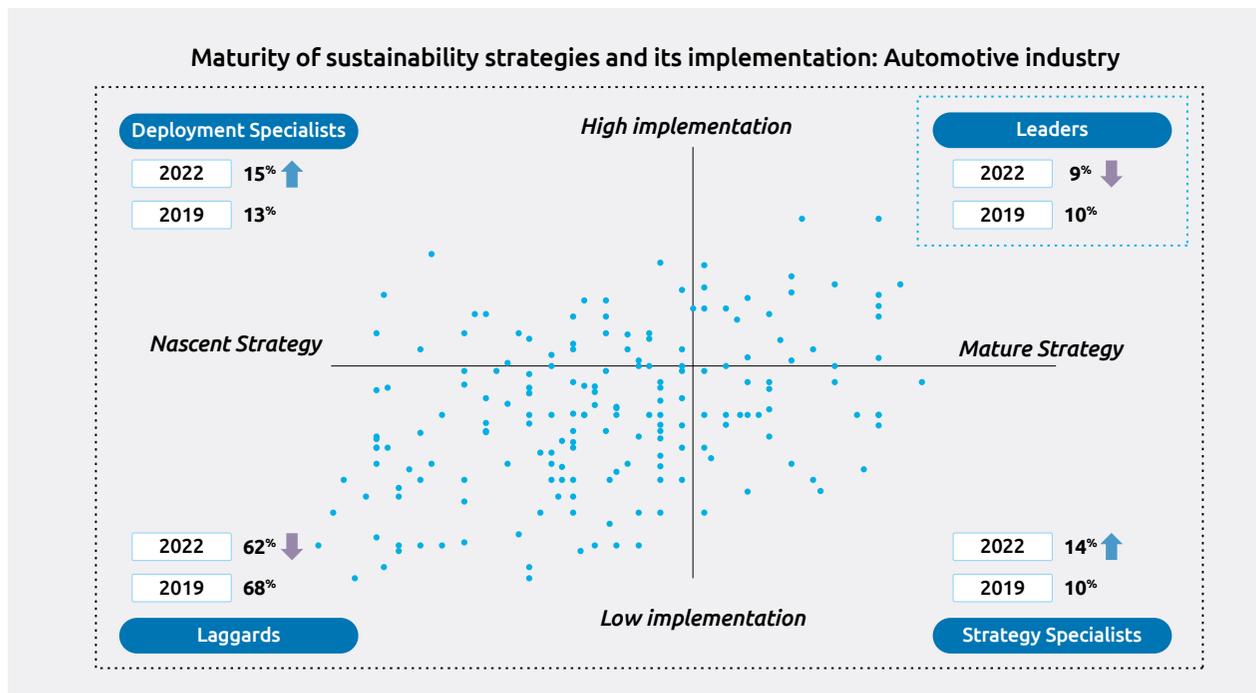


+ Less than 10% of organizations are mature in their sustainability strategies and implementation

Our research indicates that overall maturity of sustainability initiatives in automotive, on both strategy and implementation fronts, has sat still since 2019. Upon comparing the current maturity of organizations' sustainability strategies against their level of implementation, we observed that: while the proportion of Laggards has decreased overall, the proportion of Leaders (those who have an advanced strategy as well as a high level of implementation) has remained broadly unchanged since 2019 (see Figure 14). This indicates that automotive organizations have been able to progress on sustainability in isolated areas of strategy or implementation, but rarely to make coordinated progress in both areas at once.

Figure.14

Automotive organizations have improved sustainability maturity only marginally since 2019



*Each dot represents one organization, and the placement of the dot corresponds to the comparative maturity of the organization in both strategy and implementation of sustainability. The percentages represent the share of organizations in each quadrant.
Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=183 automotive organizations (including OEMs and suppliers); Capgemini Research Institute, *The automotive industry in the era of sustainability, 2020*.

+ WHO ARE THE LEADERS ON SUSTAINABILITY?



We looked for specific characteristics in two facets of sustainability when identifying Leader organizations:

01

On the strategy front, Leaders:

- have a comprehensive sustainability strategy
- prioritize most or all of the top industry sustainability initiatives
- and establish leadership and governance for planning and overseeing sustainability

02

On the implementation front, Leaders:

- deploy initiatives in most or all of the top sustainability areas
- invest heavily in sustainability
- and are committed to specific sustainability targets

For the purpose of comparison with the 2019 data, we have omitted organizations from Japan and South Korea from the current sample, as they were not part of the 2019 study.

In particular, OEMs have advanced their strategies in the past three years, with the proportion of Strategy Specialists increasing from 9 percent in 2019 to 17 percent in 2022; however they have struggled with implementation. Emphasizing the importance of an all-encompassing sustainability strategy, Richard Leopold, Regional Director at Bentley Motors, says: ***“As a luxury manufacturer, to remain relevant in the future, we had to develop a new vision that secures sustainability, not just in our products, but also across our entire supply chain.”***

In contrast, suppliers have been able to increase considerably their implementation of sustainability initiatives since 2019, with the share of Deployment Specialists increased from 11 percent to 20 percent in 2022. Nevertheless, they have generally failed to increase the robustness of their strategies and governance (further details on the OEMs and suppliers analysis in the Appendix).

Amid heightened regulatory requirements, automotive suppliers have little choice but to make their components more sustainable. Nolian Diaz, Director of Product Positioning at Fisker, an EV automaker based in the US, adds: ***“We pick suppliers that have manufacturing facilities close to us and have adopted more sustainable practices that minimize our carbon emissions.”***

“By and large, the automotive industry is still taking a “wait and see” approach towards circularity and carbon neutrality. OEMs and suppliers will not achieve transformative change by acting alone or being constrained to their business boundaries. Instead, a collaborative approach encompassing cross-value chain partnerships across the entire ecosystem is needed to drive down total lifecycle carbon emissions.”



Dr. Saul Reichman,
Global Director, Innovation
& Corporate Venturing at
Maxion Wheels

Further, large automotive OEMs are already preferring more sustainable suppliers –

01

Ola Källenius, CEO of Mercedes-Benz, states that sustainability will be an awarding criterion for all its supplier contracts.¹²

02

BMW has already entered into more than 400 contracts with its suppliers to use 100 percent green electricity.¹³

03

Toyota has launched its own Green Purchasing Guidelines to prioritize the purchase of parts with a low environmental footprint.¹⁴

As a luxury manufacturer, to remain relevant in the future, we had to develop a new vision that secures sustainability, not just in our products, but also across our entire supply chain.



Richard Leopold,
Regional Director at
Bentley Motors

+ EVOLUTION OF TOP FOCUS AREAS FOR SUSTAINABILITY IN THE PAST THREE YEARS

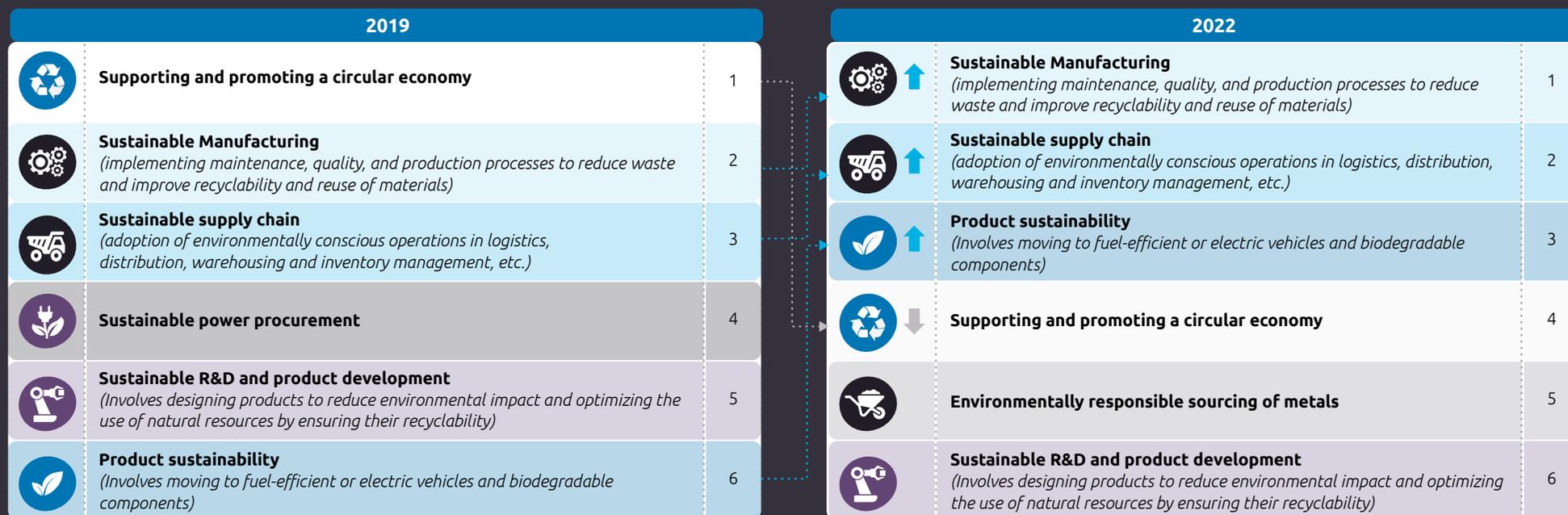
Sustainable manufacturing and supply chain are the biggest focus areas for automotive organizations today (and were among the top three focus areas in 2019). In addition, the focus on product sustainability (including the transition to EVs) has increased significantly, moving up by three places since 2019 (see Figure 15).

To address the adverse impact on supply chain, organizations are focusing on responsible sourcing of metals. While the circular economy was automotive's top sustainability focus in 2019, it has fallen to fourth place, while the focus on sustainable R&D remains more or less at the same level.



Figure.15

How automotive industry's top-ranked sustainability priorities have evolved: 2019-22



Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=1,080 executives.
Capgemini Research Institute, The automotive industry in the era of sustainability, 2020.

“We pick suppliers that have manufacturing facilities close to us and have adopted more sustainable practices that minimize our carbon emissions.”

Nolian Diaz

Director of Product Positioning
at Fisker, an EV automaker
based in the US

Organizations today, are focusing on emissions reduction, prioritizing initiatives over which they have direct control – such as manufacturing and decarbonizing vehicle fleets – and which have a direct bearing on their sustainability targets. However, in the wake of upcoming stricter regulations, such as the Supply Chain Due Diligence Act in EU, organizations will need to increase their focus on circularity and ensure that environmental and social standards are observed across their value chains, including direct and indirect suppliers, their own operations, and suppliers of products and services.¹⁵



“As a luxury manufacturer, to remain relevant in the future, we had to develop a new vision that secures sustainability, not just in our products, but also across our entire supply chain.”

Richard Leopold,
Regional Director at Bentley Motors



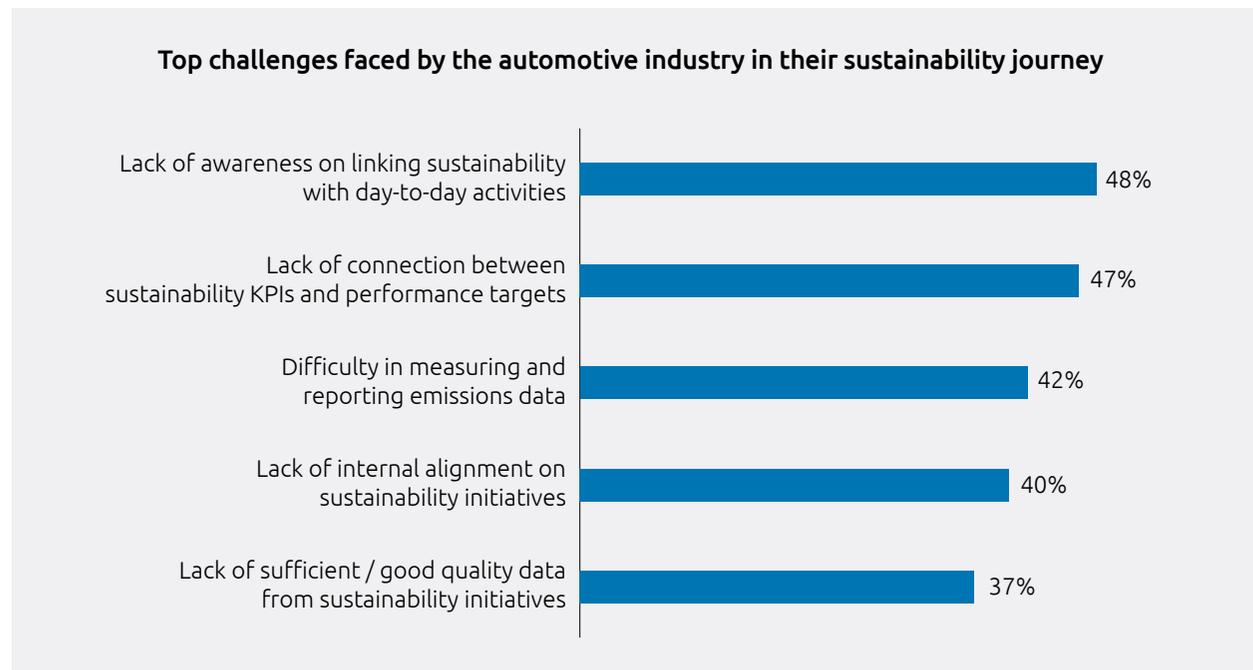
02

CHALLENGES TO SUSTAINABILITY INITIATIVES

There are several challenges facing the automotive industry in its pursuit of sustainability (see Figure 16), which we will discuss later in the report.

Figure.16

Linking sustainability with day-to-day activities and misalignment of KPIs and performance targets are major roadblocks



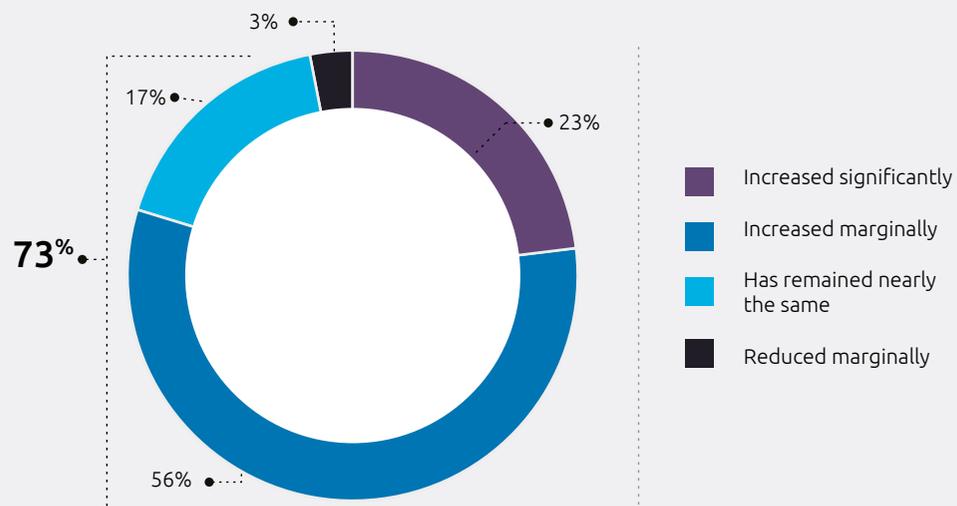
Executives cite a lack of awareness as to how to link sustainability with day-to-day activities as the top challenge (48 percent agree). More than seven in 10 executives (73 percent) attest that the adoption of sustainability practices in their day-to-day activities and processes has increased only marginally or remained the same in the last 2-3 years (see Figure 17).

Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=1080 executives.

Figure.17

Adoption of sustainability practices in day-to-day activities has increased only marginally or remained the same in the past 2-3 years

How has the adoption of sustainability practices in day-to-day activities and processes changed in the last 2-3 years?



Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=1,080 executives.

A director of sustainability at an automotive supplier firm comments: *“One of the key challenges we face is in translating sustainability goals into our day-to-day operations. To tackle this, we are building these goals into our KPIs, and we track them on a monthly basis. We also reward company-wide and group-wide facilities that have come up with better ways to improve our current operations and functions.”*

73%

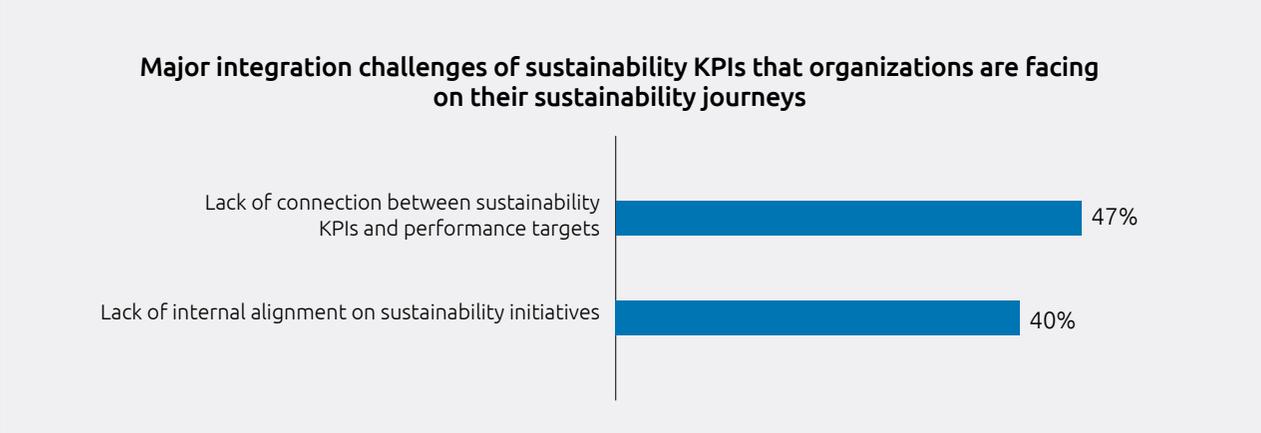
of executives attest that the adoption of sustainability practices in their organization’s day-to-day activities and processes has increased only marginally or remained the same in the past 2-3 years.

Figure.18

Lack of alignment of KPIs and performance management a key challenge

+ Poor integration of key sustainability KPIs into performance management is hampering implementation

Lack of a connection between sustainability KPIs and performance targets, and lack of internal alignment on sustainability, emerge as critical challenges to organizations.



Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=1,080 executives.



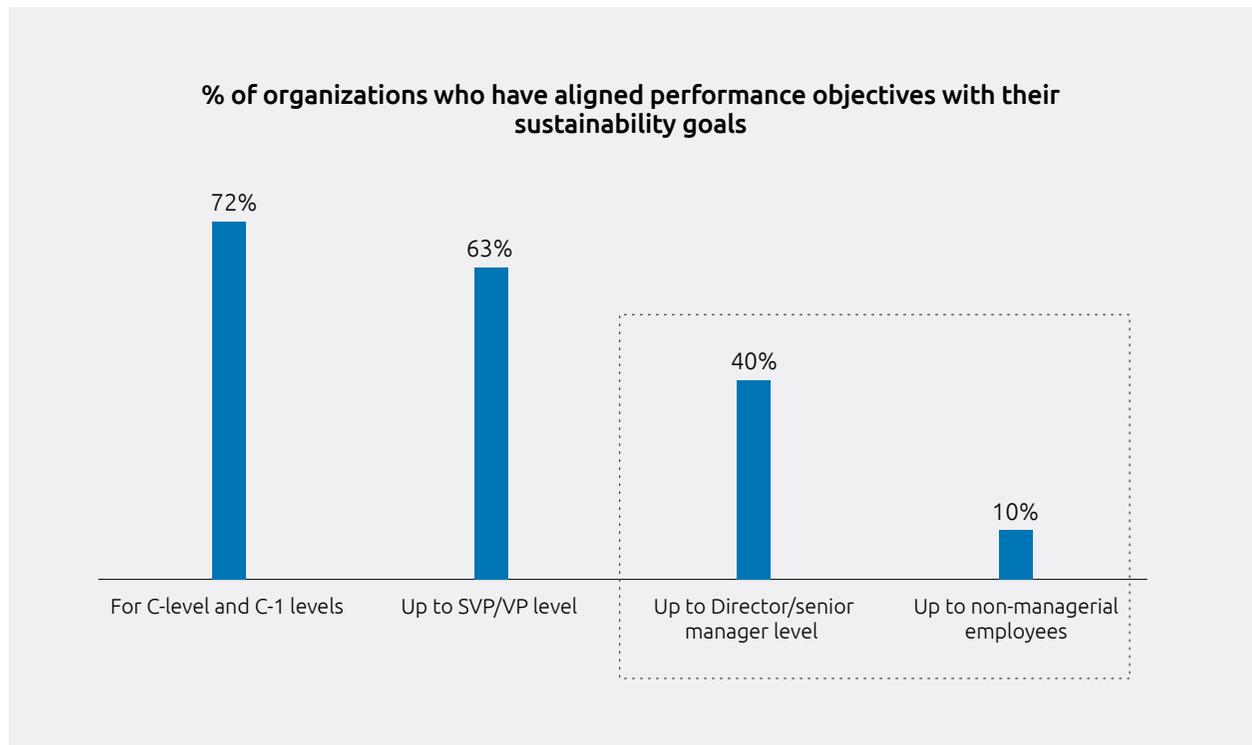
Figure.19

Organizations have not sufficiently aligned performance objectives with sustainability goals

At the highest level, organizations, at least to some extent, align performance objectives with sustainability goals. However, moving down the hierarchy, we note an absence of this alignment (see Figure 19):

- 40 percent of executives say that their organizations have aligned their performance objectives up to director/senior manager level, but a mere 10 percent agree that they are aligned for up to non-managerial employees
- Only Japan (26%), India (16%) and Germany (14%) have attested to aligning more than 10% of the performance objectives at non-managerial levels

Since the actions of non-managerial employees can be extremely impactful on sustainability, this lack of alignment results in sustainability failing to progress at the desired level.



Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=378 executives.

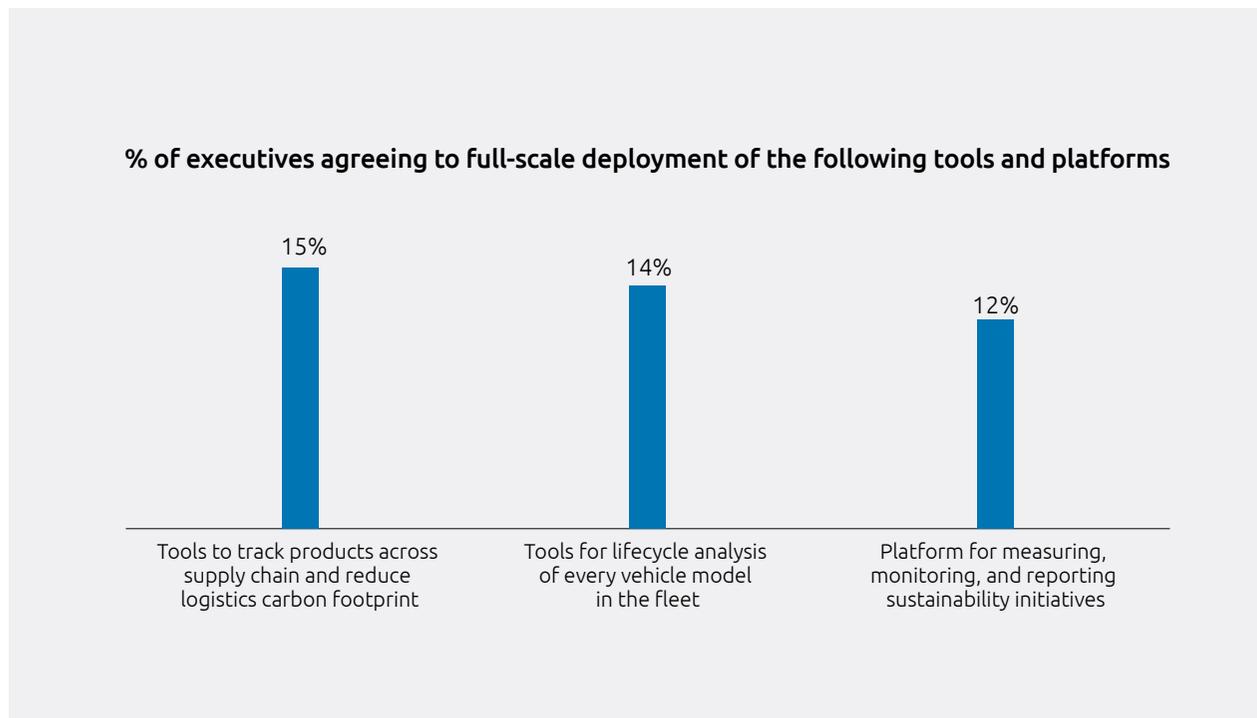
+ Lack of tools for data collection and management a key hindrance

Organizations are under pressure to capture, monitor, and analyze sustainability data effectively. One of our recently published reports finds that, through embedding emissions data in their decision-making, organizations across industries have seen an average 4.6 percent annual reduction.¹⁵

However, difficulty in measuring and reporting emissions data is one of the top three challenges for the automotive industry; for instance, only 12 percent of executives say that their organization has full-scale deployment of a platform for measuring, monitoring, and reporting sustainability initiatives (see Figure 20).

Figure.20

Organizations struggle in collecting, managing, and analyzing sustainability data



Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=108 executives.

Finally, there is also a shortage of the human skills required to make sense of the sustainability data and further integrate it into decision making. We found that only 13 percent of executives say that their business teams are “highly equipped” – while 31 percent say they are only “moderately equipped” to use emissions data to drive decision-making.¹⁷

12%

of executives say that their organization has full-scale deployment of a platform for measuring, monitoring, and reporting sustainability initiatives

“One of the key challenges we face is in translating sustainability goals into our day-to-day operations. To tackle this, we are building these goals into our KPIs, and we track them on a monthly basis. We also reward company-wide and group-wide facilities that have come up with better ways to improve our current operations and functions.”

Director of sustainability at an automotive supplier firm





03

**SUSTAINABILITY
LEADERS
DERIVE HIGHER
BENEFITS**

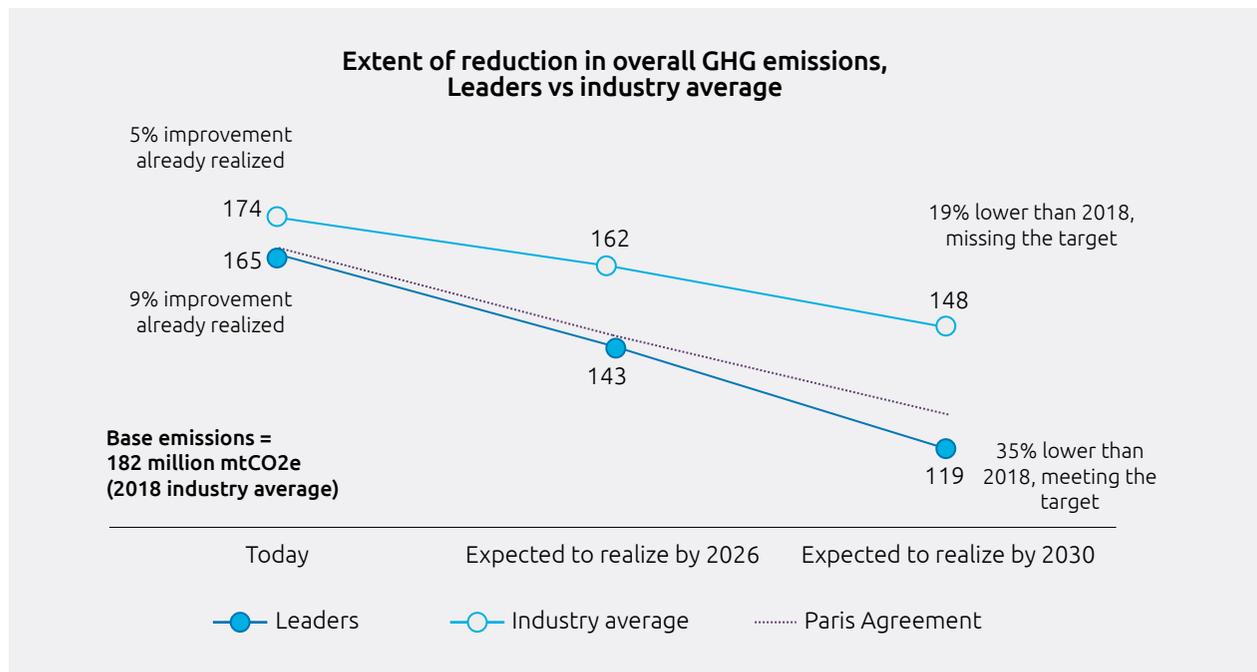
Our research also finds that sustainable initiatives contribute positively to business KPIs. We found that Sustainability Leaders (as defined in Chapter I) have realized (and expect to realize) larger benefits as a result of their sustainability initiatives.

+ Sustainability Leaders are reducing their GHG emissions faster

As we saw in Chapter I, based on current maturity, the automotive industry is not expected to meet the Paris Agreement target. However, with more mature strategies and more effective implementation in key focus areas, Leaders are reducing their GHG emissions much faster than the industry average. As a result, they are much better aligned with the Paris Agreement target of 30 percent reduction in GHG emissions by 2030 from 2019 levels (see Figure 21).¹⁸ (The Methodology behind this calculation is in Appendix.)

Figure.21

Leaders are expected to meet the Paris Agreement target



Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=183 automotive organizations, CDP, Bloomberg New Energy Outlook 2021. Emission numbers are in million mtCO₂e. Industry average = Average of all emissions, including Scope 1, Scope 2, and Scope 3 of 20 large global OEMs for years 2018 and 2021 sourced from CDP (disclosed by OEMs).

One of the sustainable ways in which organizations can reduce emissions is by using lighter materials. Volkswagen uses hot-formed components from sheet metal with different thicknesses at various points, eliminating 100 kg of a new model's weight. Similarly, by switching to aluminum bodywork for some models, Ford has reduced overall weight by over 360 kg.¹⁹



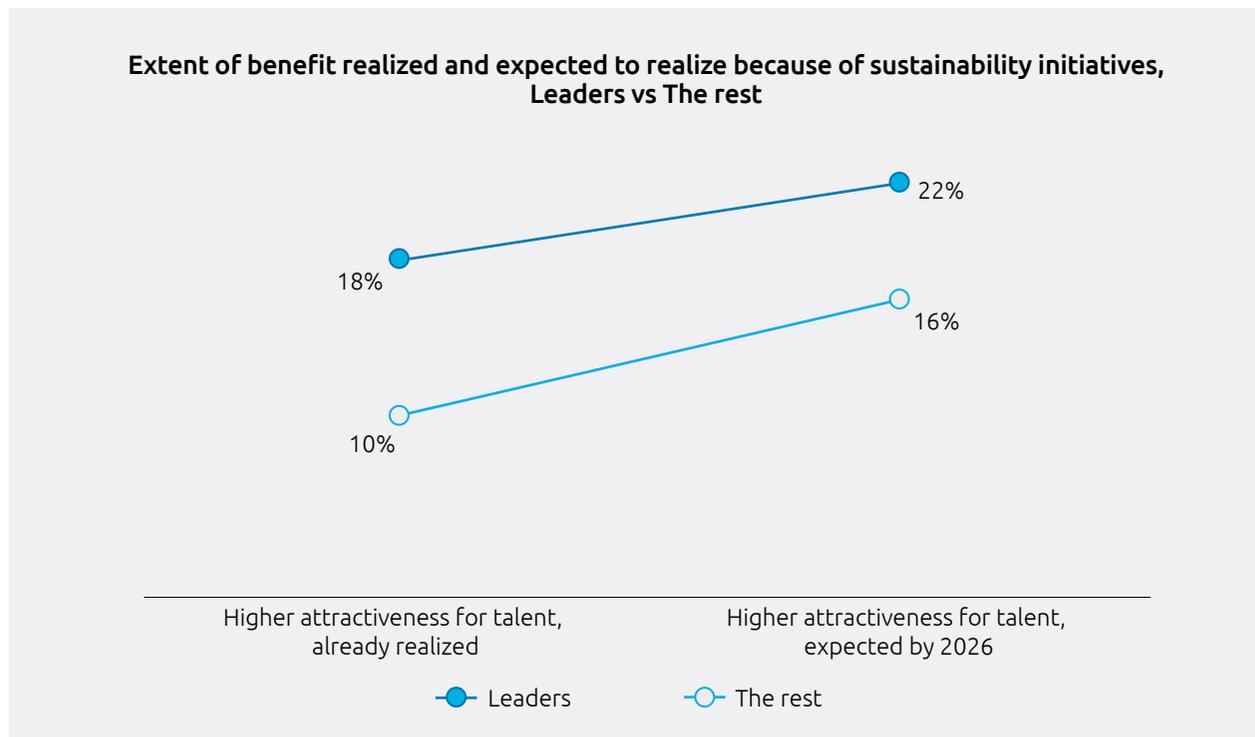
+ Sustainability Leaders have better employer brand image and higher attractiveness for talent

The workforce today, especially the younger generation, prioritize sustainability over other factors when determining the attractiveness of a job.²⁰ Our previous research revealed that 78 percent of employees working in the automotive industry feel that it is important that their organizations have a clear vision and lead with purpose, and not be motivated solely by sales and profit.²¹

We find that Leaders, by being perceived as more sustainable, are able to attract more talent than the rest of the organizations (see Figure 22).

Figure.22

By demonstrating sustainable initiatives, Leaders attract more talent



Martin Charter, Professor of Innovation and Sustainability and Director of The Centre for Sustainable Design at the University for the Creative Arts in the UK, emphasizes: *"The new green consumer wave post COVID-19 is different from the past, since it is not just about climate change, but also biodiversity, nature, and the social dimension of sustainability. Organizations will need to focus on these dimensions to engage younger, more proactive generations as they move into consumer and employee roles."*²²

35% vs 19%

Reduction in GHG emissions by 2030, from 2018 levels, for Leaders vs the rest

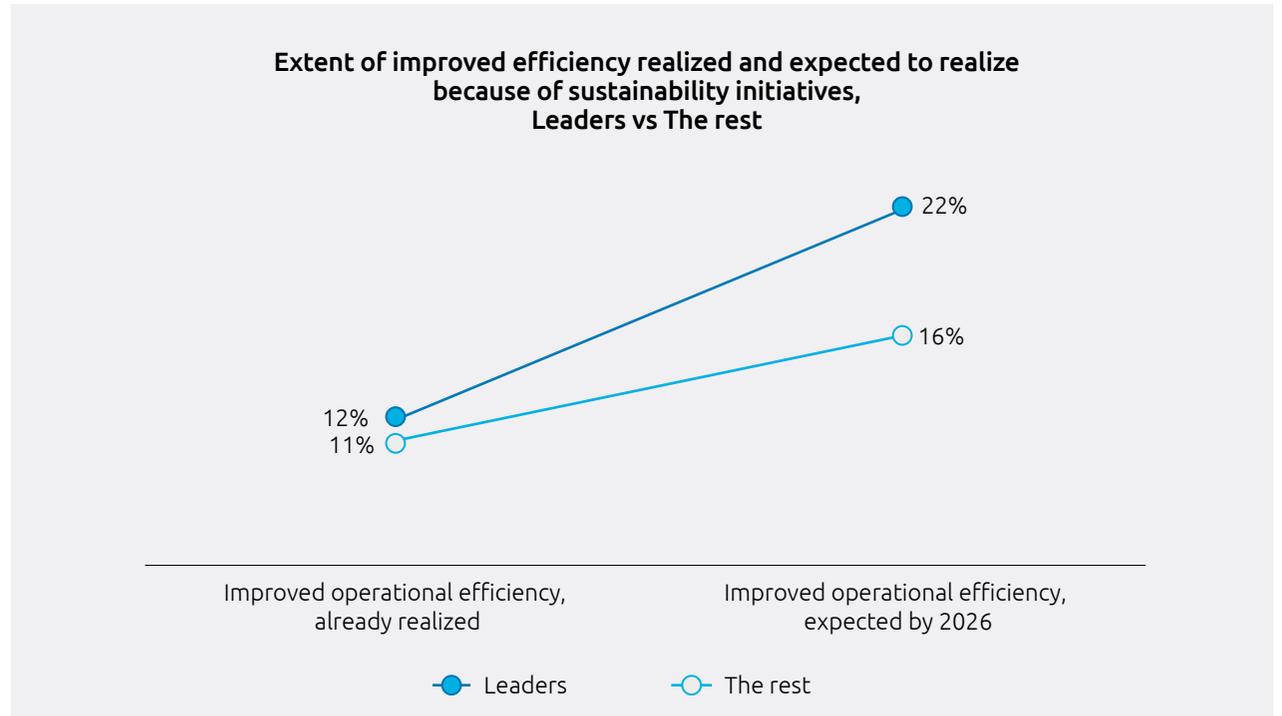
Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=183 automotive organizations.

+ Sustainability Leaders are improving operational efficiency

As sustainability improves transparency across the automotive value chain, it also boosts operational efficiency. Leaders, by virtue of being more sustainable, can also expect greater efficiency-related benefits, of 22% improvement on average through 2026, compared to 16% for the rest (see Figure 23).

Figure.23

Leaders are expected to see a greater boost to their operational efficiency



Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=183 automotive organizations.

“The new green consumer wave post COVID-19 is different from the past, since it is not just about climate change, but also biodiversity, nature, and the social dimension of sustainability. Organizations will need to focus on these dimensions to engage younger, more proactive generations as they move into consumer and employee roles.”

Martin Charter

Professor of Innovation and Sustainability and Director of The Centre for Sustainable Design at the University for the Creative Arts in the UK

A strategy director at an automotive organization comments: *“We are introducing more and more sustainable methodologies because they lead to a greater operational efficiency throughout the product lifecycle.”*

Some examples of sustainability initiatives which have helped organizations enhance their efficiency are:

- at the **BMW Group** plant in Dingolfing, Germany, through the development of new battery and electric engine technology, energy and water consumption per vehicle has been cut by more than one-fifth;²³
- **Renault** is replacing its traditional auto manufacturing plant in Flins, France, with recycling and reconditioning activities, which has resulted in improved operational efficiency. This program is expected to decrease the time required to prepare a used car for resale from 21 to 8 days.²⁴

+ ELECTRIC VEHICLES – NECESSARY BUT NOT ENOUGH

According to the International Energy Agency (IEA), EV sales doubled, year on year, in 2021, to reach 6.6 million.²⁵ A healthy dose of government incentives has helped accelerate this adoption.

We found that implementation of battery sustainability of EVs falls as the lifecycle progresses.

EV battery sustainability falls throughout lifecycle

However, looking at our survey data, we see that organizations are deploying initiatives in areas of battery manufacturing and material sourcing, but that the level of deployment is reducing as we go down the value chain (see Figure 24). This reduction is underpinned by several factors such as low volume of batteries leading to limited market for second-life or end-of-life batteries; high cost of logistics for collecting and recycling used batteries; and lack of consumer-friendly initiatives for battery disposal and recycling.

[Read more on EV battery manufacturing in the next chapter: “Ensuring sustainability of production and end-of-life of EV batteries.”]

EV manufacturers are failing to tap into these later stages, which are crucial to perpetuating the circular economy. Fewer than half (41 percent) of the executives we surveyed said that their organization has a dedicated sustainability initiative for battery end-of-life, while the number is even lower (28 percent) for the second life of batteries.

OEMs need to increase their EV-battery production capacities and develop a battery ecosystem that incorporates the second-life and end-of life stages of the battery lifecycle.



Figure.24

Implementation of battery sustainability reduces across the lifecycle stages



Sumreen Rattan, Co-founder and COO at Moment Energy, says: ***“ By first repurposing and creating a second-life application appropriate to its stage of degradation, we extend the battery’s useful life and increase the capacity of clean-energy storage worldwide.”***²⁶

28%

of the executives said that their organization has a dedicated sustainability initiative for battery second-life options

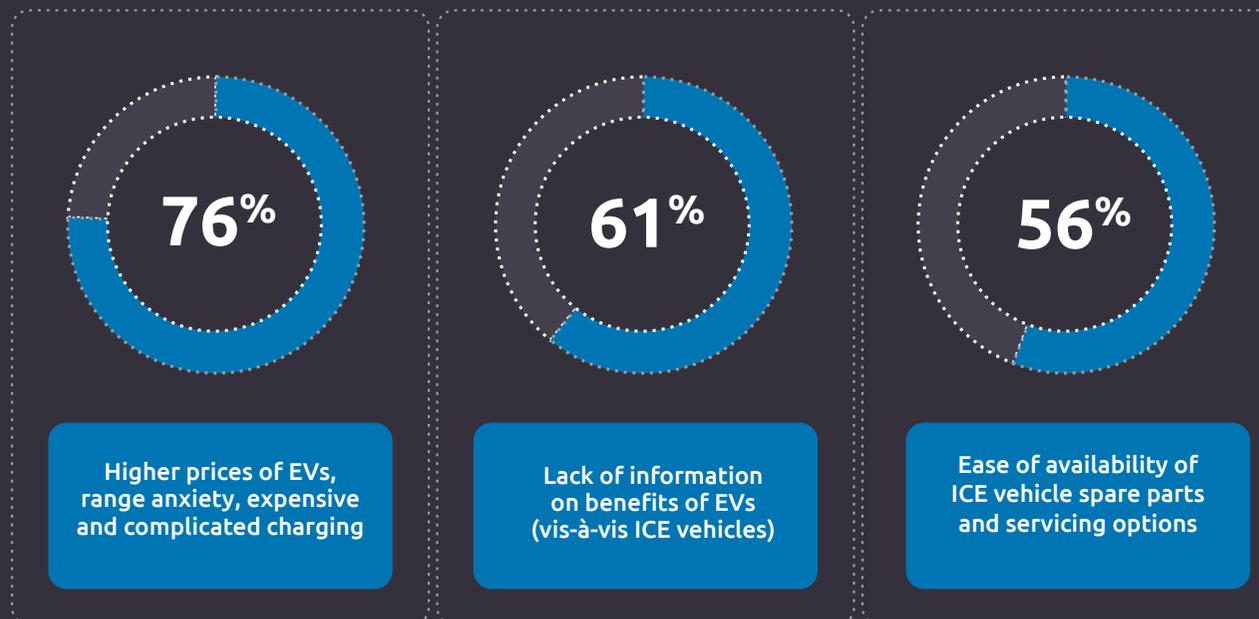
Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=369 executives.

Figure.25

Higher prices of EVs and range anxiety are major roadblocks in customer adoption

Higher cost, complicated charging infrastructure and insufficient benefits information are the biggest hurdles to EV adoption

Despite increasing sales of EVs, customers are reluctant to switch to electric (see Figure 25). For instance, 76 percent of executives attest to higher prices of EVs compared to traditional ICE vehicles; moreover, complicated charging methods are a major impediment for consumers.



Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=432 executives

76%

of executives attest higher prices of EVs, range anxiety, expensive and complicated charging are major impediments for consumers.

OEMs are increasingly electrifying their vehicle fleets to reduce emissions and attempting to resolve customer challenges. However, increasing the adoption of EVs is insufficient to combat climate change, as, when powered by non-renewable fossil fuels, they leave a significant carbon footprint.

Greening of the charging infrastructure

According to MIT research, cleaning up the grid can reduce emissions from EVs by 75%, from about 200g of CO₂ per mile today to about 50 grams of CO₂ per mile in 2050.²⁷ Hence, it is critical that EV manufacturers have a clean charging infrastructure.

Roll out green charging stations. Using renewable sources of energy for charging is a significant sustainability lever, a fact that OEMs have recognized. For instance, Mercedes-Benz earlier this year announced it would meet more than 70% of its energy needs through renewable energy by 2030. Using renewable sources of energy for charging is a significant sustainability lever, a fact that OEMs have recognized. For instance, Mercedes-Benz earlier this year announced it would meet more than 70% of its energy needs through renewable energy by 2030.²⁸ Kia and Hyundai are harnessing solar energy for their charging networks.

Introduce smart charging, which optimizes energy consumption and adapts to the need of EV users and the grid. In November 2021, Hyundai introduced smart charging app that allows the grid to be optimally balanced and promotes greener charging.²⁹ Jason Jeong, president of Kia Europe adds: *“By pushing more green energy into the grid, we can increase the energy mix in favor of more sustainable sources”.*³⁰

Support the advancement of charging infrastructure to facilitate longer trips and reduce range anxiety. The EU requires its member states to install EV charging stations no more than 60 km (around 37 miles) apart throughout the entire European road network by 2025. Nevertheless, our survey shows that fewer than half of OEMs (47 percent) have a strategic partnership with utilities/suppliers in the battery charging/swapping space.

Sustainable mining of rare minerals/metals

Production of a battery with a capacity of 40 kWh emits approximately 2,920 kg of CO₂, of which 40% is generated by mining, conversion, and refining. The momentum towards EVs has resulted in an increase in demand for rare metals such as lithium, cobalt, and nickel, triggering over-exploitation of these metals that, in turn, may lead to scarcity. R.J. Scaringe, CEO, Rivian Automotive, says: ***“At present, global battery production represents well under 10% of what we will need in 10 years.”***³² Currently, 85% of global lithium production comes from China, Chile, and Australia; manufacturers are planning to diversify sources to meet rising demand.

“At present world’s battery production combined represents well under 10% of what we will need in 10 years”

RJ Scaringe
CEO at Rivian Automotive



61%

of executives say that lack of information on benefits of EVs (vis-à-vis ICE vehicles) is a hurdle in customer adoption.

"We have an ambition to be a 100 percent electric brand in Europe by 2030. It is an aggressive goal; however, we believe that it's possible with competitive and affordable electric cars. With a number of in-house innovations, we're able to have smaller batteries, yet higher energy density and a modular vehicle design. All this helps us produce EVs as affordably as possible, while also being profitable."



Andreas Chochod,
Director Strategy, Plan & Organization of
Research & Advanced Engineering at
Renault Group

A decorative green vine with several spirals, starting from the top left and curving towards the bottom right, set against a light green background.

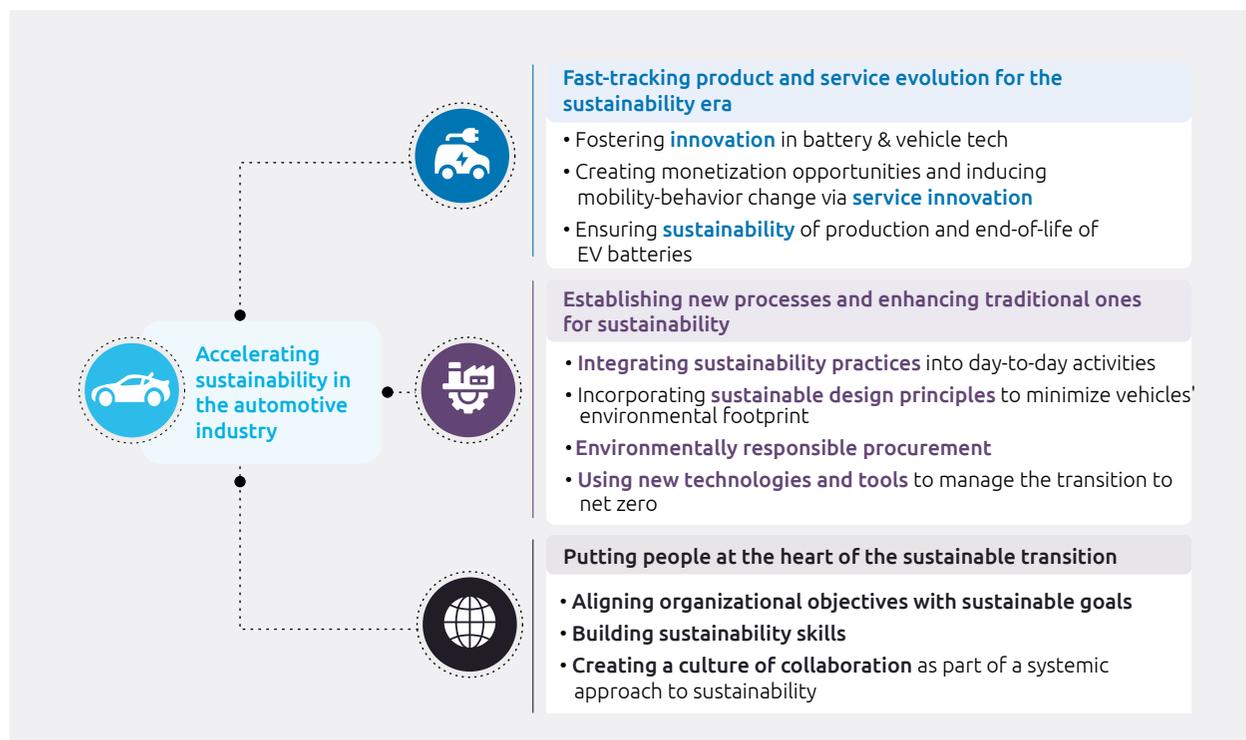
04

HOW CAN AUTOMOTIVE ORGANIZATIONS ACCELERATE TOWARDS A SUSTAINABLE FUTURE?

While Sustainability Leaders are progressing towards net zero goals at a good pace, the broader industry is in the slow lane. Through our research, discussions with industry experts, and experience of working on automotive sustainability initiatives with top OEMs and suppliers, we believe it is possible to boost automotive sustainability with combined action on three key pillars pertaining to product, processes, and people (see Figure 26).

Figure.26

Automotive requires combined action to boost sustainable progress



Source: Capgemini Research Institute analysis.

+ Fast-tracking product and service evolution for the sustainability era

Fostering innovation in battery and vehicle technology

Innovation will be an important lever to fast-track the transition to zero-emission vehicles. Innovation drives advances in vehicle and component quality, while also moderating the cost of high-quality products over the long run. Driven by efficiencies in battery-cell production, lithium battery costs have fallen by an astonishing 98 percent in the past three decades.³² In the early 1990s, the battery capacity to power a house would cost about \$75,000; today, it would be about \$2,000. Renault, for instance, is working on pioneering a unique battery technology, and software to improve battery performance, and efficiency.³³ It expects to reduce the cost of its ZOE line of batteries from \$170/kWh by 36% to \$100/kWh by 2024 through upgraded cell energy density, standardized cell and module design, and simplified pack and vehicle integration. Such innovations have significant potential to reduce vehicle cost and spur demand, as the cost of an EV battery is 25-35% of the overall cost of an EV.³⁴

Zero-emission vehicles, such as EVs, plug-in hybrid vehicles, and those powered by new fuels such as hydrogen, particularly

commercial vehicles, will lead the charge in decarbonizing the global vehicle fleet. Global sales of ICE cars have likely peaked in 2017 and EV adoption has surged; nevertheless, recent estimates suggest that the ICE fleet will keep growing through 2030.³⁵ It would require a much stronger push from OEMs, governments, and policymakers to decarbonize the vehicle fleet and phase out ICE vehicles. At the COP 27 climate summit held in 2021, 30 countries agreed to “work together and make zero-emission vehicles the new normal by making them accessible, affordable, and sustainable in all regions by 2030 or sooner.”³⁶

Likewise, advances in automotive technology have substantially reduced CO₂ emissions and increased vehicle economy. According to recent data from US EPA, CO₂ emissions for new vehicles fell by 24% between model year 2004 and 2020.³⁷ In the same time period, new vehicle fuel economy has improved by 32%, and new vehicle weight has increased by just 1%. Technological advancements like these will continue to benefit zero-emission vehicles, even though some of these advancements have been nullified by greater sales of larger vehicle types such as SUVs and trucks, particularly ICE ones. This trend gives further boost to calls for rapid decarbonization of the global vehicle fleet.

Andreas Chochod, Director Strategy, Plan and Organization of Research and Advanced Engineering at Renault Group, says: *“We have an ambition to be a 100 percent electric brand in Europe by 2030. It is an aggressive goal; however, we believe that it’s possible with competitive and affordable electric cars. With a number of in-house innovations, we’re able to have smaller batteries, yet higher energy density and a modular vehicle design. All this helps us produce EVs as affordably as possible, while also being profitable.”*

[“ Read more on EV battery manufacturing and supply chain in the next sub-section on “Ensuring sustainability of production and end-of-life of EV batteries.”]

Creating monetization opportunities and inducing mobility-behavior change via service innovation

OEMs and suppliers will need to innovate new services and business models to create monetization opportunities for customers and themselves. EV fleets create new services around vehicle-to-grid (V2G) smart charging – allowing EV batteries to give back to the grid, creating revenue from reusing batteries, and reducing the cost of battery recycling and thereby the cost of EV ownership over its lifecycle.



Renault has plans to roll out its V2G service by 2024 with an estimated value of €400 per battery per year, which will be shared between the customer, Renault, and the ecosystem. In addition, it estimates €500 in incremental value on each EV battery through the potential to generate value by using these batteries in stationary and mobile energy storage (e.g., in smaller vehicles requiring shorter trips on average) in their second life. It expects that its expertise in appraising batteries value and industrial-scale battery repackaging will help generate competitive advantage. Further, it estimates that it will be able to reduce the cost of recycling of batteries by two-thirds. Renault's Mobilize suite of mobility and energy services are designed to take the company beyond automotive, harnessing new growth opportunities. Renault expects it to contribute more than 20% of Renault Group's turnover by 2030.³⁸

Reducing vehicle emissions during its use-phase will be critical to achieving net zero. Experts believe that it will be crucial to change people's mobility and vehicle ownership habits to fully decarbonize the transport sector.³⁹ This means allowing people to lease or rent vehicles as required, rather than owning a vehicle for its entire lifecycle. It reduces per capita vehicle emissions while also increasing vehicle utilization. Mobility habits are heavily influenced by cultural and local contexts; for instance, more than 90% of passenger kilometers travelled in the US are in cars, whereas in the Netherlands it is only 69%, as people rely on other modes of transport, such as bicycles, trains, and waterways. Volkswagen recently launched its EV sharing service, WeShare, in Hamburg with 800 EVs.⁴⁰ The fleet is charged with 100% green electricity.

Audi has rolled out an app called ecomove which helps users assess and reduce their mobility-related GHG emissions and offers ways to offset unavoidable emissions. It also has gamification to induce a behavior change among users to make more sustainable mobility choices.



Ensuring sustainability of production and end-of-life of EV batteries

In 2021, EV battery demand was 340 GWh, more than twice the 2020 level.⁴¹ It is expected to grow more than sixfold by the end of this decade, to 2.2-3.5 TWh. This will lead to a surge in demand for the relevant metals and minerals that make up batteries, such as lithium, cobalt, and nickel.

The battery lifecycle is a fairly complex, resource-intensive and, therefore, carbon-intensive process. As such, it requires careful design considerations for supply chain, sourcing, processing, and second-life/end-of-life approaches.

OEMs need to increase their EV-battery production capacities and develop a battery ecosystem that incorporates the second-life and end-of-life stages of the battery lifecycle. We believe this is possible through a set of four coordinated key actions (see Figure 27):

90%

of passenger kilometers travelled in the US are in cars, whereas in the Netherlands it is only 69%, as people rely a on other modes of transport such, as bicycles

“A culture that considers sustainability in day-to-day decisions is critical to any organization. There needs to be a strong top-down, bottom-up approach that pulls together innovation and skill-building. It is about spending time getting leadership walking side by side, training your employees and involving them in your decisions.”



Magdalena Gerger,
VW Group Sustainability
Council Advisory Board to the
Management Board

Figure.27

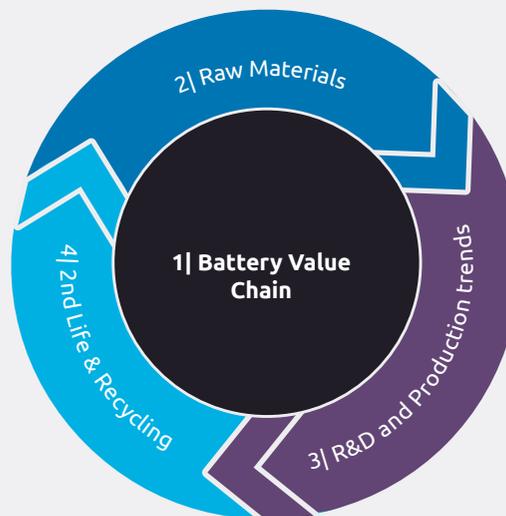
Ensuring sustainability of EV batteries from sourcing to end-of-life

The Battery Value Chain of a more sustainable future

- OEMs must diversify their battery supply chains
- Production facilities must be set up to meet growing demand
- OEMs must build a strong battery network

Recycling & 2nd Life Solutions as success factors and business opportunities

- Players must consider battery end-of-life scenarios now
- No one-size-fits-all solution - individual strategies tailored to meet specific targets
- Relevance of a strong partner ecosystem to tackle challenges

**Raw Materials are crucial for battery supply**

- React to materials markets price volatility
- Reduce uncertainty over future battery compositions
- The need for transparency, data and risk management

R&D and Production Trends enable continuous improvement

- Flexible production to scale up for future technologies
- Battery design must meet design-for-recycling standards
- Production must reach full digitalization potential

Source: Capgemini Research Institute analysis. Capgemini, *Powering Change: How Batteries Can Foster the Electric Vehicle Revolution*, September 2022.

1. **Carefully design the battery supply chains.** Disruption caused by geopolitical developments, as well as cyclical delivery shortages, poses a major risk to OEM battery supply chains. OEMs need to mitigate this through diversification by establishing partnerships and joint ventures with companies that have proven battery production expertise. In its Gigafactory in Nevada, Tesla, in partnership with Panasonic, manufactures battery packs for its EVs and energy-storage solutions. In 2018, the Gigafactory reached an annual production level of 20 GWh of battery capacity, making it the highest-volume battery plant in the world.⁴²
2. **Ensure resiliency in supplies of raw materials for battery production.** Most of the minerals consumed in battery production are mined in just a few countries, such as China, Australia, the Democratic Republic of Congo, and Indonesia.⁴³ Moreover, the industry is dominated by Chinese organizations. However, efforts are being made to identify sources in North America and Europe, to offer local supply to manufacturers, improving security of supply and reducing price volatility and transportation emissions. Currently, some mineral supplies are sourced via a web of suppliers and contractors located in conflict zones; manufacturers are taking steps to inculcate more

responsible sourcing and mining practices to develop a more sustainable and ethical battery value chain.

A related issue is price movement of battery minerals due to automotive industry supply-chain challenges; if supply is constrained, input prices rise, which, ultimately, must pass through to the price of batteries and EVs. The price of lithium, for instance, rose 400 percent between September 2021 and September 2022, and 220 percent in 2022 alone.⁴⁴ More effective tracing and tracking of materials can bring transparency and also assuage ESG concerns of potential investors. The EU's Digital Product Passport – providing a digital twin for every product that captures data throughout its lifecycle – is expected to come into effect from 2026. This would offer reliable, comparable product-sustainability data, helping stakeholders (including consumers, businesses, and policymakers) make better-informed choices.⁴⁵

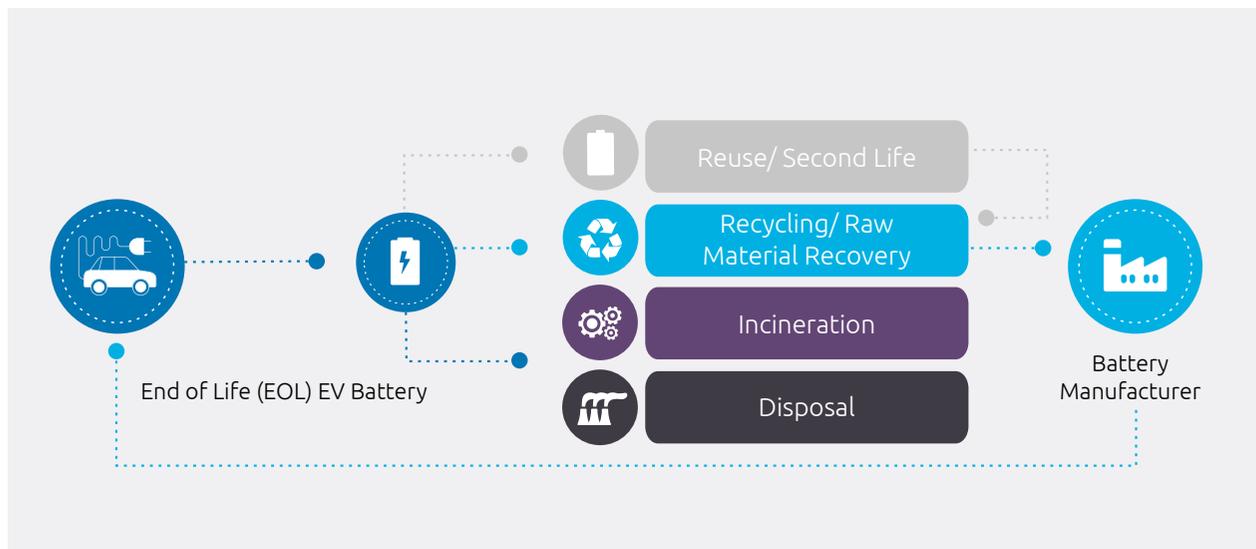
3. **Capitalize on improvements in battery R&D and production.** OEMs and suppliers should adapt their manufacturing systems to keep their production facilities flexible and scalable. Suppliers such as BYD and CATL have developed cell-to-pack (CTP) and cell-to-chassis (CTC) technologies that have an optimized pack structure, reducing volume by up to 70 percent compared to conventional lithium batteries.

Figure.28

Four major options for managing battery life

4. Treat recycling and second-life solutions as key success factors. Reusing and recycling batteries will be instrumental in reducing resource depletion and GHG emissions. In general, battery end-of-life entails a 20-percent fall in cell capacity from the rated value.⁴⁶ There are four major management options: reuse (second life), recycling and raw-material recovery, incineration, and disposal (see Figure 28). A number of second-life use cases are becoming popular, particularly, mobile applications (e.g., in light-duty vehicles, and EV charging stations), residential and commercial energy storage, and utility-scale storage.

The automotive organizations are treading cautiously with respect to second-life use cases for batteries. Only about one in four organizations in our survey (28%) have initiatives around second-life uses of batteries. The second life of batteries is likely to be a game-changer in the battery economy, with the potential to close the gap between battery life (5-8 years) and vehicle life (~15 years). The market for second-hand batteries is quite fragmented, informal and predominantly local (except for very high-end products). Second, these markets depend on manageable cost of transporting batteries back and



Source: Capgemini Research Institute analysis. Capgemini, Powering Change: How Batteries Can Foster the Electric Vehicle Revolution, September 2022.

forth; it can be challenging to locate and transport the correct level of second-hand battery on demand. Third, the remanufacturing level of a battery needs to

be assessed with care, as a high level reduces the cost benefit significantly.

+ Establishing new sustainability processes and enhancing traditional ones

Integrating sustainability practices into day-to-day activities

Translating sustainable goals and objectives of the organization into practicable activities and processes is both crucial and is proving to be the biggest hurdle to the implementation of initiatives. Organizations should take a top-down approach to aligning individual activities and processes with sustainability goals. General Motors has instituted a common Global Environmental Policy which serves as a guiding light for environmental stewardship, under which all GM facilities operate. The policy helps reduce the impact of GM's actions on environment by ensuring that local plant policies reinforce a commitment to environment and applicable laws. It also provides a framework for

setting and reviewing environmental goals and targets, and are regularly documented and communicated to all employees. Additionally, every GM manufacturing site has one or more environmental leaders. They are supported by a regional environmental leader and a team of subject matter experts in regional central offices. Similarly, Volvo has constituted "Functional Management Teams" whose responsibility is to ensure that sustainability becomes an integrated part of everyone's daily work. This includes ensuring that necessary resources and funding are secured to enable delivery of their respective targets and ambitions. This team is separate from a "Global Sustainability Team" that is centrally responsible for the day-to-day governance and coordination of sustainability.



Mickael Aubry, Global Innovation Program Manager at Faurecia, explains how his organization breaks down broad sustainability goals into specific targets: *“We divide up the long-term target of emissions-reduction and set internal milestones on that basis. So, this long-term target has been segregated into two different work packages and each one is linked to a specific target within the overall goal of emissions-reduction.”*⁴⁷

Incorporating sustainable design to minimize vehicles’ environmental footprint

Our recent research into sustainable product design has found that it is a business imperative to reach net zero.⁴⁸ Nearly two-thirds (65 percent) of automotive organizations in our research have seen a reduction in carbon emissions due to the implementation of sustainable product design strategies. Moreover, an estimated 80 percent of the environmental impacts of a product are linked to decisions made at design stage.⁴⁹

Oliver Zipse, Chairman of the Board of Management of BMW AG, comments: *“We must design our vehicles for sustainability from the very first day of development, reducing the amount of material used and, above all, planning for reuse and recycling from the very beginning. In the face of rising raw-material prices, this is not just an environmental, but also a business imperative.”*⁵⁰

Although sustainable R&D and product development is a top-five strategic priority among all sustainable initiatives, it is yet to achieve a greater scale of implementation:

- as many as 85 percent of automotive organizations in our survey have only up to 40 percent of their current engineering, R&D, and design landscape implementing sustainability initiatives at scale;
- more than three in four automotive organizations (78 percent) conduct vehicle lifecycle assessments, including environmental impacts, for less than 40 percent of their products;
- fewer than half of the organizations (44 percent) have a sustainability initiative for the prototyping phase of R&D/engineering (for instance, use of digital technologies such as digital twins, virtualization, 3D printing, etc.).

Vehicle design needs to incorporate Design-for-Recycling (DFR) keeping in mind vehicle end-of-life recycling, recovering, or disposal. Currently, a sizeable share of end-of-life automotive products is subjected to disassembling, shredding or crushing which leaves an unavoidable GHG footprint. Thus product design and development has to be done keeping in mind dismantling strategies, residue recovery, recycling, and reuse. OEMs also need to design end-of-life processing strategy, and develop technologies and processes to achieve maximum recovery.

“We must design our vehicles for sustainability from the very first day of development, reducing the amount of material used and, above all, planning for reuse and recycling from the very beginning. In the face of rising raw-material prices, this is not just an environmental, but also a business imperative.”

Oliver Zipse

Chairman of the Board of Management
of BMW AG

Environmentally responsible procurement

Our research finds that fewer than two in five automotive organizations (38 percent) conduct sustainability due diligence on all material and product procurement, and only about half (54 percent) have adopted ethical resources management and procurement at scale. Volvo Cars has made sustainability requirements an integral part of its contractual agreements with suppliers. Since 2019, it has administered a self-assessment questionnaire (SAQ) as a mandatory requirement of all material suppliers. In 2021, 847 of its supplier sites (82 percent) completed this assessment. It places a strong emphasis on proactively addressing sustainability-related issues and driving improvement. Since 2015, Volvo Cars has performed 182 sustainability audits among its tier-1 and directed sub-tier suppliers and, as at 2021, had addressed 94 percent of improvement findings identified in its audit program.

However more sustainable products and components are generally costlier than their traditional counterparts; 77 percent of supply-chain executives and 79 percent of manufacturing executives believe that product costs have increased as a result of the adoption of sustainable practices and initiatives (e.g., requiring use of more lightweight or sustainable material, which is more responsibly sourced). OEMs have traditionally expected suppliers to bear this higher cost.

Our survey data shows that suppliers believe customers (OEMs or other suppliers) would be willing to pay 8.5-8.7 percent more for sustainable products, features, and aftersales purchases. For suppliers, however, the challenge is to prove the additional value to OEMs. To command a premium, suppliers will need to bundle additional services with sustainable products. For instance, Bosch provides a state-of-the-art customer-support service, one of the largest in the industry.⁵² Its seven logistics centers, which are in close proximity to its production facilities, store over 200,000 replacement parts, reducing time to resolve issues and conserving resources. The Bosch eXchange program allows customers to have defective vehicle components replaced with remanufactured products. It remanufactures around 2 million components, saving nearly 3,100 metric tons of material and the equivalent of 8,600 metric tons of CO₂.

79%

of manufacturing executives believe that product costs have increased as a result of the adoption of sustainable practices and initiatives (e.g., requiring use of more lightweight or sustainable material, which is more responsibly sourced).

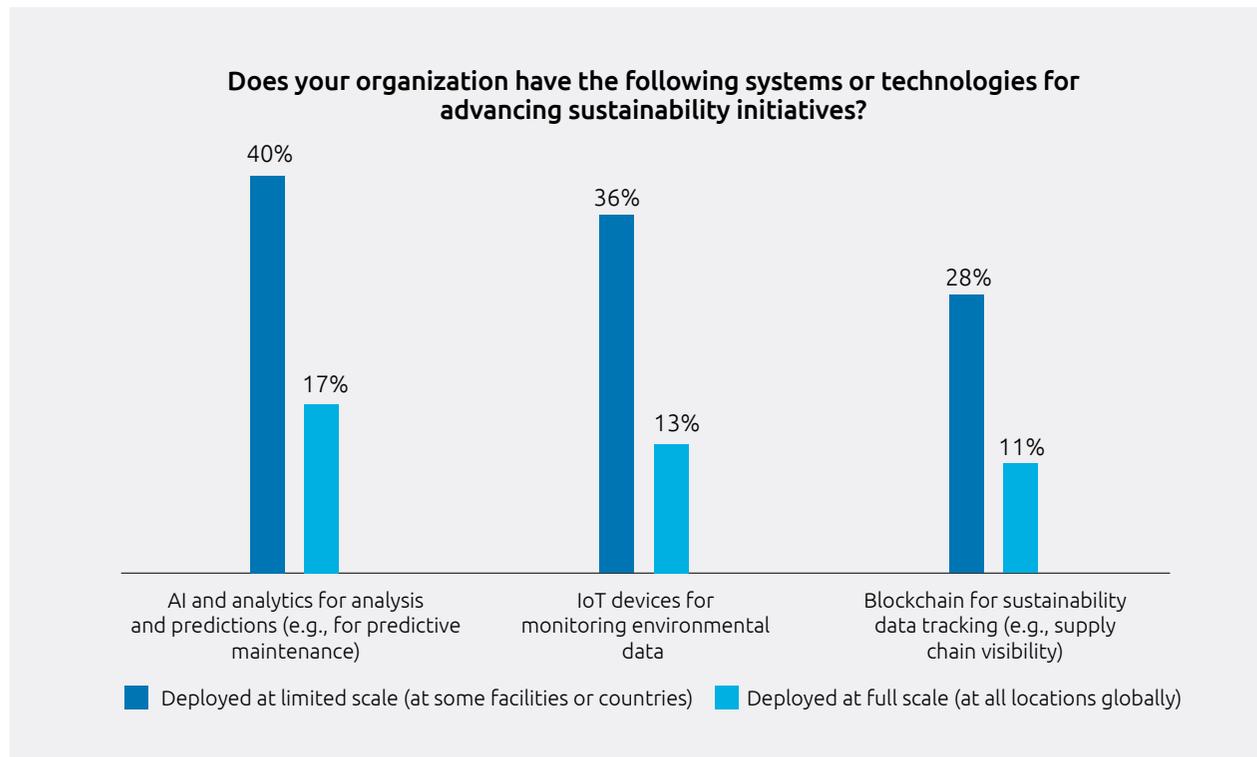
Using new tools and technologies to manage the transition to net zero

On average, fewer than one in five organizations (14 percent) in our survey have harnessed tools and technologies to advance their sustainability initiatives. Only about one in six (17 percent) has deployed artificial intelligence (AI) and data analytics (e.g., predictive maintenance [see Figure 29, below] to support energy conservation and emissions reduction. The director of sustainability at a large US-based tier-1 supplier, adds: ***"We have a tool that allows us to monitor our KPIs at a granular level from different locations to understand the energy consumption and GHG-emission patterns; that way, we know which operations to improve to reduce our emissions."***



Figure.29

Deployment of tools and technologies for advancing sustainability initiatives



Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=108 executives.

Data is a significant lever to accelerate organizations' journeys to net zero. The use of emissions data can enhance organizational decision making in three key ways: increasing visibility of baseline emissions levels and identifying emissions hotspots; improving existing business processes by streamlining carbon-intensive activities; and predicting and prescribing business outcomes to identify further emissions reduction opportunities. However, our recent research on use of data by organizations to reach net zero goals found that organizations are not adequately embedding emissions data in decision-making 45% of organizations in our research use data only for mandatory reporting.⁵³ Further, while 55% say they embed it in decision making in some form, we found that they largely use emissions data to measure sustainability performance, and few use it to improve existing processes or to predict and prescribe opportunities for emissions reduction using forecasting and scenario-analysis techniques.

To enhance data coverage, granularity, and accuracy, organizations should automate the ingestion of emissions data from multiple external (emissions factor databases, ESG data providers, LCA databases, supplier data, etc.) and internal (ERP systems, IoT, sensors, facility-management systems, etc.) sources and eliminate

manual, spreadsheet-based data collection. To date, only 6 percent of organizations in the automotive industry have automated collection of emissions data at-scale.

Once the collection and reporting of individual data from various systems has been accomplished, organizations must strive to establish a **sustainability control tower**: that is, a connected and customizable dashboard of sustainability data that provides end-to-end visibility, scenario-planning features, and control of all sustainability initiatives across the organization. A control tower can aid decision-making, reduce reaction time in uncertain scenarios, and ensure progress on key sustainability KPIs. Our survey suggests that fewer than half of organizations (45 percent) have deployed a sustainability control tower to date, with about half (48 percent) planning to do so in the next 1-3 years.

45%

of organizations in our research use data only for mandatory reporting.



Figure.30

Stellantis has linked performance incentives to achievement of climate-related KPIs

+ Putting people at the heart of the sustainable transition

Aligning organizational objectives with sustainable goals

As we saw in Chapter II, a majority of automotive organizations struggle to align individual performance objectives with sustainability goals. When performance objectives and metrics are not updated to reflect the sustainability goals of the organization, the workforce is unlikely to feel incentivized to prioritize them. Stellantis has tackled this issue by rolling out incentive plans linked to climate-related targets (see Figure 30). All Stellantis employees eligible for incentive plans have their variable compensation linked to annual CO₂ emission-reduction target. Similarly, members of various functional units are set climate-related targets.

Examples of incentives plans for the management of climate-related issues

Organizational Divisions	Climate-related targets
All Stellantis employees eligible for the incentive plans	Annual CO ₂ emission target is used as a payoff trigger for the variable compensation.
Chief Executive Officer	Annual and multi annual CO ₂ reduction targets on the CO ₂ emissions of the vehicles sold.
Top Executive Team members	Targets dealing with Stellantis' position in vehicle efficiency (vehicle CO ₂ emissions, new mobility services development, share of electrified vehicles, etc.).
Planning	Short-term CO ₂ related targets, on the implementation of specific programs aligned with the ambition to reduce average CO ₂ emissions of the vehicles sold worldwide. Vehicle project managers can have targets based on vehicle CO ₂ performance.
Manufacturing	Short-term CO ₂ reduction targets based on improved energy consumption and increased share of decarbonized electricity. Energy, environment and facility managers are operationally involved in facilities environmental management and energy saving and have targets related to energy savings in terms of CO ₂ emission reduction.
Purchasing and Supply Chain	Short-term CO ₂ reduction targets based on the increase of the share of strategic suppliers demonstrating a CO ₂ trend compliant with the Paris Agreement and on the implementation of processes allowing to reduce CO ₂ emission of purchased parts for EVs.

Source: Stellantis, *Corporate Social Responsibility Report 2021*, February 2022.

Besides aligning performance objectives with sustainability goals, organizations must incorporate sustainability KPIs into critical business decisions, moving away from the traditional business framework of cost-benefit, break-even/payback period. While a majority of Sustainability Leaders have integrated metrics such as use of renewable energy in operations (56 percent) and recycling manufacturing waste (53 percent) into business decisions, only about one-third (31 percent and 37 percent, respectively) of the rest have done so.

Magdalena Gerger, VW Group Sustainability Council Advisory Board to the Management Board, says: *“A culture that considers sustainability in day-to-day decisions is critical to any organization. There needs to be a strong top-down, bottom-up approach that pulls together innovation and skill-building. It is about spending time getting leadership walking side by side, training your employees and involving them in your decisions.”*

Building sustainability skills

The automotive industry is currently undergoing a transformation that involves blending skills from both traditional engineering and IT. Candidates that fit the required profile (inasmuch as it can be defined at this point) are in high demand, not only in automotive but across all industries, as transformations develop in parallel. With the added requirement for sustainability, the situation looks bleak. Our survey indicates that the majority of automotive organizations (55 percent) are upskilling/reskilling existing employees as a dominant

strategy. Further, Sustainability Leaders place much higher emphasis on mandating sustainability in all corporate training (41 percent) and new employee induction, than do the rest (27 percent).

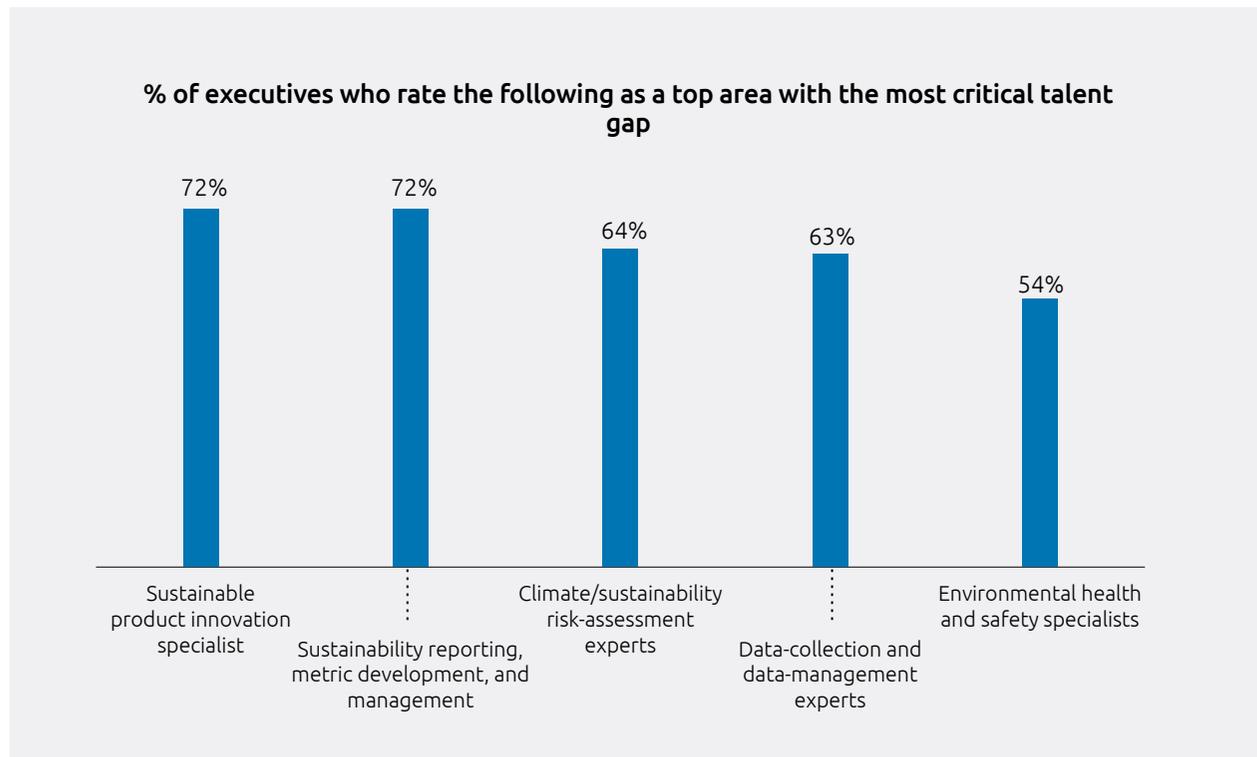
New initiatives to tackle skills shortages can be modified to incorporate sustainability training. Such initiatives include setting up software academies; launching reskilling programs; and spinning off subsidiaries, often in partnership with tech companies, to create long-term career perspectives for potential candidates. Jaguar Land Rover recently announced that it will train 29,000 of its own employees, as well as workers in franchised dealerships, to develop, manufacture, and service EVs⁵⁴. Along similar lines, Mercedes-Benz recently announced that it will invest more than €1.3 billion in the qualification, training, and continuing education of its employees by 2030.⁵⁵

Laura Nunnery, Head of UX - Infrastructure & Online Sales at Volvo Cars says, *“We educate people about sustainability at a very fundamental level because not everyone knows or understands what goes into, say, carbon emissions of cars. And it starts with educating our internal stakeholders and sales representatives. For the benefit of our consumers, we have integrated sustainability awareness into our cars as well.”*

Specialist skills in sustainability will still be required and will often be available through ecosystem partnerships. We asked automotive executives which areas are experiencing the highest demand for sustainability skills, and found that product innovation, reporting, and risk assessment are top (see Figure 31).

Figure.31

Top five areas with the largest talent gap on sustainability skills



Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=1,080 executives

Creating a culture of collaboration as part of a systemic approach to sustainability

No single OEM or supplier acting independently can deliver measurable environmental benefits on a global scale – certainly not with the speed dictated by the climate emergency. A wide range of collaborative initiatives at industry level and above are already emerging, such as the German government’s Innovate2030-SDG11, designed to foster climate-smart, sustainable cities and communities.

It makes sense for automakers to work together, share knowledge, and establish standards, as is happening in initiatives such as Catena-X.⁵⁶ Automakers are also assembling their own ecosystems to help them meet sustainability goals. Each ecosystem is likely to include a wide range of organizations.

Marco Philippi, Head of Procurement Strategy at Audi, says: *“We interact with more than 14,000 direct suppliers from more than 60 countries. That adds up to a large responsibility but, at the same time, it offers enormous potential. If we succeed in steering the network in the right direction, then this not only has a positive effect on Audi, but also on our entire sector.”*⁵⁷

+ CONCLUSION

The automotive industry is poised to enter a crucial decade, as it pivots its product portfolio from ICE vehicles to EVs – a transformation on a scale not witnessed since the dawn of the automotive era. Even as automotive technology is increasingly driven by software and customer experience, long-term sustainability is becoming the requirement for all stakeholder types. Leading organizations have positioned themselves well for this change, yet the industry as a whole is still on a side-road, slowing down on the path from ambition to action. A combination of actions on rapid decarbonization, sustainable operations (from design and procurement, to end-of-life), and inclusivity, can get it back on course and in the fast lane.

+ APPENDIX

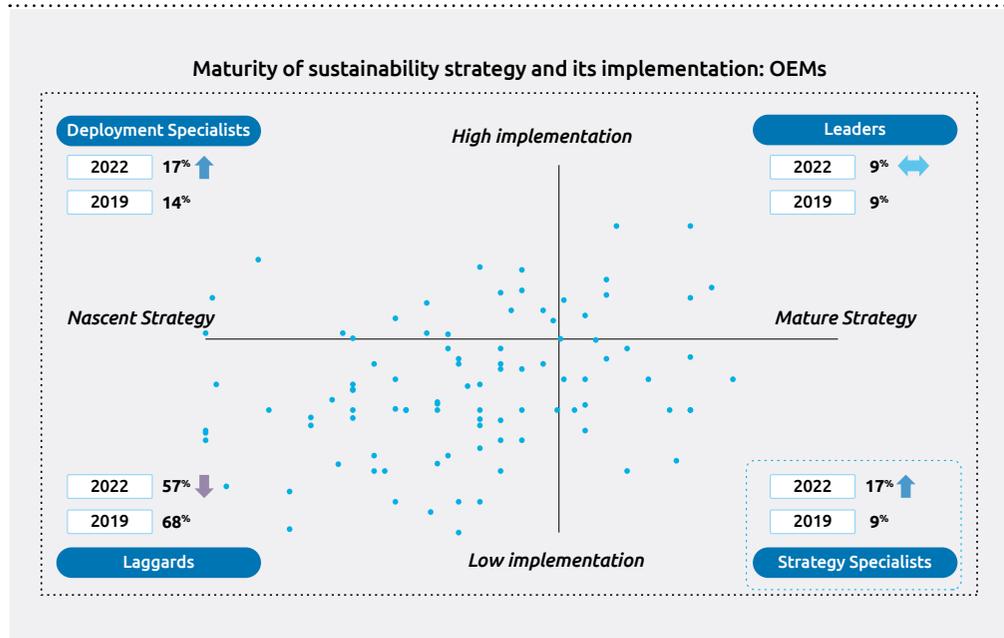
Elements on which the maturity analysis is based (Chapter I)

The following are the elements based on which we conducted an analysis to segregate the organizations into Leaders and The rest:

Elements on which the analysis for the x-axis (i.e., 'Maturity of Strategy') was based	Elements on which the analysis for the y-axis (i.e., 'Maturity of Implementation') was based
<ul style="list-style-type: none"> • Presence of a comprehensive sustainable strategy • Assessment of current portfolio of products and assets in terms of sustainability and long-term environmental impact • Priority assigned to the top sustainability initiatives, as identified by the industry • Presence of a central governance body, and a dedicated leader for sustainability 	<ul style="list-style-type: none"> • Level of deployment of top sustainability initiatives, as identified by the industry • Level of investment in sustainability • Existence of dedicated sustainability targets for key executives

Maturity of OEMs and Suppliers (Chapter I)

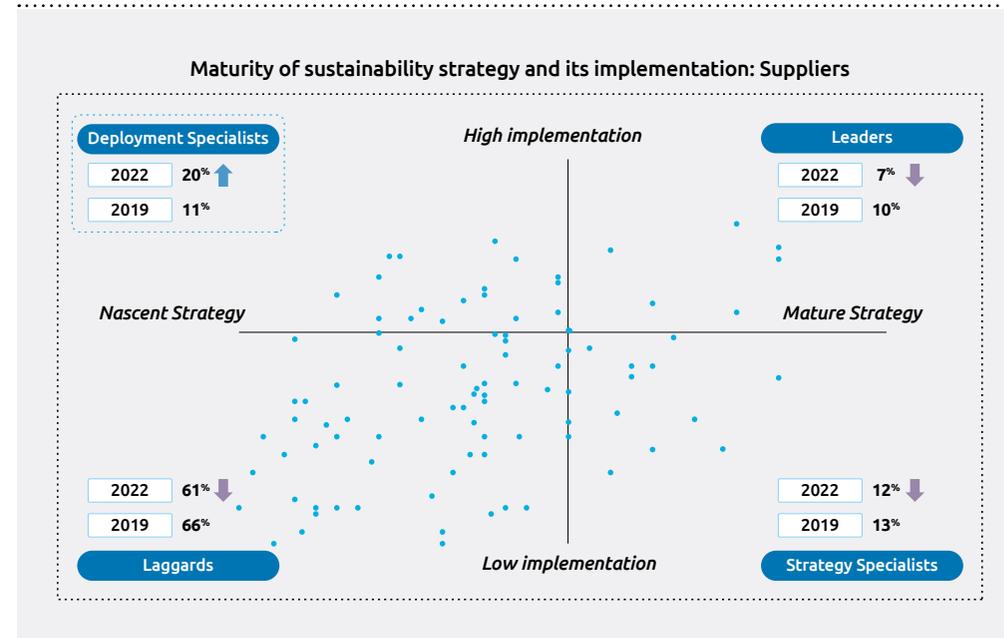
In the past three years, OEMs have advanced their sustainability strategies



Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=93 OEMs; *The automotive industry in the era of sustainability*, March 2020.

*Each dot represents one organization, and the placement of the dot corresponds to the comparative maturity of the organization in both strategy and implementation of sustainability. The percentages represent the share of organizations in each quadrant.

Suppliers have improved their implementation of sustainability initiatives in the past three years



Source: Capgemini Research Institute, Sustainability in Automotive Executive Survey, July-August 2022, N=90 suppliers; *The automotive industry in the era of sustainability*, 2020.

*Each dot represents one organization, and the placement of the dot corresponds to the comparative maturity of the organization in both strategy and implementation of sustainability. The percentages represent the share of organizations in each quadrant.

Methodology to calculate GHG emission reduction for Leaders and the industry (Chapter III)

To determine the average industry emissions rate, we took an average of the actual yearly data (including scope 1, scope 2, and scope 3), as reported by the top OEMs. We arrived at average emissions of 182 million mtCO₂e for the industry in 2018:

01

For the Paris Agreement target, we used the 2018 industry average emissions as base the to arrive at the 2030 target.

02

For Leaders, we applied the actual and expected percentage improvement, calculated from our survey data, on the average 2018 emissions to arrive at future emissions

03

Finally, for the industry, we used the expected rate of improvement in emissions, on average, for the entire industry (from our survey data) and applied it to the actual industry average emissions in 2018 to arrive at future emissions

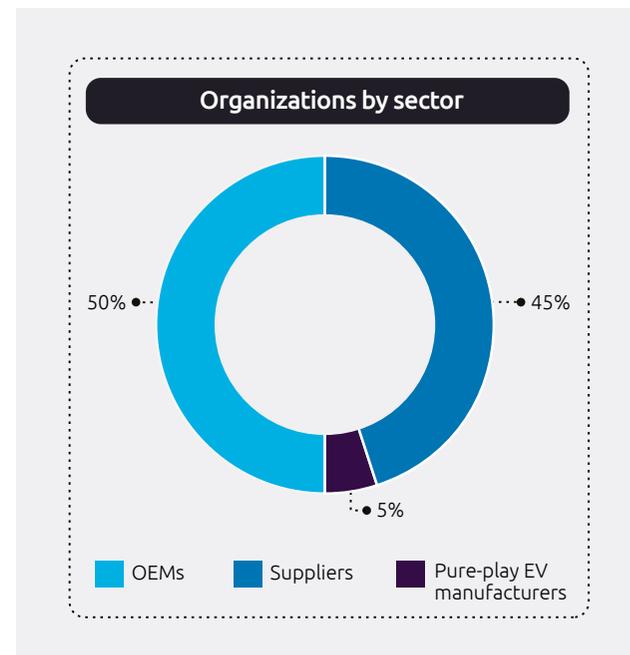
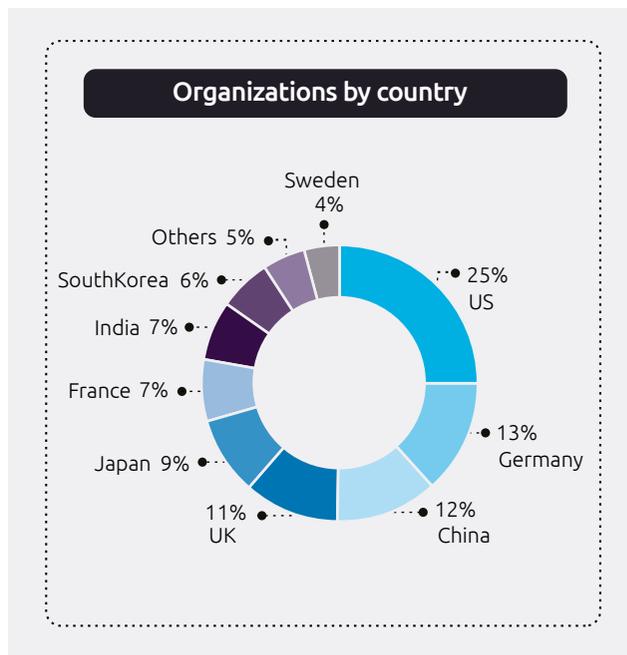
+ RESEARCH METHODOLOGY

This survey aims to address the current state, challenges, and the future of sustainability for the global automotive industry. We will be looking at automotive organizations' sustainability strategy, initiatives, governance, investments, and any benefits and outcomes from those. We also want to understand the nature of impact, significance, and criticality of these initiatives.

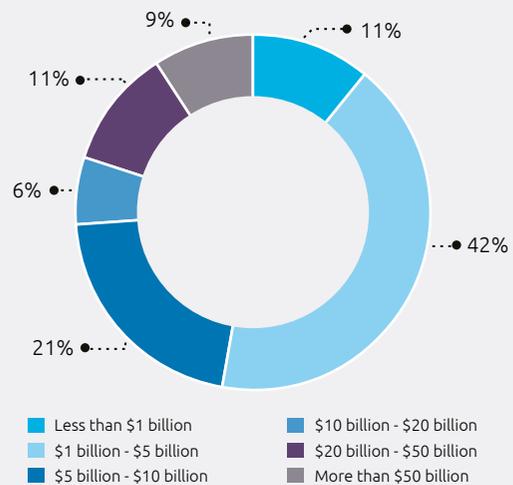
Executive survey

During July–August 2022, we surveyed 1,080 senior executives (director level and above). The organizations comprise OEMs and suppliers. For the purpose of this survey, we are considering environmental sustainability and associated issues and are not looking into the social and governance aspects of sustainability.

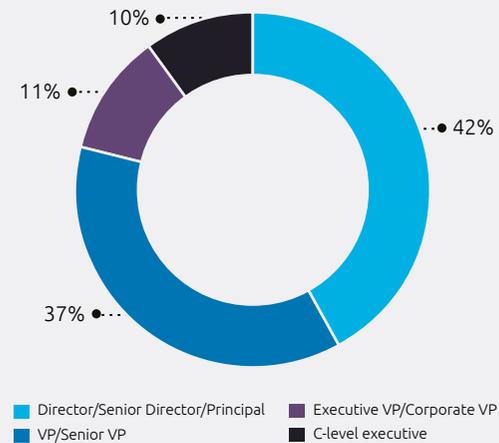
The distribution of respondents and their organizations is provided below:



Organizations by annual revenue



Executives by title





In-depth interviews

We also conducted 20 in-depth interviews with senior industry executives and experts.

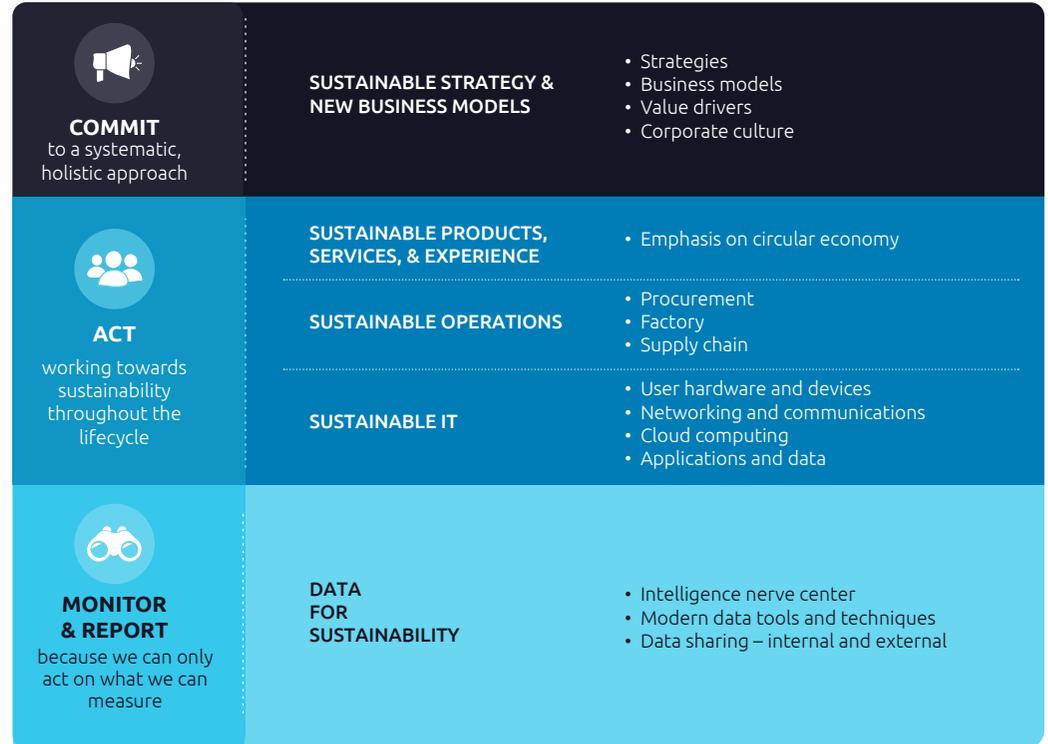
+ CAPGEMINI CAN HELP ACCELERATE YOUR SUSTAINABILITY INITIATIVES

As we have seen, automotive companies can boost their progress toward sustainability by taking action on products, processes, and people.

To achieve such far-reaching change, automakers need a holistic and systematic sustainability approach that addresses the entire automotive product lifecycle, as well as the business as a whole and all of its value chain.

Capgemini is here to support automotive companies in realizing their sustainability goals as fast and smoothly as possible. **To help us do that, we have developed our own comprehensive approach based on a three-step framework, summarized in the figure below.**

Capgemini's framework for sustainable mobility





In addition to our three-step framework (in the figure), **Capgemini has the capabilities and offers to assure success at each step of an automotive company's sustainability journey.**

As clients **commit** to sustainability, we guide them in developing and adopting new strategies, business models, and value drivers, along with a sustainability-oriented corporate culture.

The **act** step entails working toward sustainability across the end-to-end lifecycle. Here we advise organizations on building a portfolio of sustainable products and services, always with an emphasis on the circular economy. We also help them achieve sustainable operations throughout the vehicle lifecycle and right along the supply chain. When it comes to IT, we empower clients to realize technology's potential to make the business more sustainable while minimizing environmental damage associated with IT itself.

For the **monitoring & reporting** step, we assist automakers in using data to steer the business toward sustainability while also delivering on conventional KPIs such as profitability. Modern data management techniques make it possible to provide end-to-end transparency of the supply chain and product lifecycle, equipping decision-makers to optimize overall sustainability. We help companies select and use the most appropriate tools, including sophisticated analytics and advanced machine learning (ML).

The **circular economy** is at the heart of our approach. At each step of the journey, we ensure its requirements are addressed, and that the best use is made of enablers such as **innovation, industrialization, talent management, and ecosystem working.**

Let's drive the future together for a world of sustainable mobility.

+ REFERENCES

1. Lectra, "Sustainability generates material cost savings for the automotive industry," October 2020.
2. Volvo company website.
3. GM website.
4. Honda, Sustainability Report 2021.
5. Reuters, "Germany to reduce electric car subsidies in 2023," July 2022.
6. Forbes, "Inflation Reduction Act benefits: Electric vehicle tax incentives for consumers and U.S. automakers," September 2022.
7. Reuters, "EU proposes effective ban for new fossil-fuel cars from 2035," July 2022.
8. United Nations, "Report of the World Commission on Environment and Development: Our Common Future"
9. The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard
10. Sprinkler, "Waste Management Strategies for Sustainable Development", January 2019
11. Capgemini Research Institute, The automotive industry in the era of sustainability, March 2020..
12. WardsAuto, "Mercedes-Benz chairman emphasizes sustainability," April 2022. i
13. BMW company website.
14. Toyota company website.
15. European Commission, "Just and sustainable economy," February 2022.
16. Capgemini Research Institute, Data for net zero, September 2022.
17. Capgemini Research Institute, Data for net zero.
18. BloombergNEF, New Energy Outlook 2021, accessed September 2022.
19. PreScouter, Automotive lightweighting: Strategies for improving fuel efficiency, September 2021.
20. LinkedIn, "Sustainability and the workforce: Why now is the time to pay attention," September 2021.
21. Capgemini Research Institute, Re-learning Leadership, December 2021.
22. Capgemini Research Institute, Sustainable product design, September 2022.
23. BMW company website.
24. Automotive News Europe, "Renault sees \$1.1b in revenue from recycling, refurbishing business by 2030," December 2021.
25. International Energy Agency, Global EV Outlook 2022, May 2022.
26. Automotive News Europe, "How Audi, Mercedes, Nissan aim to gain from second-life EV batteries", September 2022
27. CNBC, "Are electric cars 'green'? The answer is yes, but it's complicated", 26 July 2021
28. Company website
29. Jedlix smart charging, "Hyundai takes the next step in green & smart charging with the Hyundai SmartCharging-app", November 2021
30. The Driven, "Kia and Hyundai source wind energy to power charging networks", February 2022
31. Changeit, "What is the environmental impact of lithium batteries?"
32. The Wall Street Journal, "Rivian CEO Warns of Looming Electric-Vehicle Battery Shortage", April 2022
33. The Economist, "Lithium battery costs have fallen by 98% in three decades," March 2021.
34. Renault Group, Renault EWAYS Electropop Presentation, July 2022.

35. HT Auto, "GST on EV batteries could be reduced to bring down cost of electric vehicles," June 2022.
36. Bloomberg NEF, New Energy Outlook 2020, June 2021.
37. UNFCCC, "Zero Emission Vehicle Pledges Made at COP26," November 2021.
38. US Environmental Protection Agency, The EPA Automotive Trends Report 2021, November 2021.
39. Renault, "Renault: all about our strategic plan," January 2021.
40. BloombergNEF, "Net Zero Could Mean Fewer Cars on Top of Switching to EVs," June 2022.
41. Audi, "Audi on the road to climate-neutral mobility," August 2021
42. Volkswagen, "Volkswagen begins electric car sharing in Hamburg," February 2021.
43. IEA, "Global supply chains of EV batteries," July 2022.
44. Tesla company website.
45. IEA, Global Supply Chains of EV Batteries, July 2022.
46. Benchmark Mineral Intelligence website, accessed September 2022.
47. University of Cambridge – Corporate Leaders' Group, "Digital Product Passport: The ticket to achieving a climate neutral and circular European economy?" July 2022.
48. United States Advanced Battery Consortium (USABC) website.
49. Capgemini Research Institute, Sustainable operations: A comprehensive guide for manufacturers, June 2021.
50. GM Sustainability Report 2021.
51. Volvo Car Group Sustainability Report 2021.
52. Capgemini Research Institute, "Rethink: Why sustainable product design is the need of the hour," September 2022.
53. European Commission, EU Science Hub, retrieved from <https://ec.europa.eu/jrc/en/research-topic/sustainable-product-policy>
54. BMW, "Over 200 million tonnes: BMW Group sets ambitious goal to reduce CO2 emissions by 2030," May 12, 2021.
55. Volvo Cars, Annual and Sustainability Report 2021.
56. Bosch, Decoding Tomorrow – Sustainability Report 2021, accessed September 2022.
57. Capgemini Research Institute, Data for net zero: Why data is key to bridging the gap between net zero ambition and action, September 2022.
58. Bloomberg, "Jaguar Land Rover to train 29,000 staff to work on electric cars," September 2022.
59. Bloomberg, "Mercedes-Benz Is investing more than €1.3 billion in the qualification of its employees," July 2022.
60. Catena-X website. Catena-X sees itself as a rapidly scalable ecosystem in which all participants in the automotive value chain participate equally. The goal: to provide an environment for the creation, operation, and collaborative use of end-to-end data chains along the entire automotive value chain.
61. Capgemini Research Institute, Sustainable operations: A comprehensive guide for manufacturers, June 2021.

+ AUTHORS

**Alexandre Audoin**

Executive Vice President,
Head of Global Automotive Industry
alexandre.a.audoin@capgemini.com

**Markus Winkler**

Executive Vice President,
Global Automotive Industry
markus.winkler@capgemini.com

**Pascal Feillard**

Senior Solution Director,
Capgemini Engineering
pascal.feillard@capgemini.com

**Jean-Marie Lapeyre**

Chief Technology & Innovation Officer,
Global Automotive Industry
jean-marie.lapeyre@capgemini.com

**James Robey**

EVP Global Head of Environmental
Sustainability, UK Architects of Positive
Futures Lead
james.robey@capgemini.com

**Sebastian Tschödrich**

EVP, Global Head of Automotive,
Capgemini Invent
sebastian.tschoedrich@capgemini.com

**Siegfried Adam**

Global Lead Sustainable Mobility,
Capgemini Invent
siegfried.adam@capgemini.com

**Vera Schneemann**

Global Lead Sustainable Operations and
Supply Chain, Capgemini Invent
vera.schneemann@capgemini.com

**Maryem Sahnoun**

Sustainability Accelerator,
Capgemini Engineering
maryem.sahnoun@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

**Hiral Shah**

Manager,
Capgemini Research Institute

hiral.shah@capgemini.com

**Navya Atmakuri**

Consultant,
Capgemini Research Institute

navya.atmakuri@capgemini.com

+ For more information, please contact:

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

The authors would also like to thank Emmanuel Lochon, Benjamin Alleau, Brad Young, Klaus Feldmann, Philipp Haaf, Simon Schäfer, Jean-Baptiste Perrin, Thomas Svahn, Clément Chenut, Sven Dahlmeier, Daniel Garschagen, Lucas Birn, Philipp Kolbeck, Ruth-Anne Peters, Findikdali Guelmez, Henrik Norrman, Katie Neck, Patricia Noble Gonzalez, Masahiko Mochizuki, Anil Kandpal, Sandhya Sule, Nithin Divakar Naik, Ashish Sharma, Baljeet Yadav, Laurence Jumeaux, Clément Falquet, Per Holmblad, Vivek Kamath Mulki, Jayashree Ravichandran, Anuraag Bharadwaj, Benjamin Fritz, Ralf Blessmann, Olivier Saignes, Roshan Batheri, Suparna Banerjee, Aparajita Paul, Rupali Chakraborty, and Punam Chavan for their contribution to the research.

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 United Kingdom, and the United States. It was recently ranked number one in the world for the quality of its research by independent analysts.

Visit us at www.capgemini.com/researchinstitute/

Global contact

Alexandre Audoin
Capgemini Group
alexandre.a.audoin@capgemini.com

Sebastian Tschödrich
Capgemini Invent
sebastian.tschoedrich@capgemini.com

France
Arnaud Bouchard
arnaud.bouchard@capgemini.com

India
Anuraag Bharadwaj
anuraag.bharadwaj@capgemini.com

Italy
Gerardo Ciccone
gerardo.ciccone@capgemini.com

Markus Winkler
Capgemini Group
markus.winkler@capgemini.com

Findikdali Guelmez
Capgemini Group
findikdali.guelmez@capgemini.com

North America
Andy Howard
andy.howard@capgemini.com

Nordics
Caroline Segerstéen Runervik
caroline.sergersteen-runervik@capgemini.com

Spain
Yoann Groleau
yoann.groleau@capgemini.com

Jean-Marie Lapeyre
Capgemini Group
jean-marie.lapeyre@capgemini.com

Klaus Feldmann
Capgemini Engineering
klaus.feldmann@capgemini.com

Germany
Ralf Blessmann
ralf.blessmann@capgemini.com

China
Chu Yan
yan.chu@capgemini.com

Belgium
Belgium Evy Nerinckx
evy.nerinckx@capgemini.com

Pascal Feillard
Capgemini Engineering
pascal.feillard@capgemini.com

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

UK
Robert Pears
robert.pears@capgemini.com

Japan
Yonoshin Mori
yonoshin.mori@capgemini.com

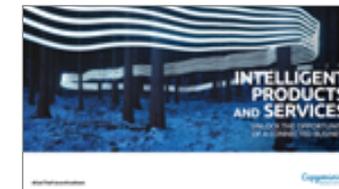
+ More Capgemini Research Institute Publications



Rethink: why sustainable product design is the need of the hour



Data for Net Zero



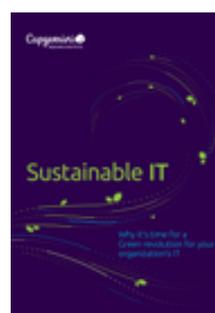
Intelligent products and services: Unlock the opportunity of a connected business



Next destination: Software How automotive OEMs can harness the potential of software-driven transformation



Circular economy for a sustainable future



Sustainable IT



Data Mastery: How data-powered organizations outperform their competitors



Sustainable operations



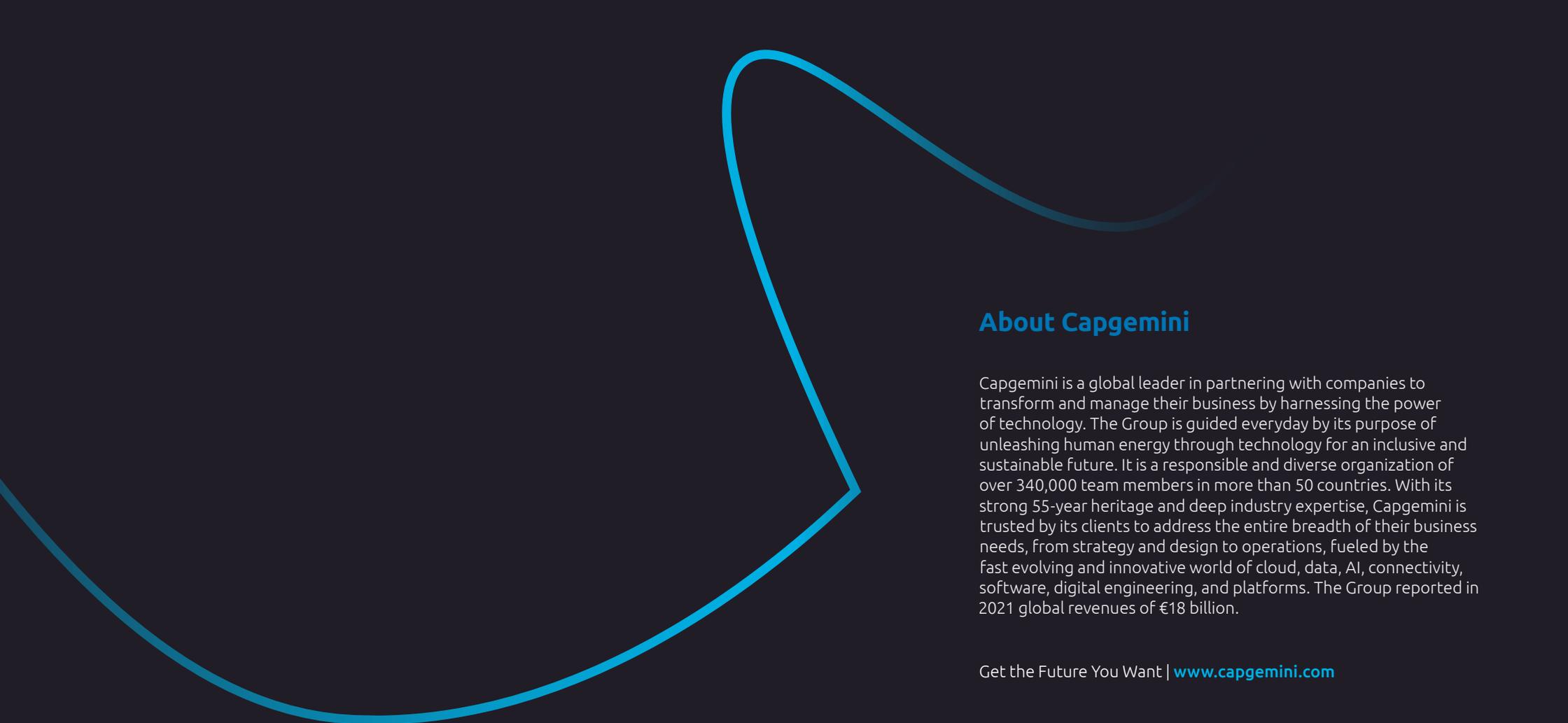
The automotive industry in the era of sustainability

+ 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/>

A screenshot of the Capgemini Research Institute subscription form. The form is titled 'Capgemini Research Institute' and includes a close button in the top right corner. Below the title, it states 'Fields marked with * are required'. There are three input fields for 'First Name *', 'Last Name *', and 'Email *'. Below these fields is a checkbox for 'By submitting this form, I understand that my data will be processed by Capgemini as indicated above and described in the Terms of use *'. At the bottom of the form is a 'Submit' button.



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 everyday by its purpose of unleashing human energy through technology for an inclusive and sustainable future. It is a responsible and diverse organization of over 340,000 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 2021 global revenues of €18 billion.

Get the Future You Want | www.capgemini.com