

The Automotive Industry in the Era of Sustainability

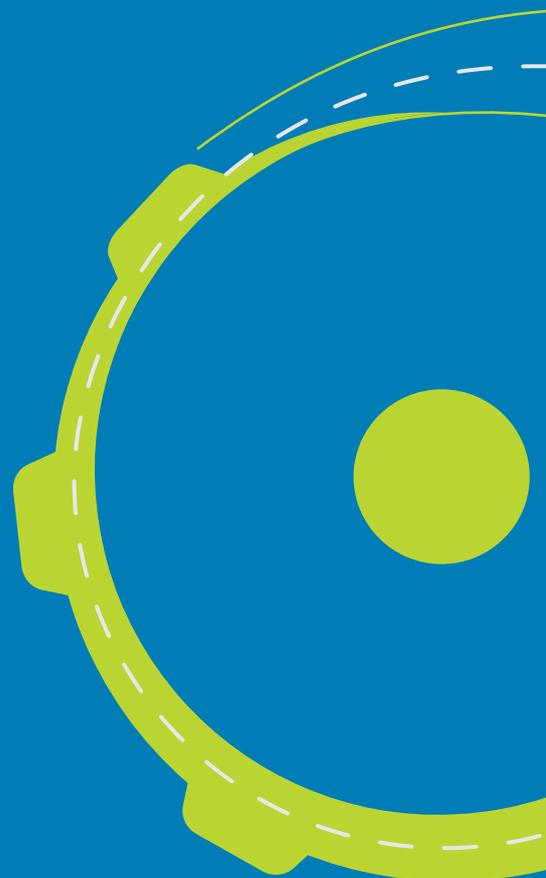


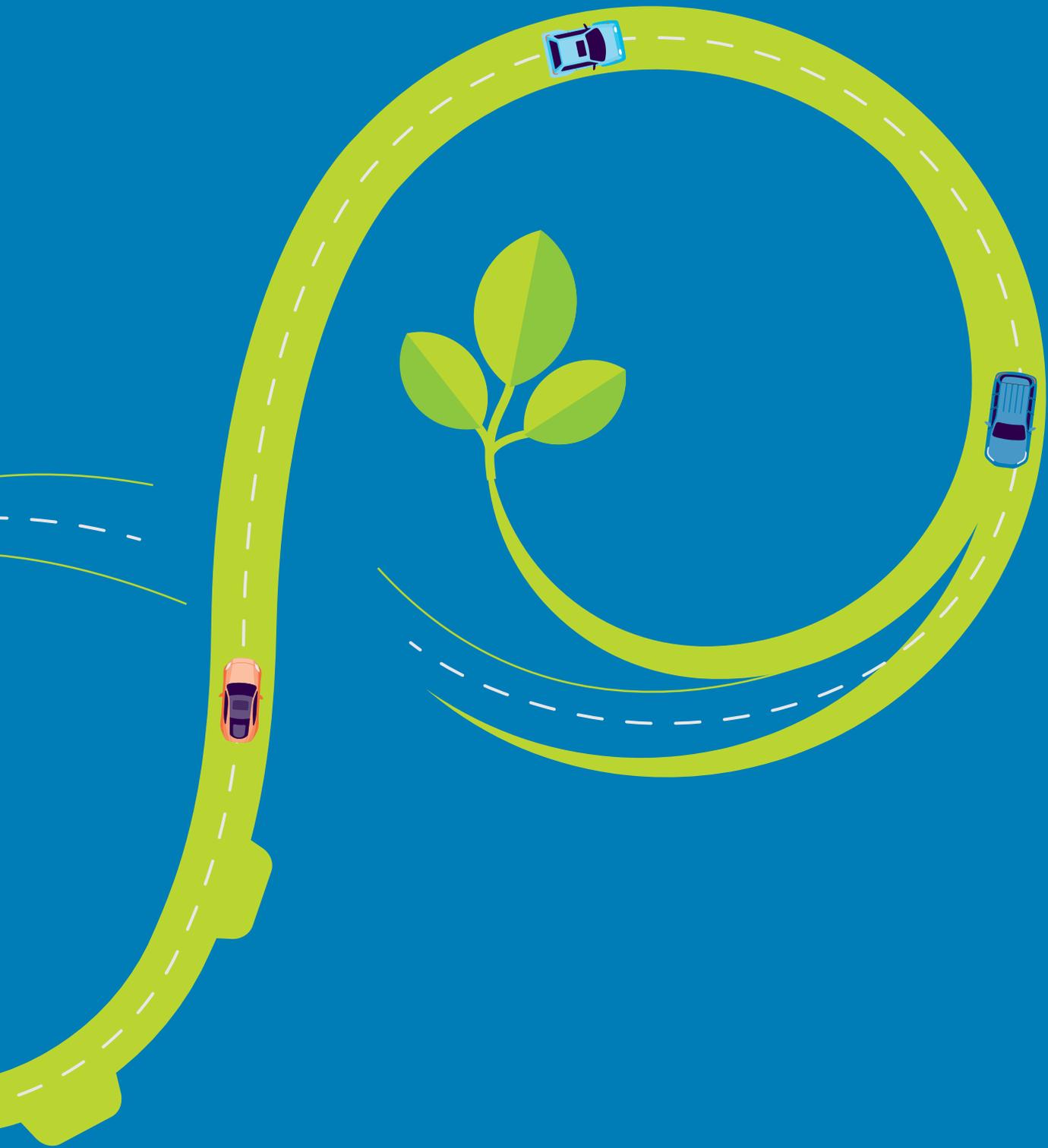
Executive summary

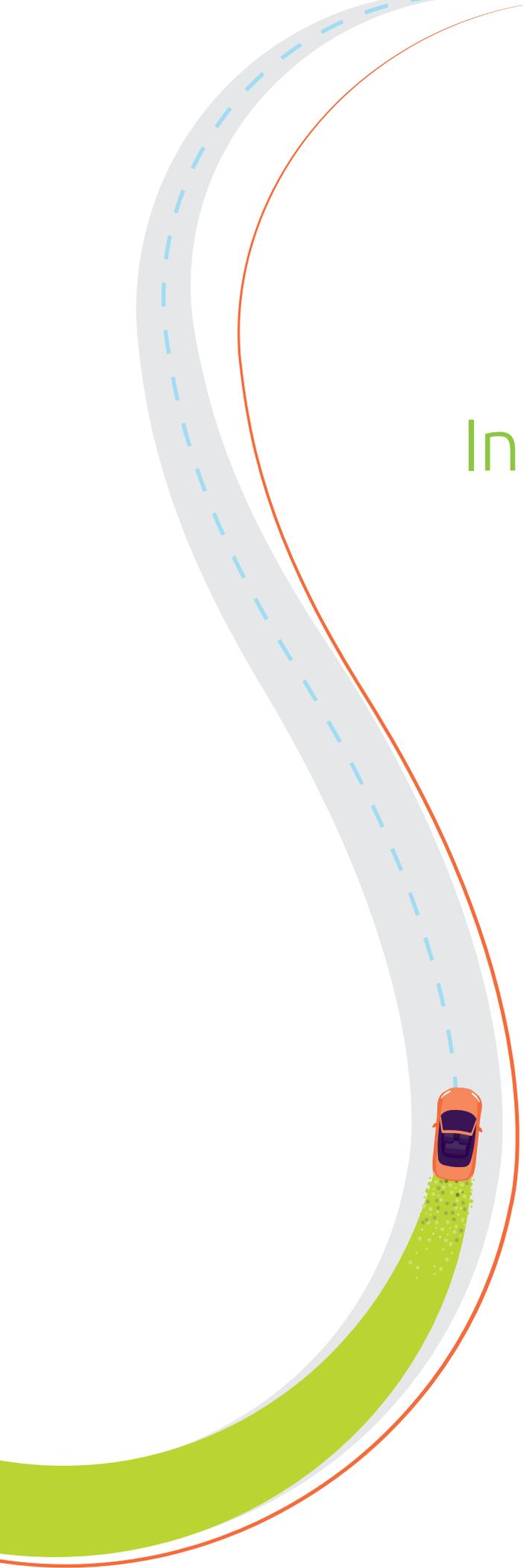
With growing concerns of climate change and environmental degradation, sustainability has become a strategic priority for automotive organizations. Governments, consumers and investors are now pushing automotive organizations to change their ways of working, culture and products. This will have far reaching implications for the industry, that while making substantial progress still requires to step up its sustainability efforts.

Our research tried to gauge how the automotive industry is responding to the challenge. This includes scrutinizing their progress and initiatives with the collective knowledge of more than 300 sustainability experts and regulators. Our key findings are:

- Sustainability is a strategic issue for the automotive industry and key to organization purpose
- The implementation of sustainability initiatives is fragmented and lacking on many fronts:
 - Some areas such as sustainable R&D and sustainable manufacturing – which are closer to the core competency of the industry – receive greater attention. But there is not a consistent focus on sustainability initiatives across the value chain. For instance, sustainable sales, marketing, aftersales and mobility services and vehicle usage are pursued by only a minority.
 - Most organizations do not have a central governance body for sustainability and only half of the automotive industry have sustainability targets for key executives.
- An estimated USD 50 billion is required over the next five years to meet their sustainability targets in addition to the current investment in electric vehicles, autonomous vehicles and digital mobility services.
- Two critical areas will drive maximum sustainability impact for the automotive industry:
 - Ensuring that electric vehicles are truly sustainable. Based on the grid which charges EVs, in the 27 EU countries and the UK, for example, the shift to electric vehicles would cut the overall lifetime greenhouse (GHG) footprint by about 37% for passenger vehicles while reducing the operating footprint by 75%, when powered by renewable sources.
 - Incorporating circular economy practices across the automotive value chain. Circular economy has the potential to offer big economic benefits and make EVs more sustainable. However, currently, only 32% of the automotive organizations' supply chain contributes to the circular economy.
- Based on learnings from sustainability leaders (less than 10% of organizations we analysed), we highlight key best practices:
 - Demonstrate tangible progress on sustainability by adopting standardized public disclosures.
 - Pursue sustainability as an organization-wide mission
 - Make business executives accountable for sustainability and invest in robust governance
 - Envision and spread sustainability initiatives across the automotive value chain
 - Use technology to improve sustainability of operations
 - Strengthen alliances and partnerships for greater impact







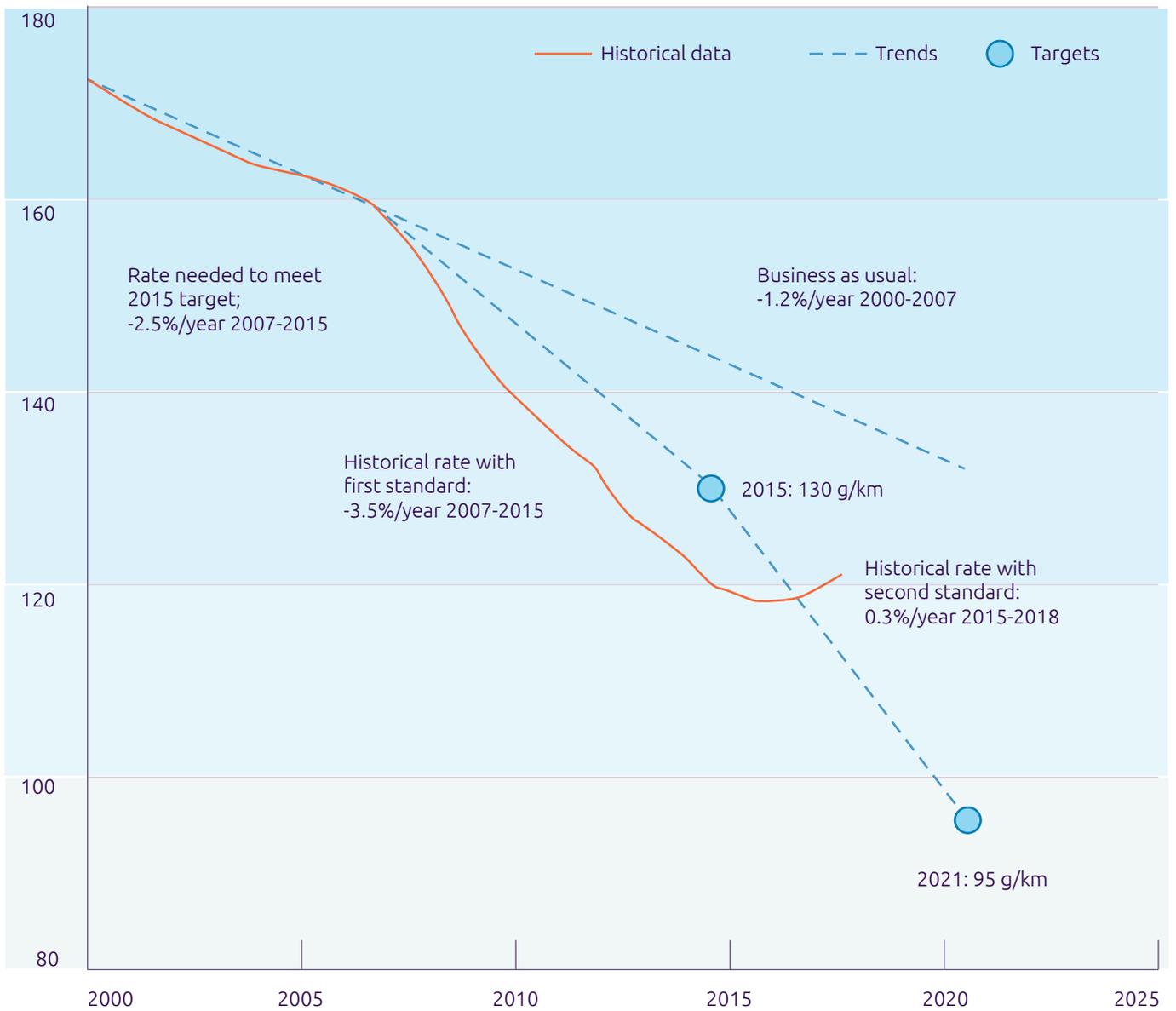
Introduction

For the past couple of decades, the automotive industry has been under considerable pressure from governments and society to pursue a more sustainable model of growth. This reflects the significant impact it has on the environment:

- Transportation accounted for a quarter of the world's global CO₂ emissions in 2016, with road transportation alone accounting for 18%.¹
- The degradation of natural ecosystems. China mines most of the natural graphite used in electric vehicles. Increased demand along with lax environmental regulations have led to crop failures, soil pollution, water contamination and large-scale environmental degradation.²
- Non-biodegradable waste from end-of-life usage and manufacturing waste have resulted in a considerable contribution to landfills, land toxification, and water pollution. Between January and June 2017 alone, the US, Europe, and Japan exported 3.1 million tons of plastic waste to developing countries, mostly in Asia.³ A substantial part of this was from end-of-life vehicles.⁴
- Production of vehicles takes considerable energy, water, and resources, increasing the carbon footprint. The automotive industry uses 5.2 billion litres of water and produces 1 million tons of CO₂ from UK manufacturing of cars and components alone.⁵

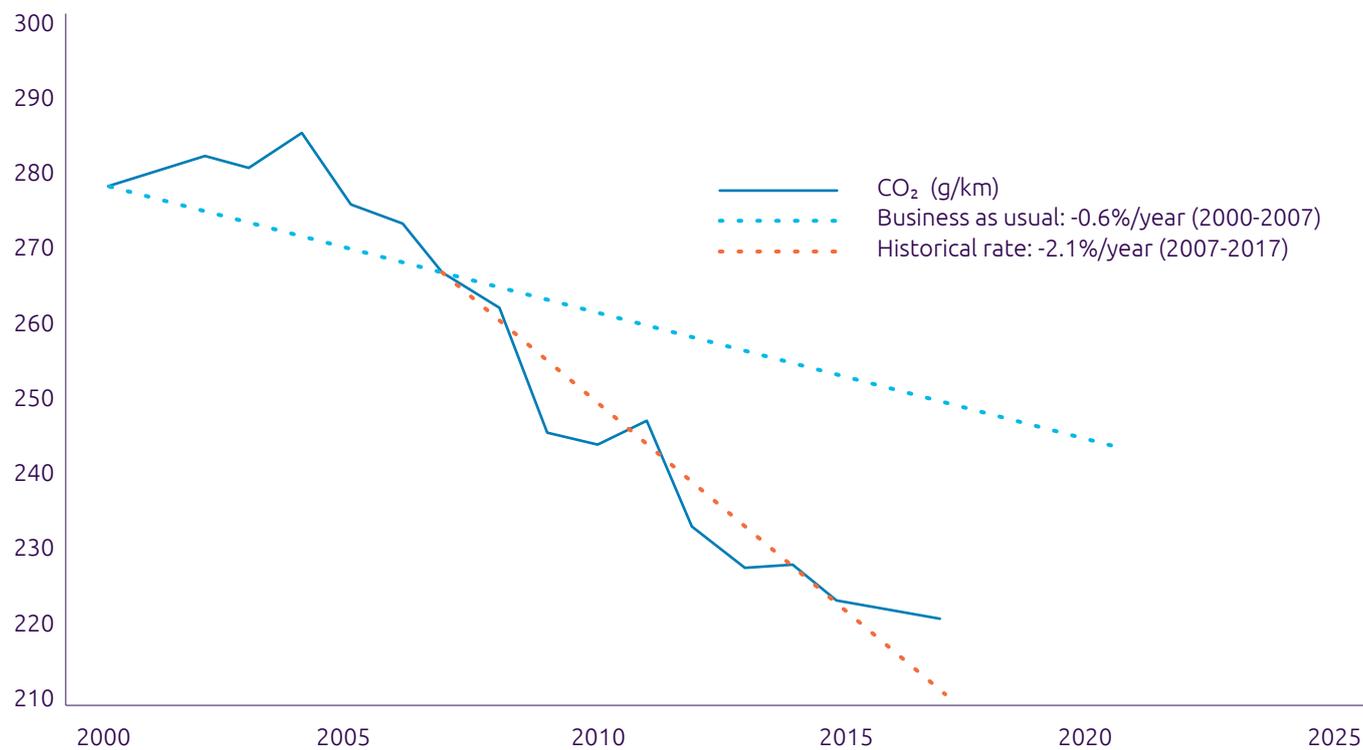
The industry, in response, has been working on addressing many of these concerns. For instance, between 2000 and 2015, EU automotive companies were ahead of the carbon footprint reduction targets set by regulators – achieving CO₂ emissions of close to 120 g/km against a target of 130 g/km (see Figure 1).⁶ A similar trend could be seen in the US.

Figure 1: New passenger fleet CO₂ emission, EU (g/km, NEDC)



Source: International Council on Clean Transport, European Vehicle Market Statistics – 2019/2020 edition, December 2018.

Figure 2: New passenger fleet CO₂ emissions, US (g/km, Real world – EPA’s GHG model)



Source: Environmental Protection Agency, “The 2018 Automotive Trends Report,” March 2019.

However, after 2015, carbon emissions started to rise, led by growing sales of SUVs. At the same time, growing environmental concerns have meant increased pressure from a variety of stakeholder groups:

- **Regulators.** Globally, regulators are imposing more stringent and comprehensive measures to reduce the environmental impact of vehicles.⁷ A growing number of cities are restricting the entry of vehicles with high emissions.
- **Public-interest groups.** Globally, there is rising public awareness and concern about the harmful impact of the human activities on the environment.⁸ This, combined with the transport sector’s high share of total emissions, has meant the industry is under intense pressure and scrutiny from environmental and public-interest groups, and society at large, to take active measures to curb emissions. This is reflective of consumer demand for electric vehicles. It has grown phenomenally – 63% in 2018 to 5 million stock units. It is expected by 2030, electric vehicles will have global sales of 23 million units (excluding two/three wheelers) and 130 million electric vehicles on the road.⁹
- **Investors and financial institutions.** Investment firms are pushing for sustainability and climate change as investment criteria to evaluate target companies. Large players in capital markets – such as BlackRock,

the world’s largest asset manager – are making a major strategic shift to environmental sustainability.¹⁰ Financial regulators, insurers, and central banks are also considering sustainability as a critical part of their risk portfolio and regulation.

To understand where the automotive industry stands today in terms of its sustainability efforts, we launched a comprehensive research program, surveying 500 large automotive organizations as well as 300 experts, including regulators, academics, and non-governmental organizations working in the field of sustainability. More details on the research methodology are at the end of the report.

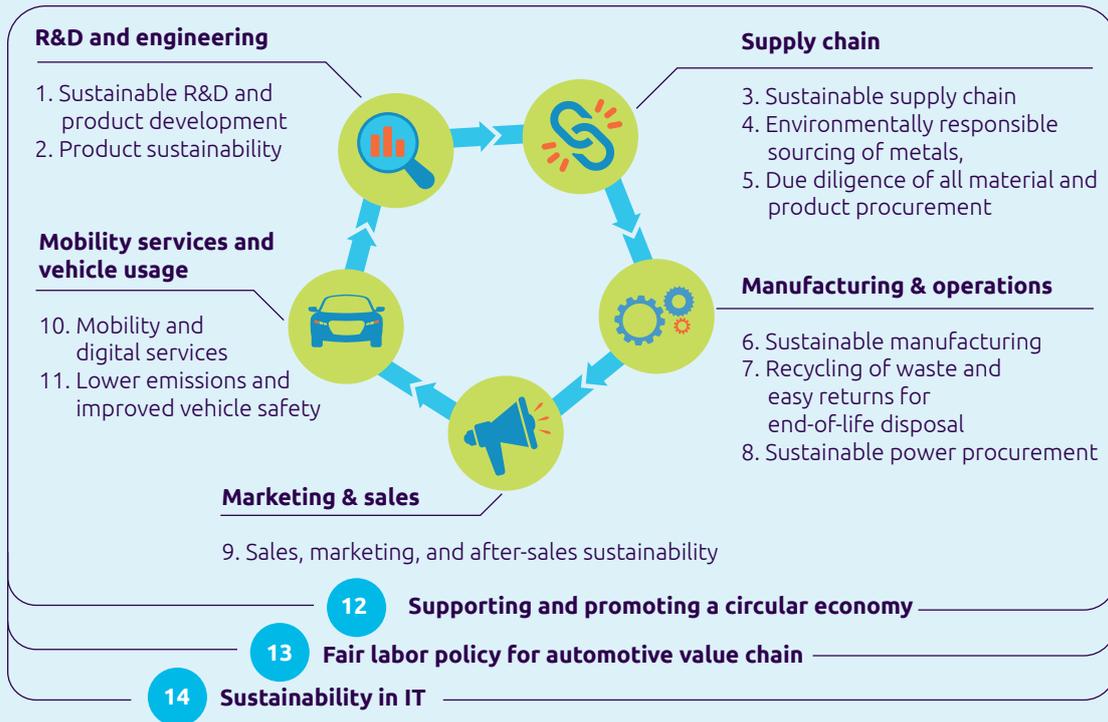
Our research looks to answer the following questions:

- What are automotive original equipment manufacturers (OEMs) and their suppliers doing to ensure that the entire automotive value chain is sustainable – from responsible mining of metals to sustainable waste disposal?
- How mature are automotive organizations in implementing their sustainability initiatives?
- How can the automotive industry ensure that major sustainability drivers such as electric vehicles and supporting a circular economy deliver on their promise?
- What can automotive organizations learn from leading players who are at the forefront of sustainability?

What do we mean by sustainability in the automotive industry?

Sustainability in the automotive industry involves a comprehensive view of planet- and human-friendly operations, processes, products, and services. As Figure 3 shows, we identified 14 elements that the industry is pursuing in the field of sustainability. These range from “Sustainable R&D and product development” to “Fair labor policy” and span the automotive value chain, from R&D to Mobility Services.

Figure 3: Sustainability across the automotive value-chain



Examples*

R&D and engineering

Groupe PSA consolidated its R&D efforts to two platforms, designed to limit CO₂ emissions by reducing weight and improving aerodynamics.

Volkswagen uses renewable raw materials such as the natural fibers, flax, cotton, wood, cellulose and hemp to produce components, wherever possible.

Supply chain

Scania co-founded a consortium to encourage the roll-out of bio-gas (from waste and residues and 90% less polluting) fuelled trucks. It will build a network of gas filling stations across major commercial routes in Europe.

Manufacturing & operations

Yamaha Motors achieved zero waste, both direct and indirect, to landfill by using thermal recycling processes to create materials to be used as combustion improvers and using post-combustion residue in making cement and roads.

General Motors runs its SUV assembly plant in Texas, US, on 100% clean wind energy.

Marketing & sales

Tata Motors took back an equivalent of 26,993 vehicles for refurbishing and reuse in the year 2017-18.

Mobility services and vehicle usage

Daimler-owned moovel Mobility-as-a-service platform makes it possible to purchase and pay for public transport tickets in German cities and it also offers users access to other mobility options such as carsharing, ride-hailing and bike rentals.

1. **Sustainable R&D** involves designing products to reduce environmental impact and optimizing the use of natural resources by ensuring their recyclability.
2. **Product sustainability** involves moving to fuel-efficient or electric vehicles and biodegradable components.
3. **Sustainable supply chain** includes adoption of environmentally conscious operations in logistics, distribution, warehousing and inventory management, etc.
4. **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.
5. **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.
6. **Sustainable manufacturing** involves implementing maintenance, quality, and production processes to reduce waste and improve recyclability and reuse of materials.
7. **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.
8. **Sustainable power procurement** includes activities such as building or leasing renewable energy assets.
9. **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. **Emission control 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.

***Sources:** Capgemini Research Institute analysis: "CMP: The New Modular, Multi-energy Platform for Groupe PSA," Groupe PSA press release, October 2018; "Volkswagen Investors Worry About Ambitious Electric Car Plans," Forbes website, May 2019; Company sustainability reports; "General Motors Texas Plant Runs 100% on Wind Power," Industry Week, October 2018.

Sustainability is now a strategic priority for the industry

While sustainability has been on the agenda for automotive organizations for some time now¹¹ today it has achieved a new urgency and importance. As the head of sustainability at a large OEM told us, “We recently reaffirmed our focus on sustainability strategy at the corporate level into three key areas: climate action, circular economy, and ethical and responsible business. It’s a long-term plan to go beyond ensuring sustainability in our operations and work with our supply chain network to make our entire value chain sustainable.”

As Figure 4 shows, for example, the number of investor events in the sector that mention sustainability topics has increased dramatically. Sustainability now plays a key role in the investor and board priorities. According to our survey, the two largest drivers for automotive sustainability are “commitment to be a responsible organization” and “addressing consumer expectations around sustainability.”

Our panel of experts – including regulators, academics, and environmental NGOs – agree that the industry is embracing this issue with enthusiasm. Nearly half (46%) believe that the industry has made better progress in sustainability

Figure 4: Automotive industry is increasingly discussing sustainability with its key stakeholders



*Investor events are public conferences, shareholder meetings, analyst roadshows, etc. discussing the company’s strategy/earnings/valuation, etc.

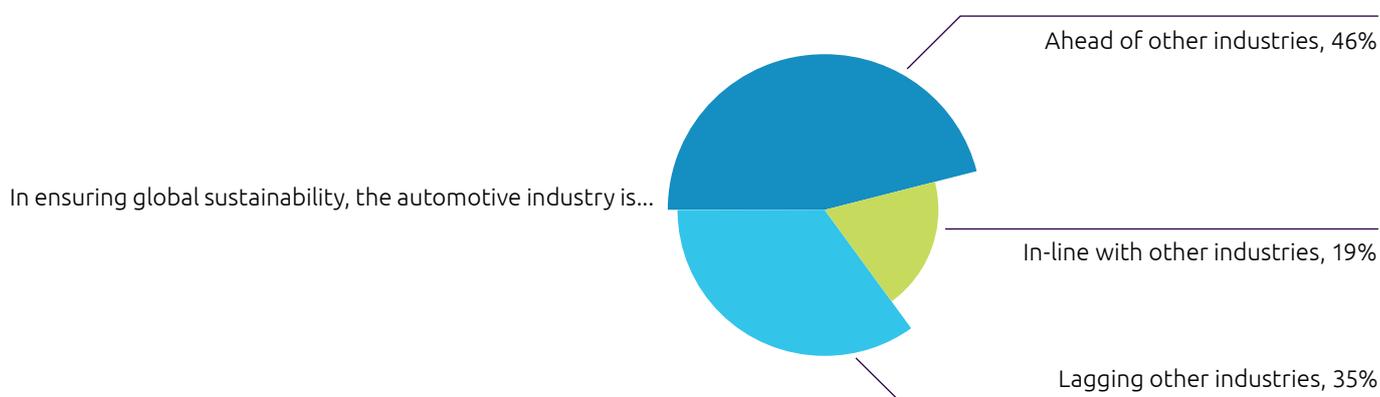
Source: Capgemini Research Institute analysis.



“Our three plants are meeting more than 50% of their electricity consumption demand from solar power. And to offset what we are consuming from the grid, we have undertaken extensive tree plantation in and around our plants as well as at CSR (corporate social responsibility) project sites across India.”

– Ashish Srivastava
Head of Sustainability, Marelli India

Figure 5: Expert views on progress of automotive relative to other industries

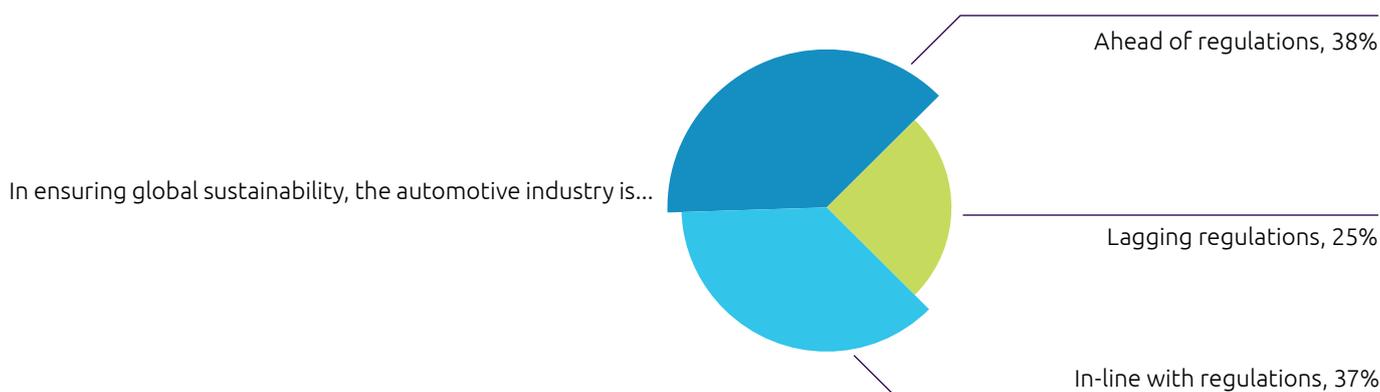


Source: Capgemini Research Institute sustainability experts survey (N=317), November–December 2019.

relative to that of other industries (see Figure 5). Marelli, a tier-1 automotive component supplier, is working at local levels to address sustainability. As Ashish Srivastava, head of sustainability at Marelli India, told us, And, as Figure 5 shows, three-quarters (75%) of the experts we surveyed also believe that the automotive industry has progressed in line, or ahead

of, regulatory requirements. For instance, according to the US Environmental Protection Agency, all large US OEMs earned Greenhouse Gas (GHG) emission credits for 2017, implying that they exceeded the GHG norms through the period 2012–2017.¹²

Figure 6: Experts believe that automotive organizations are broadly in-line with or ahead of regulations on sustainability



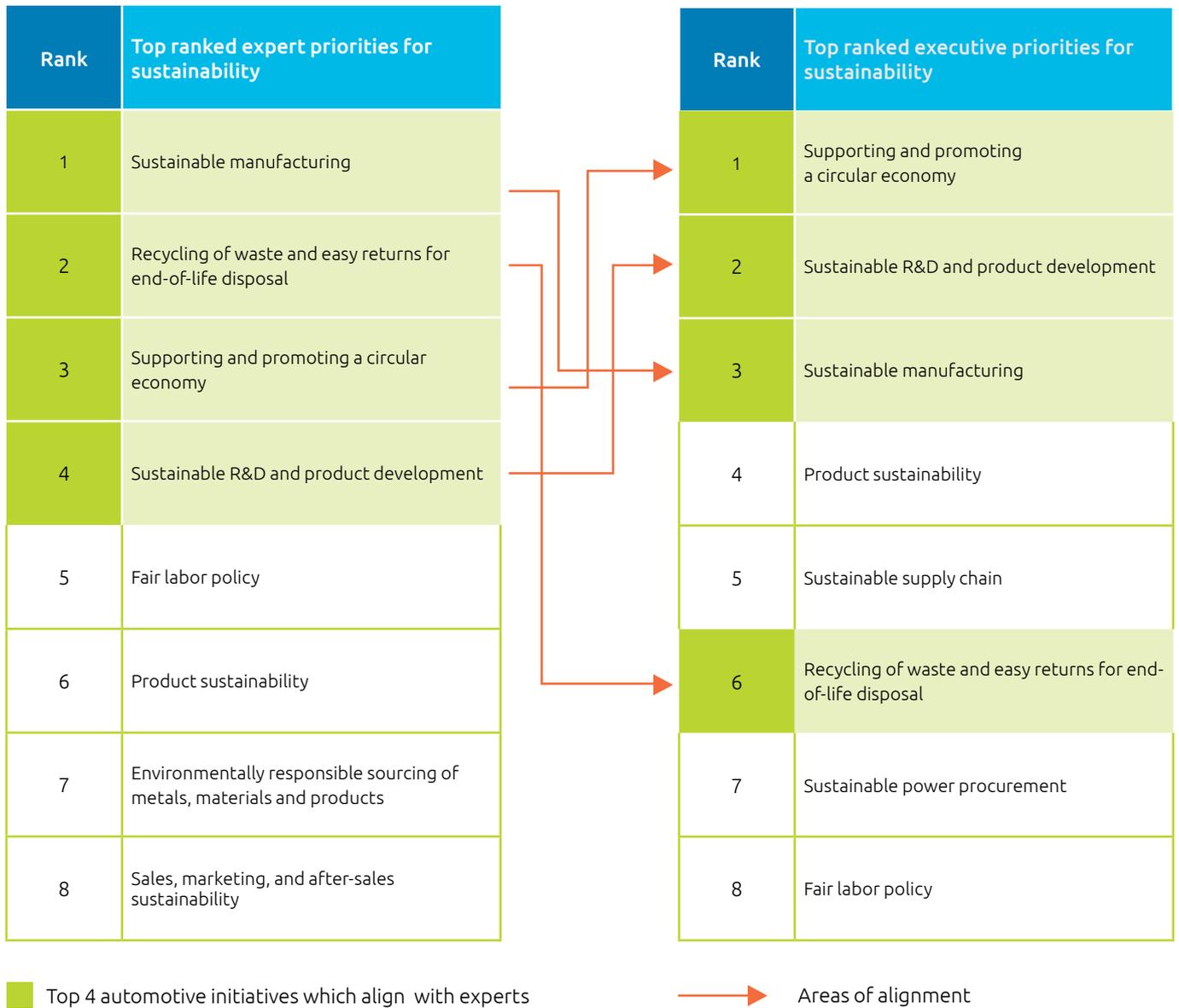
Source: Capgemini Research Institute sustainability experts survey (N=317), November–December 2019

The automotive industry and experts are aligned on sustainability priorities

With the industry united behind sustainability as a strategic priority, we also found broad alignment on the priorities that will have most impact on driving results and progress.

As Figure 7 shows, for example, the top four initiatives that experts think will have most impact are also being prioritized by industry executives.

Figure 7: Top ranked priorities among experts and executive for the automotive sector



Source: Capgemini Research Institute survey of automotive executives (N=503) and sustainability experts (N=317).

However, the implementation of sustainability initiatives is fragmented

For sustainability to meet the ambitious goals of the industry, it needs to be pursued across the value chain. Our survey found that 62% of automotive organizations claimed to have developed a comprehensive sustainability strategy with well-defined goals and targets. To assess this, we analysed the deployment of those sustainability initiatives we defined earlier in Figure 3, from “Sustainable R&D and product development” to “Sustainability in IT”:

- It is clear that some initiatives receive significant attention, but there is not a consistent focus on the entire value-chain. The most commonly deployed initiative is “supporting and promoting a circular economy”. This is being deployed by 52% of the companies we surveyed.

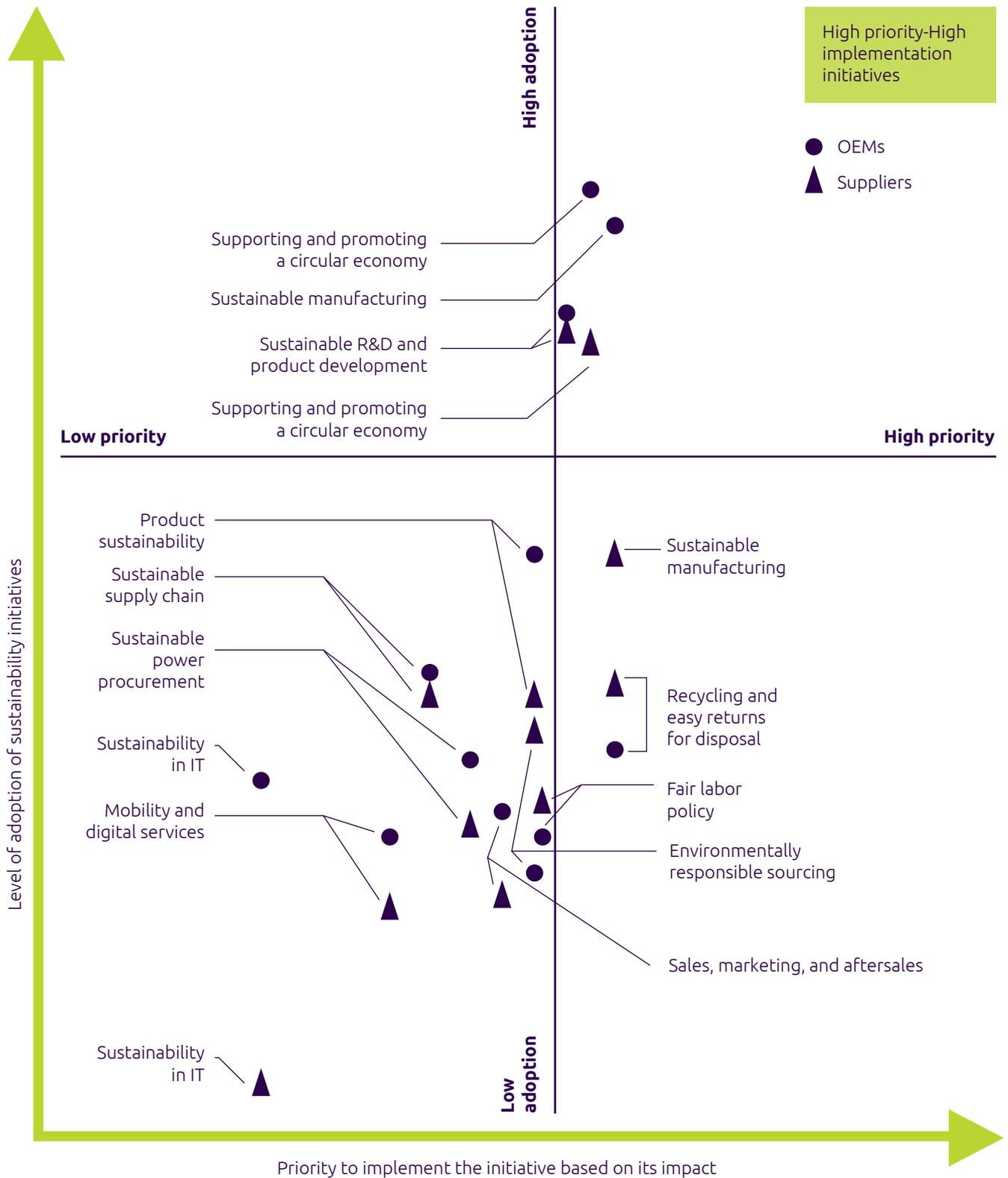
- In contrast, “sustainability in IT” is only being adopted by 8% of the organizations.

As Figure 8 shows, we compared the level of adoption of sustainability initiatives against their priorities indicated by experts. The top-right quadrant is the sweet spot – where OEMs and suppliers are implementing initiatives that have the most impact. We found that OEMs outperformed suppliers in all apart from three initiatives.

The average level of adoption of initiatives is on the lower side.



Figure 8: Suppliers lag OEMs in adopting sustainability initiatives*



* Level of adoption is the percentage of OEMs/suppliers mandating and deploying a sustainability initiative. Priority to implement based on impact represents the percentage of experts who define an initiative as one among the top three priorities for automotive organizations.

Source: Capgemini Research Institute survey of automotive executives (N=503) and sustainability experts (N=317), November-December 2019.

At a country level, there are significant variations in the sustainability initiatives deployed (see Figure 9). Take 'supporting and promoting a circular economy'. In Germany, 67% of the companies we surveyed are deploying this

initiative. However, in India, only 22% of organizations are deploying it. Germany and the US dominate the leader table, occupying 8 of the leading spots.

Figure 9: The highest and lowest adoption of sustainability initiatives - by country

Sustainability initiative mandated and deployed*	Highest adoption		Lowest adoption	
	Country	Deployment	Country	Deployment
Supporting and promoting a circular economy	Germany	67%	India	22%
Sustainable R&D and product development	France	56%	China	37%
Sustainable manufacturing	Germany	55%	France	31%
Product sustainability	France	38%	India	26%
Sustainable supply chain	US	37%	France	23%
Recycling of waste and easy returns for end-of-life disposal	US	35%	UK	13%
Sustainable power procurement	Germany	31%	India	15%
Fair labor policy	US	30%	UK	6%
Environmentally responsible sourcing of metals, materials and products	Sweden	30%	France	8%
Sales, marketing, and after-sales sustainability	US	28%	UK	13%
Mobility and digital services	Germany	23%	UK	3%
Sustainability in IT	Sweden	22%	UK	13%
Due diligence of all material and product procurement	India	15%	Sweden	4%

* Deployment implies that the organization has a working initiative as part of its standard sustainability practices. Percentages imply the number of executives who have mandated and deployed said initiative. Countries under consideration: US, UK, France, Germany, India, China, Sweden.

Note: We asked executives, "Which initiatives as part of your sustainability strategy are currently mandated and deployed?" The responses may not include similar initiatives that organizations have elsewhere (such as fair labor policy as part of HR) but not part of their sustainability strategy.

Source: Capgemini Research Institute survey of automotive executives (N=503) and sustainability experts (N=317), November–December 2019.

Additionally, it appears that the automotive organizations are not reaching out to the farther ends of the automotive value chain while implementing sustainability initiatives. For example, while adoption is greater in areas such as sustainable R&D, after-sales sustainability is only being

pursued by a small minority. This reflects that most of the automotive industry is working on areas which are closer to its core competency – such as R&D and manufacturing, but not beyond on either side of the value-chain.

Is sustainability being managed and measured?

As well as fragmented effort, we also found that more needs to be done in governance. Only 44% of automotive organizations have a central governance body to oversee their sustainability objectives and only two in five combine central governance with an empowered sustainability team. As a result, the influence of sustainability teams is weakened. *“There is a need to have oversight,”* says Kaisa Tarna-Mani, global head of sustainability at Autoliv, a Swedish automotive supplier. *“This is about knowing that we are doing the right things and that we are putting the focus on the correct issues. Having this central approach also allows us to integrate all of these key initiatives into our business strategy.”*

Ford offers an example of governance best practice. As Ramki Srinivasan, executive director, Business Office, Ford Motor Company, China told us, *“We have a standalone division – Sustainability, Environment & Safety Engineering – which implements sustainability best practices throughout Ford and leads its global environment and safety strategy, policy, and performance.”*



“There is a need to have oversight. This is about knowing that we are doing the right things and that we are putting the focus on the correct issues. Having this central approach also allows us to integrate all of these key initiatives into our business strategy.”

– Kaisa Tarna-Mani

Global Head of Sustainability at Autoliv, a Swedish automotive supplier

The KPIs required to establish accountability and measure progress are also lacking in several areas. For example, only 45% of automotive organizations have dedicated sustainability targets for key executives. Overall, only 19% have at least four quantifiable targets aligned with areas identified as having maximum impact on sustainability performance (such as recycling of waste, use of freshwater and ethical labor guidelines).

Groupe PSA provides a comprehensive blueprint for how to organize a sustainability group. The firm’s Supervisory Board, responsible for oversight and control at the Group level, has included climate as a part of its strategic plan. The company actively identifies and manages risks and opportunities related to climate change. The Group’s head of sustainable development reports on progress versus targets on the organization-wide climate commitments. At the execution level, each function such as programs and strategy, industrial, quality and engineering, purchasing, etc. are responsible to control, monitor and achieve functional targets set at the Board level.¹³

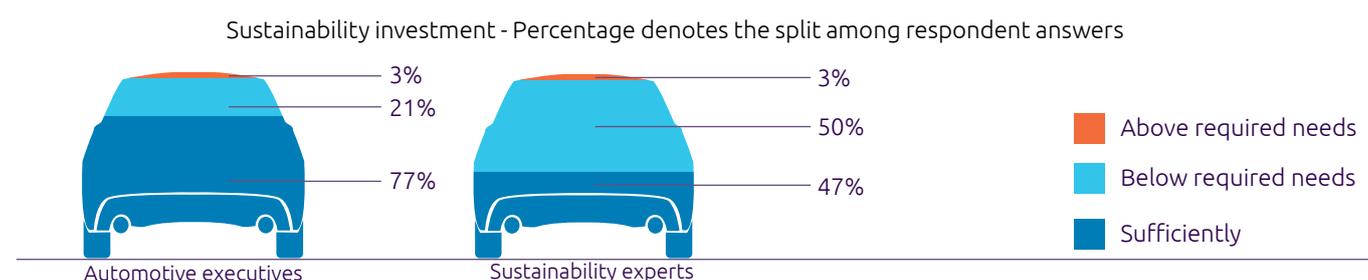
Although 75% of automotive organizations claim to be conducting sustainability audits, experts consider this as an area for improvement. They call for regular, third-party audits of automotive firms’ operations (94%) as well as those of suppliers and dealers (88%) from a sustainability perspective.

An additional \$50 billion investment is needed to meet sustainability commitments

Sustainability requires considerable investment, yet only 3% of automotive executives and experts claim that they invest sufficiently above required needs. Automotive executives believe more strongly than sustainability experts that their investments are sufficient (see Figure 10). A majority of experts (50%) believe that the automotive organizations are investing less than what they should to achieve their sustainability targets, such as those set out in the Paris Agreement.

experts (51%) who say that the industry's investment levels are less than sufficient, believe that the automotive organizations are investing 20% less than what is needed to achieve sustainability targets. Whether the overall investment by the industry is enough to meet sustainability goals. Our survey panel of sustainability experts (51%) who say that the industry's investment levels are less than sufficient, believe that the automotive organizations are investing 20% less than what is needed to achieve sustainability targets.

Figure 10: The automotive industry needs to invest more in sustainability



Source: Capgemini Research Institute survey of automotive executives (N=503) and sustainability experts (N=317), November–December 2019.

Areas of investment range from increasing renewable power generation capacity at manufacturing plants to water treatment facilities to control freshwater usage:

- Bosch has earmarked €100 million per year from 2018 to 2030 to save 1,700 GWh of energy and generate 400 GWh of its energy needs from renewable sources to power its plants and buildings. Similarly, it has earmarked €10 million per year to reduce the withdrawal of water by 25% by 2025.
- BMW Group invested €161 million in 2018 on environmental protection. This included resource-friendly production processes at its paint shops to reduce electricity consumption, CO₂ emissions, and solvent use.
- In 2018, Honda invested 8.1 billion yen (€67 million) on a variety of initiatives that include: installation, operation, and acquisition of certification for environmental management systems; waste processing, treatment, reduction, elimination and recycling; and environmental improvement measures, such as ecosystem protection, clean-ups, green space development and natural landscape conservation.

However, while leading players are making significant investments such as these, there are question marks over whether the overall investment by the industry is enough to meet sustainability goals. Our survey panel of sustainability

We quantified the shortfall of investment as follows:

- Target sustainability investment to revenue ratio derived from our survey of experts: 0.9%
- Actual sustainability investment to revenue ratio (based on sample of 10 large automotive organizations): 0.4%
- Shortfall in sustainability investment to revenue ratio: 0.5%
- Average annual forecast revenue of the automotive industry over the next five years: \$1.9 trillion
- Total investments over 5 years: USD 47.5 billion or ~USD 50 billion

This investment needs to be made in addition to the investment also needed for large-scale manufacturing and R&D for electric vehicles and autonomous vehicles.

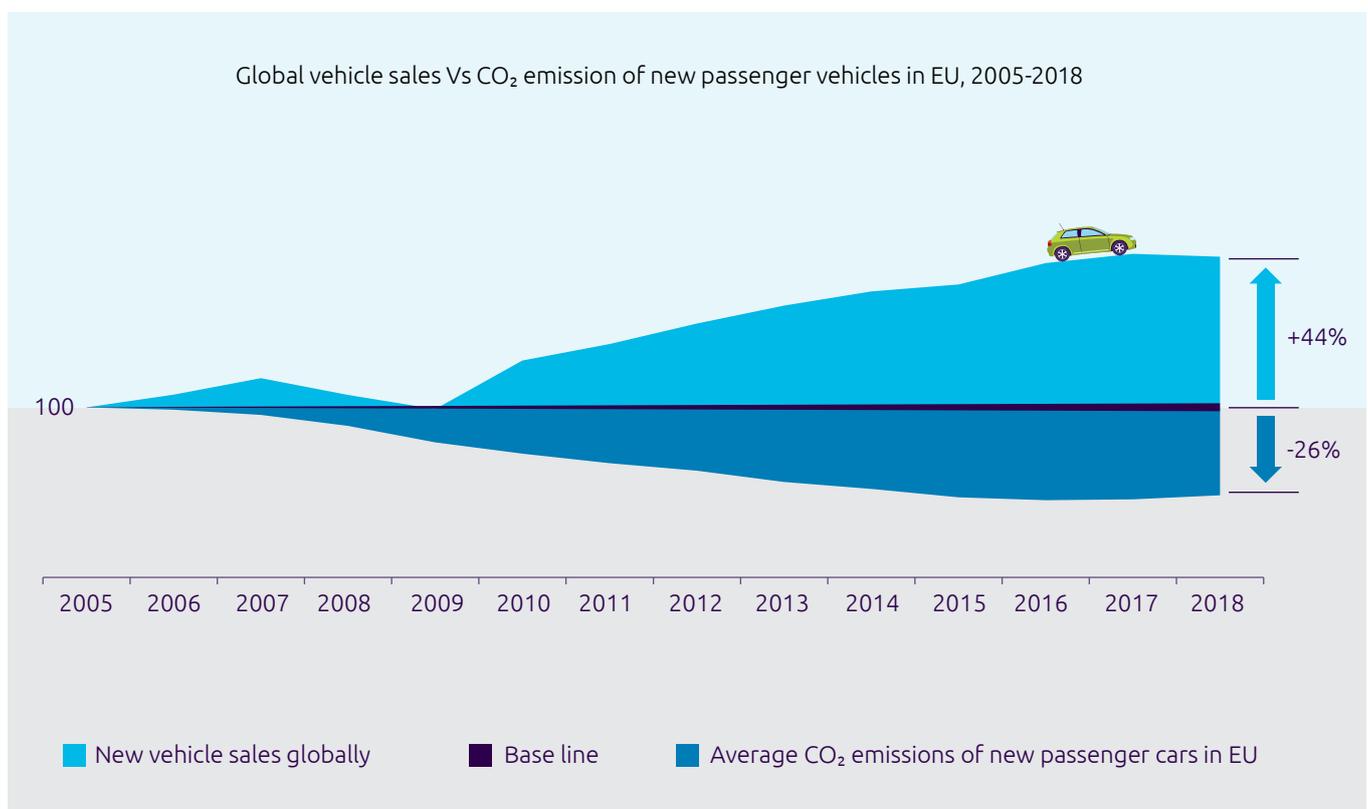
Given that this investment shortfall will likely take some time to catch up, automotive organizations will need to bolster their sustainability strategy in the short term to ensure that they don't fall behind on sustainability objectives. A good place to start is to focus efforts on two major initiatives – reinforcing sustainability of electric vehicles and adoption of circular economy practices. We believe that these two initiatives will drive the biggest positive impact among all other sustainability programs that automotive organizations undertake. In the next chapter, we explain how the automotive industry can get these two critical priorities right.

Realizing the true sustainability potential of electric vehicles and circular economy is critical

Based on our research, discussions with industry experts and executives, and experience of working with large automotive organizations, we believe two critical areas will drive maximum sustainability impact for the automotive industry: ensuring that electric vehicles are truly sustainable and incorporating circular economy¹⁷ practices across the automotive value chain. Here's why:

Electric vehicles: The largest contributor of GHG across the lifecycle of a conventional internal combustion engine (ICE) vehicle is tailpipe emission (see Figure 13). Automakers have continuously improved the fuel efficiency of vehicles, which has led to a significant reduction (26%) in emissions per car. However, growing demand for vehicles is undermining any gains -- from 2005 onwards, the industry has sold 44% more vehicles (see Figure 11).¹⁸ To reduce overall GHG emissions, companies will have to shift to EVs, with zero emissions when powered by renewable energy sources.

Figure 11: Growing sale of vehicles negates gains made in ICE efficiencies



Source: European Environment Agency, "Average CO₂ emissions from newly registered motor vehicles," August 2019. International Organization of Motor Vehicle Manufacturers, "Registration or sales of new vehicles – all types," accessed in February 2020. Note: EU passenger car guidelines are more stringent than other categories and countries' regulations. Hence these form an optimistic estimate of global emissions efficiency gains.

Electric vehicles are witnessing a remarkable growth – 63% in 2018 to 5 million stock units worldwide. It is expected that by 2030 EVs will have global sales of 23 million units (excluding two/three wheelers) and 130 million electric vehicles on the road.¹⁹ As assistant director at a leading American automotive manufacturer told us, “EVs and EV ecosystem development are central to our business strategy. Recently, we appointed a head of EV to lead product development, purchasing and supply chain, as well as strengthening our EV product leadership. We already have a full line-up of EVs in the coming years and plan to invest \$3 billion in a plant to build electric trucks, along with partnerships to build public charging infrastructure.”

The circular economy: As experts in our survey testified, the circular economy is among the top three initiatives in terms of impact on sustainability, along with recycling of waste and end-of-life disposal. As Lidia Wojtal, a climate-energy expert and consultant, said, “Initiatives such as waste management and recycling are still not on the agenda of automotive companies. But in the next five years or so they will have to be a critical part of their agenda – car manufacturers will need to look at how they re-use materials from their own products.”

The circular economy also touches upon sustainability initiatives across the value chain, from product sustainability to end-of-life disposals. For example:

- **Sales, marketing, and after-sales services:** Using remanufactured engines results in 73% to 87% fewer CO₂ emissions compared to building a new one through traditional processes.²⁰
- **Recycling of waste and easy returns for end-of-life disposal:** At Michelin’s UK plant, old truck tires are rethreaded to bring their performance in line with a new tire. With this process, 85% of a tire is reused, which saves 30 kg of rubber and 20 kg of steel per tire, as well as 60 kg of CO₂ emissions.²¹
- **Environmentally responsible sourcing of metals, minerals and products:** In France, 86% of end-of-life components by weight is saved and recycled owing to the circular economy.²² This stops a considerable amount of waste from being consigned to landfill.

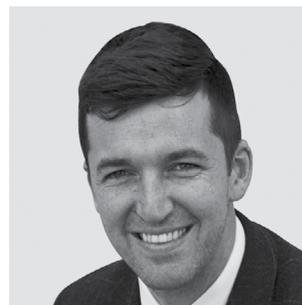
To realize the true sustainability potential of these two high-impact initiatives, there is a need to overcome several drawbacks that limit the benefits they deliver:

- Electric vehicles need to be powered by renewable energy sources to be truly sustainable
- EV batteries require a strong circular economy backbone to increase their lifespan and give them a second life
- Circular economy practices need to be infused more broadly across the automotive value chain to benefit from their cost and resource utilization benefits

Electric vehicles need the support of a strong sustainability strategy

Electric vehicles do deliver net-positive reduction in GHG emissions. For the 27 EU countries and the UK, for example, the shift to electric vehicles would cut the overall lifetime GHG footprint by about 37% for passenger vehicles (see Figure 12)²³ while reducing the operating footprint by 75%.

For these benefits, governments around the world are incentivizing automotive companies to incorporate more electric vehicles in their fleet. Shenzhen in China electrified 16,000 buses, resulting in the number of smoggy days falling from 115 in 2010 to 35 in 2015.²⁴ Oliver Kroner, Sustainability Coordinator for City of Cincinnati, Ohio, reinforces the importance of electric vehicles.



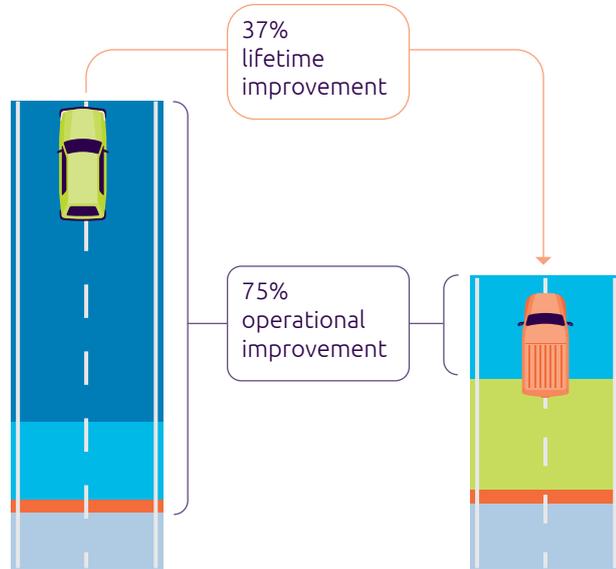
“The shift to electric vehicles, and electrification paired with renewable energy generation, will be a key component of our (City of Cincinnati) transition to sustainability”

– **Oliver Kroner**
Sustainability Coordinator for City of Cincinnati, Ohio



Figure 12: The GHG emission of electric vehicles is significantly lower than ICE vehicles over their entire lifetime

Overall lifecycle GHG emission analysis (g.CO₂ eq/km)



	Internal combustion engine vehicle	Electric vehicle
■ Fuel combustion	208	0
■ Power production/fuel production	50	67
■ Battery	0	72
■ Maintenance	9	9
■ Production of body/components	37	43

* Assuming a total lifetime distance of 150,000 Kms, EVs powered by the EU-27+UK grid. The chart shows a comparison of average GHG emissions between five EVs and five ICEs. Electric cars are Tesla Model 3 standard range (2020), VW ID.3 standard range, Polestar 2, Tesla Model 3 standard 50kWh (2018). ICE cars in consideration are Toyota Corolla Verso 177 (2013), VW Golf S2W TDI (2016), Volvo C30 2.0 and Ford Fiesta 1.25 (2017).

Source: Luxembourg Institute of Technology - Climobile Model for EV, 2019; Capgemini Research Institute analysis.

Our survey also shows that 74% of automotive OEMs have an electric vehicle strategy. However, only 56% of them have it as part of their sustainability strategy. This means that often the electric vehicle strategy is not designed with sustainability considerations e.g. how will our EVs be powered/recharged? What options do consumers have to access renewable sources to charge their cars? And how can EV battery life be extended?

Electric vehicles need the support of a comprehensive sustainability strategy which covers the entire value chain to be truly sustainable.

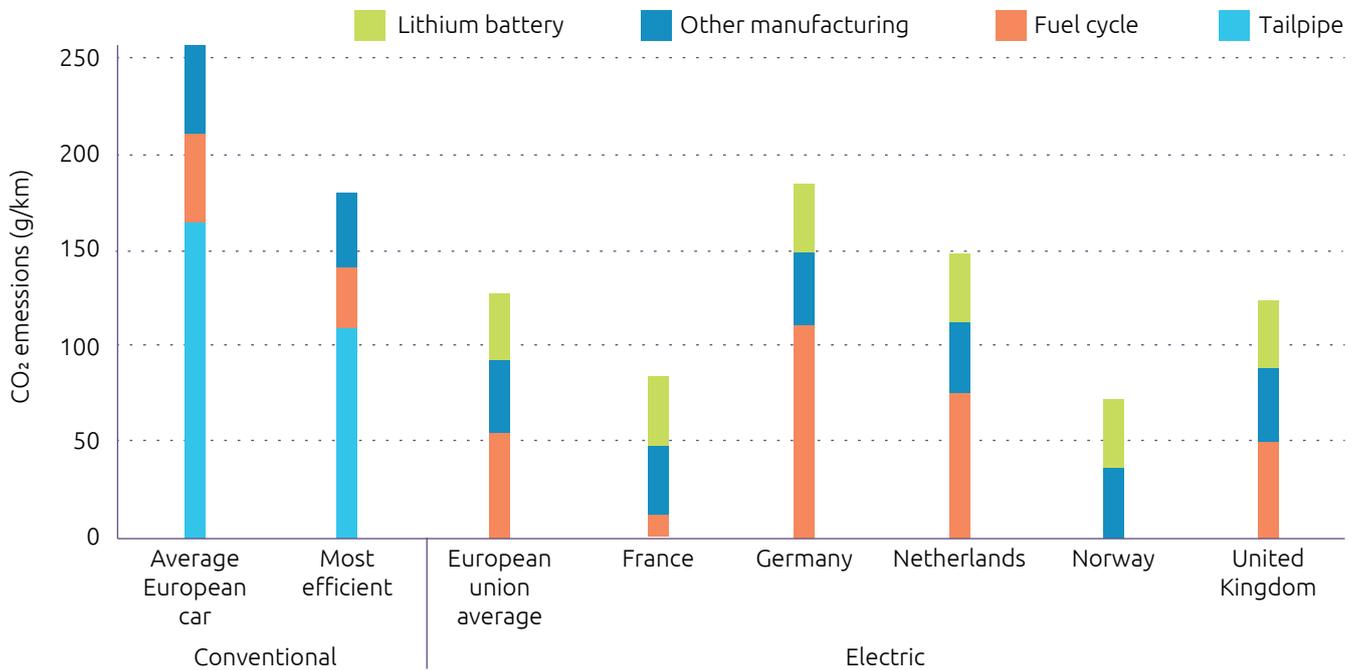
Our research also shows that only 15% of OEMs that have an EV strategy also have a plan to use a renewable-energy-powered charging infrastructure. Pairing electric vehicles with solar power and residential batteries could be a viable sustainable business model. This would require stronger collaboration between automotive organizations with utilities and governments. A good example of this initiative is by BMW partnering with Pacific Gas & Electricity for their

ChargeForward pilot program. Through incentivizing and changing consumer behaviour, most participant EV owners charged their vehicles during the day when there was an abundance of solar power.²⁵ Other viable models like leasing and circular economy also considerably improves the net positive impact of EVs over ICEs.

EVs, when powered by different mix of electricity supply, can have differing CO₂ footprints (see Figure 13). For example, Germany, which has a more carbon-intensive electric grid, results in a larger CO₂ footprint for EVs compared to Norway or France. Hence, for countries with more carbon-intensive energy generation, shifting to alternate fuels like CNG and hybrid cars would be more effective than developing electric vehicles. Overall the automotive industry must take into account the following trends, according to the IEA¹⁹:

- Growing demand for EVs would require a much wider charging infrastructure network. The charging network has grown by 44% in 2018 to keep up with EV demand,

Figure 13: EV emissions vary by country depending on the electricity grid powering them



Source: International Council on Clean Transport, “Effects of battery manufacturing on electric vehicle lifecycle greenhouse emissions,” February 2018. Note: Estimate of 150,000 km lifecycle.

however almost 90% of the increase was due to private charging points (i.e. points that feed directly from the grid).

- Effectively, most of the charging infrastructure is directly powered by the grid. This creates an incremental demand of 640 TWh by 2030 or 2.7% of the 2018 global electric output. If this increase in demand outstrips supply from renewable sources, EVs will still be dependent on carbon-intensive electricity.
- Due to the above two scenarios, in-use EV operations by 2030 would lead to an effective contribution of 230 million tonnes of CO₂ equivalent (mt CO₂-eq) while displacing 220 mt CO₂-eq.

While there are plausible alternatives for zero-emission vehicles like hydrogen-powered cars – their development and adoption are rather limited and hence their overall impact currently is less significant in the near future compared to electric vehicles.

Circular economy yields economic gains while supporting EV sustainability

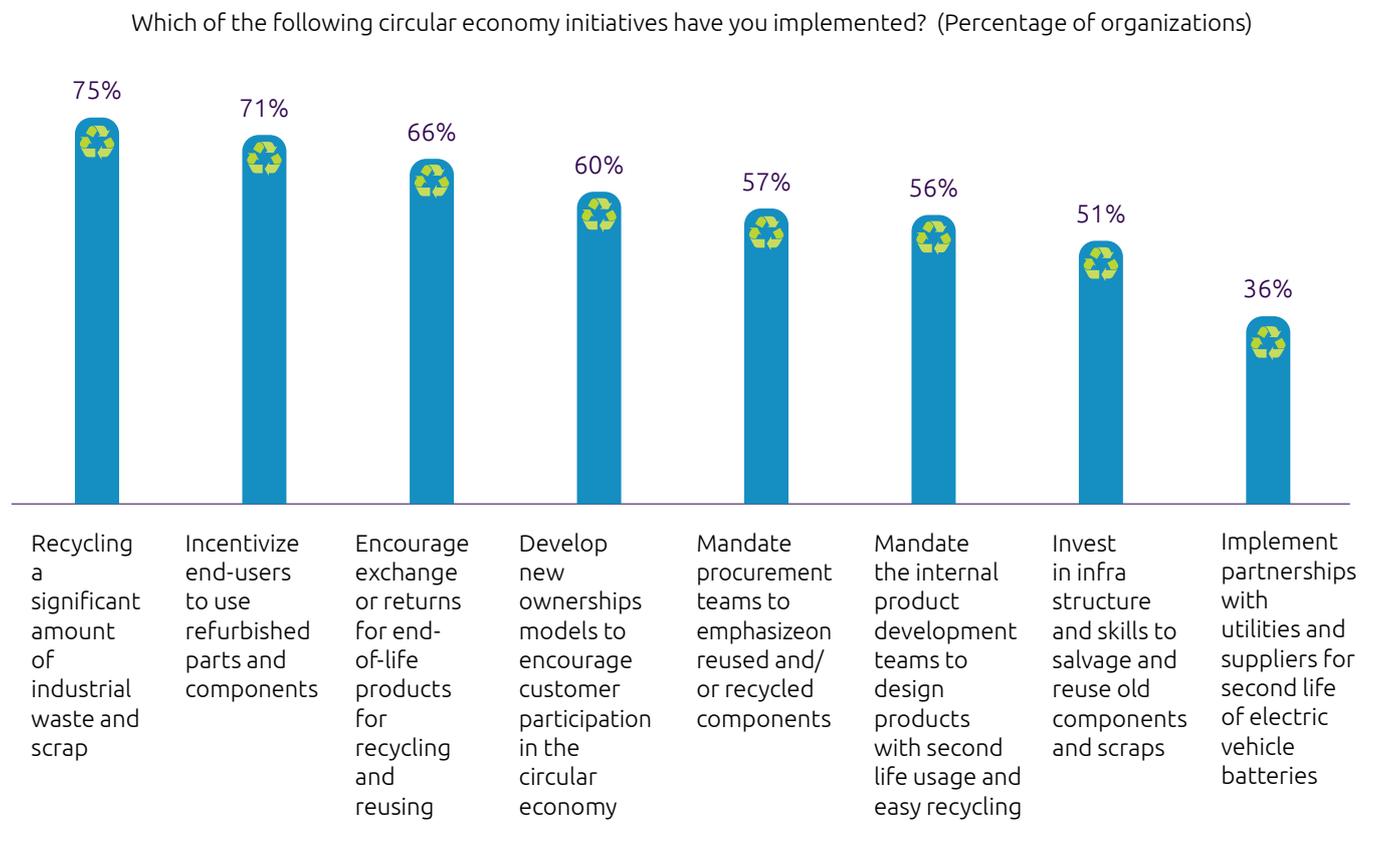
Supporting a circular economy has a strong business case. Remanufactured vehicle parts can save around 30 to 50% of the cost while retaining the same level of quality as traditionally manufactured ones.²⁶ Leveraging the circular economy provides immediate cost savings. GM has generated \$1 billion from the sale of recyclable waste, with 150 of its factories and offices designated as “zero-waste to landfill.”²⁷ Additionally, the increased cost of remanufacturing vehicle



“Organizations need to own the strategic stock of resources. They need to shift to a circular economy. It’s not just ethical, it’s just not for sustainability or environmental sustainability. It’s a matter of competitiveness and of being able to manufacture in constrained supply chains. It’s a matter of survival for the sector.”

– **Jordi Oliver Solà**
CEO, Inèdit, a circular economy consulting group.

Figure 14: Automotive organizations have significant variability in implementing various sustainability initiatives



Source: Capgemini Research Institute survey of automotive executives (N=503) and sustainability experts (N=317), November–December 2019.

parts is more than offset by the reduction in material and resource costs, as well as other overheads.²⁸

As we saw earlier, “[supporting and promoting a circular economy](#)” is the most commonly deployed initiative among the fourteen we studied. However, only half of organizations are deploying it. More needs to be done to adopt remanufacturing best practices. Additionally, only 32% of their supply chain contributes to the circular economy, and only expect this to increase to 51% in five years’ time. “[The automotive industry cannot produce hundreds of thousands of vehicles per year using virgin raw materials,](#)” says Jordi Oliver-Solà, CEO at the circular economy consulting group Inèdit.

Most automotive organizations are focused on recycling, incentivizing the use of refurbished components and end-of-life use of vehicles (see Figure 14). For example, in November 2019, Toyota set up a joint venture with Maruti to establish vehicle dismantling units across India.²⁹ However, only 51% are investing in salvage infrastructure and skills and only 36% partner with suppliers and utilities around the second life for EV batteries. Renault provides an example of what can be done in this area. It has developed a network of over 330 salvage organizations in France, through its subsidiary Renault Environment, to recycle parts and materials.³⁰

Renault cars currently sold in Europe contain on average 36% recycled materials and 10–20% recycled plastics.³¹

With the introduction of EVs, the circular economy becomes ever-more important. Supply chain constraints for materials such as lithium, which are critical for EVs, can be addressed by closing the materials loop. EVs also have a considerably larger carbon footprint in manufacturing compared to ICE due to battery production. A flourishing circular economy can reduce dependence on production and mining of lithium and rare earth metals. Extending lifetime and refurbishment of components also reduces the carbon footprint of vehicles and components considerably.

EV batteries can be given a second life as storage grid batteries, which will make renewable energy more economical while preventing the increased toxicity of battery chemicals. As Lidia Wojtal, a climate-energy expert and consultant, told us, “[The automotive industry has to invest in the disposal and reuse of electric cars and batteries along with electromobility at the same time. It is already obvious that these batteries will exhaust one day and they will need to be handled in a sustainable manner.](#)”

In the next section, we focus on key actions that the automotive organizations must take to accelerate sustainability programs in the long run.

How can automotive firms accelerate sustainability?

To understand how organizations can accelerate their sustainability strategy and deliver their goals, we wanted to identify the best practices of the organizations that are leading in this field. To do this, we assessed the maturity of automotive organizations' sustainability programs against

four areas, as shown in Figure 15:

- Sustainability vision
- Sustainability engagement
- Sustainability governance
- Iterative transformation roadmap

Sustainability in the automotive industry: a maturity framework

To assess the maturity of automotive organizations' sustainability programs, we defined a maturity framework made up of four key pillars:

- **Sustainability vision:** the long-term ambition on sustainable action, declared strategy, goals, and an assessment of risks, exposures and opportunities related to climate change
- **Sustainability engagement:** partnering within and outside the automotive value chain on mitigating environmental impact and communicating it effectively to all stakeholders
- **Sustainability governance:** how sustainability is managed, including the specific responsibilities of executives at different levels for delivering the organization-wide vision
- **Iterative transformation roadmap:** operational activities involving other value chain partners. For example, to implement and drive to completion new business models, mobility and digital services, and circular economy initiatives.

Figure 15: A sustainability maturity framework for the automotive industry



Source: Capgemini Research Institute analysis.

We scored the responses of automotive organizations that we surveyed based on the elements of the above framework. Organizations who do better than the average across all four pillars are classified as sustainability leaders. Those that perform below average on at least three of the four pillars are classified as laggards. The remaining population in between forms the majority cohort.

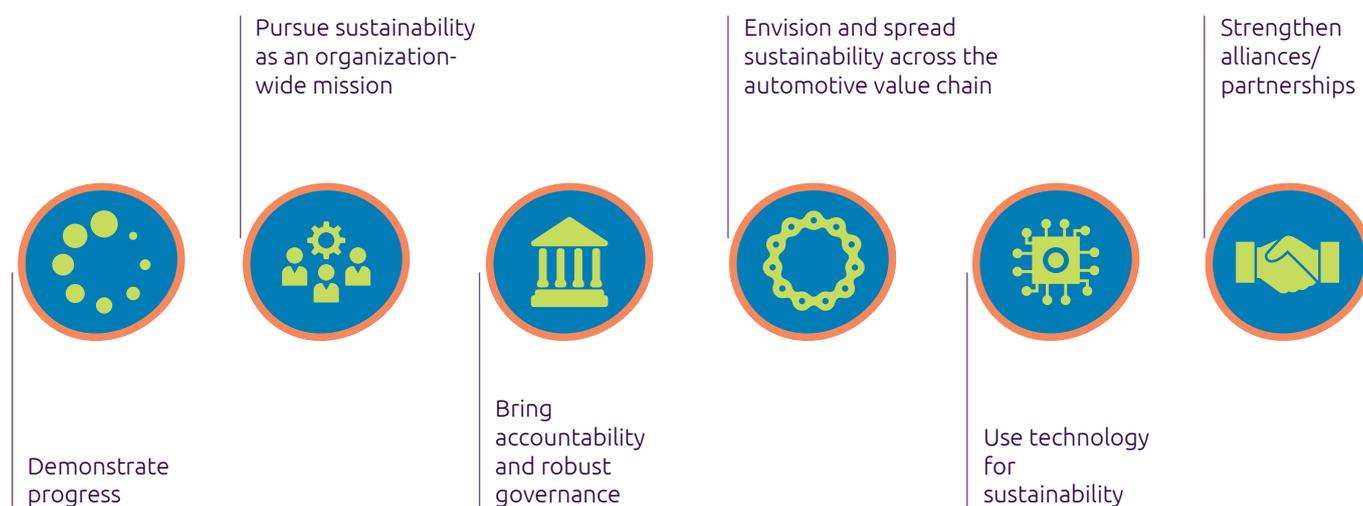
When we analysed all surveyed automotive organizations against this framework, we found that consistent high-performance is a rarity: only 9% are high performing “Sustainability Leaders” (they scored above average on all four pillars), with 91% yet to reach maturity. Of the leaders, over half come from just two geographies – Germany (28%) and the US (26%) – and tend to be large organizations with annual revenue of more than \$25 billion.

Among the immature organizations, over a quarter (26%) would be classified as laggards, with particularly underdeveloped sustainability programs and practices (they score below average on at least three of the four pillars). Overall, laggards perform worst against the “Iterative

Increasingly, demonstrating strong progress against ESG targets – and doing so in a way that is material and credible – will be critical to access to capital markets. Ratings agencies are incorporating ESG in their credit rating frameworks and financial institutions are factoring in ESG performance to their investment decision-making processes. Automotive organizations need to provide clear, comparable, consistent and trusted sustainability disclosures.

As Larry Fink, chairman and CEO of BlackRock, has said, “All investors, regulators, insurers, and the public, need a clearer picture of how companies are managing sustainability-related questions. This data should extend beyond climate to questions around how each company serves its full set

Figure 16: Sustainability best practices for the automotive industry



Source: Capgemini Research Institute analysis.

transformation roadmap” pillar. This signifies an overall underinvestment in sustainability and a lack of initiatives across the industry value chain.

In this section, we highlight certain best practices of sustainability leaders that the industry can emulate to drive their sustainability programs forward, as Figure 16 shows.

Demonstrate tangible progress on sustainability

As our survey shows, around 80% of automotive companies publish a sustainability report every year. However, often the data reported are not comparable across different companies or consistent from year-to-year. In addition, it is estimated that almost 42% of sustainability-related metrics go unreported by large organizations.³³

of stakeholders, such as the diversity of its workforce, the sustainability of its supply chain, or how well it protects its customers’ data.”³⁴

Today, assessing that performance – and comparing one organization against another – is impossible because there are no standardized metrics. The industry needs to come together to develop standardized data/KPIs which investors and other stakeholders can use to evaluate their performance on sustainability. Groupe PSA’s Climate Report complies with the recommendations of the Financial Stability Board’s Task Force on Climate-related Financial Disclosures (TCFD).³⁵ The industry also needs to include this information in their financial reports and not just in sustainability reports. An assessment of short- and long-term risks and opportunities related to their transition into a carbon-neutral economy will also be helpful for investors and other stakeholders.

Pursue sustainability as an organization-wide mission

The automotive industry has focused mostly on cost savings or efficiency improvements as drivers of their sustainability strategy. However, automotive leaders see it much more broadly – about long-term value and purpose. Sustainability leaders in our survey understand the importance of meeting these expectations. They make sustainability a key part of their purpose: 91% say that their sustainability strategy is driven by their “commitment to live up to our organization’s moral and ethical values.” For laggards, however, this drops to 57%. Ralf Pfitzner, head of sustainability, Volkswagen Group, outlines how they see sustainability as critical to their long-term value: “If we approach it the right way, sustainability is not a cost factor, but rather an investment in a viable company,”³⁶

Leader organizations embed sustainability into their culture, promote employee awareness, and advocate sustainability externally. They make it a central part of their corporate purpose or reason for being – and it is key to attracting talent and meeting the increased expectations of multiple stakeholders: investors, customers, employees, and society. For example, 72% of leaders see sustainability as central to attracting, retaining, and motivating talent, but this drops to 47% for laggards.

Make business executives accountable for sustainability and invest in robust governance

Sustainability leaders are putting in place the governance mechanisms needed to drive their sustainability goals. For 64% of leaders, sustainability is a C-level or board-level agenda, while this is true for only 37% of laggards. Almost 61% of leaders have a central governance body to oversee all sustainability objectives, versus 31% of laggards. A centralized body can help coordinate efforts across the organization – gathering relevant data, tracking progress, and socializing its impact. Recently, General Motors appointed its first chief sustainability officer to lead the company as a global advocate for climate-sensitive manufacturing and mobility operations and direct the design and implementation infrastructure for EVs.³⁷ Centralizing governance also fulfills a key decision-making role:

- Decide who to partner with: 83% of leaders empower their sustainability group to decide who to partner with externally, versus 31% of laggards
- Ensuring key functions – such as IT, HR, or marketing – are measuring their environmental impact and developing measures to contain or minimize it.
- Ensure R&D processes consider environmental impact right from the product design stage (83% for leaders versus 63% for laggards).

Envision and spread sustainability initiatives across the automotive value chain

Our research shows that organizations deploy sustainability initiatives with a limited scope. They seldom reach to the “ends” of their value chain to ensure sustainability from the mining of metals to the reuse of materials. OEMs will often have limited control over how their tier-two and tier-three suppliers implement sustainable practices. “A lot of the time, we don’t have a choice about who our tier-one suppliers choose from,” says the director at a large global OEM. “We can encourage them, but they are clearly their own businesses. There is a disconnect and sometimes we can’t drill all the way down.”

To tackle these challenges, companies are collaborating with their suppliers to develop greater supply chain transparency. Volvo is a case in point. The company partnered with two of its EV battery suppliers to create a digital ledger that tracks the source of rare-earth materials such as Cobalt.⁴¹

Leading organizations also implement sustainability across functions and processes, including R&D, design, operations, supply chain, sales, IT, and mobility services. Ninety-three percent of leaders embed principles of fair labor policy such as gender equality, human rights, and improved working conditions into their own and their suppliers’ sustainability practices. For laggards, however, this drops to 51%.

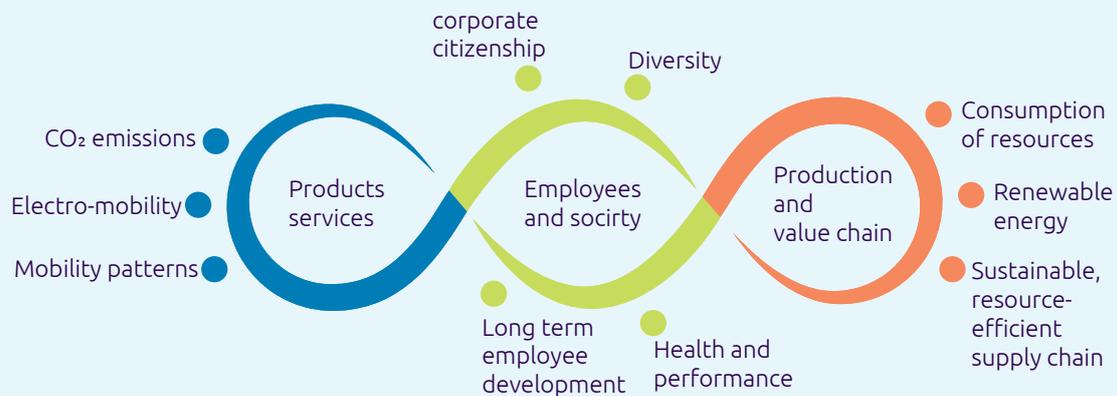
BMW's path to sustainability

In 2000 BMW incorporated a group-wide sustainability strategy, and in 2009 it set out its organization-wide sustainability targets (see Figure 17). As a result, the company has been the only automotive brand listed on the Dow Jones Sustainability Index since that benchmark began.

BMW is one of the leaders in electric vehicles in Europe and has set an ambitious target of having at least 25 electrified models in its fleet by 2023, including 13 fully electric cars. Beyond EVs, it has achieved significant traction in other critical areas of sustainability:

- **Fleet emissions:** Reduced average fuel consumption of new European fleet by 42% since 1996.
- **Battery recycling:** Formed a joint venture to develop a fully sustainable value chain for battery cells.
- **Production:** All BMW plants will run on green electricity by the end of this year. It recycles and reuses 99% of waste generated during production.
- **Logistics:** More than 50% of BMW vehicles produced worldwide are transported by rail, avoiding the greater pollution impact of truck shipments.
- **Supply chain:** BMW was the first automaker to put information on smelters and the country-of-origin of cobalt into the public domain.
- **Mobility services:** Launched a leasing program with 5,500 bicycle dealers in Germany, supporting any employees who wanted to cycle to work.
- **IT sustainability:** The company's research center at Munich uses the naturally cold temperature of groundwater to cool its computer center, using 90% less electricity than conventional sources.

Figure 17: BMW has been pursuing 10 key sustainability targets



Source: BMW sustainability report 2018.

Looking forward to 2030, BMW has a comprehensive sustainability plan involving six areas:

- Mobility solutions
- Decarbonization
- Environmental and social standards in the supplier network
- Circular economy
- Employees and culture
- Responsibility and partnerships.

Source: BMW corporate website, BMW sustainability report 2018.

Use technology to improve sustainability of operations

Automotive organizations have traditionally focused on using technologies to improve vehicle efficiencies (such as reducing waste) and developing innovations in EVs and AVs. Substantial value can also be unlocked by using forecasting and analytic techniques to calculate, track, audit and publish environmental impact. As the sustainability manager at a leading European automotive manufacturer told us, “We get the bill of materials for a car and convert it into an environmental impact using a software tool. We’re able to generate a specific figure for the entire company’s activities. We can then use that for future generations of vehicles. We can also start at the end and work back to track and monitor specific metrics. We also have these numbers independently audited against the requirements of our long-term sustainability goals.”

Leading organizations are introducing technologies to promote sustainability and employee welfare. To promote worker safety, Ford introduced a wearable technology, EksoVest, at its 15 plants. It reduces the risk of injury during the conduct of overhead work. Similarly, at one of its UK plants, Ford implemented drones with cameras for overhead inspections, cutting accident risk, as well as inspection time, drastically.³⁸

Automotive companies are already realizing significant benefits from additive manufacturing or 3D printing technologies, which help in reducing waste. They can also learn from other sectors to implement energy-efficient solutions using AI. For example, Google uses AI to monitor cooling of its data centers to lower emissions and energy consumption.

Strengthen alliances and partnerships for greater impact

Automotive industry operations are intricately linked across geographies. As a result, critical initiatives – such as the circular economy and developments in EVs – will not come to fruition without active participation of all players. Collaboration will be key. For example, BMW, Scania, Volvo, and Volkswagen were lead partners to promote a harmonized approach in driving sustainability in automotive procurement processes. It created a self-assessment questionnaire (SAQ) for suppliers for parts procurement. This questionnaire is now increasingly becoming the standard for the automotive industry.³⁹

Similarly, deploying material or component-related innovations in isolation (such as the use of biodegradable materials or recycled components) will not gain traction unless value chain partners are on board. For example, to bring the circular economy to life, automotive organizations need to work closely with suppliers to ensure that recycled materials retain their quality and properties.

Companies are involving customers and dealers in their sustainability initiatives. Amandine Muskus, senior manager for government affairs at Kia Motors Corporation, says: “Kia is actively engaged in researching the most sustainable methods to move into future mobility. Whether that be through plans to roll out 11 new EV models by 2025 – or taking on recycling initiatives for batteries and parts – we are committed to a cleaner future. A key component of this is communication: encouraging the correct handling of replacement and recycling of parts and fluids. Different countries have different regulations in place, and we are committed to communicating these changes in the most efficient and effective manner to all relevant parties.”

Companies need to move outside their industry to partner and reduce emissions across the automotive value chain. For instance, in 2019, Ford and GM partnered with DTE Energy, a US-based energy company, to procure 500,000 and 300,000 megawatt hours of wind energy.⁴⁰



We encourage our entire value chain – from suppliers to plants, dealerships to customers – to consider making more sustainable choices.

Conclusion

Automotive organizations have made sustainability a strategic priority even as the challenge to pursue it is greater and more pressing than ever. While this is a good start, ground-level action is needed across the automotive value chain. Governance, measurement, and monitoring need to be strengthened, and sustainability investments need to be significantly ramped up beyond large scale advances in R&D and manufacturing of EVs. The EV strategy itself needs to be supported by the ecosystem of renewable charging infrastructure and circular economy to be truly sustainable. These initiatives will drive a great impact, yet the industry needs a structured approach to sustainability in the long run. Automotive organizations must prudently assess the maturity of their sustainability strategy, learn from sustainability leaders, and make sustainability an organization-wide mission.

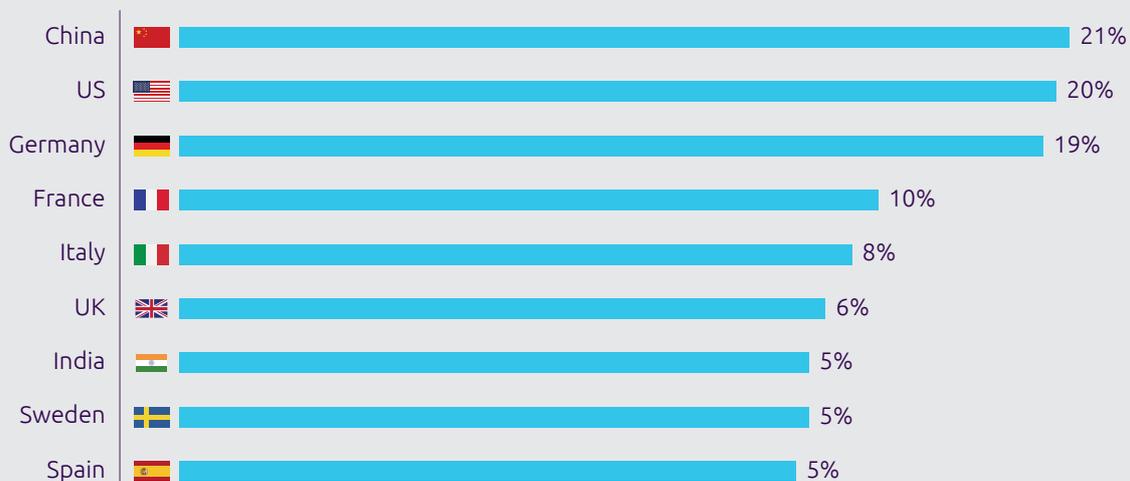


Appendix

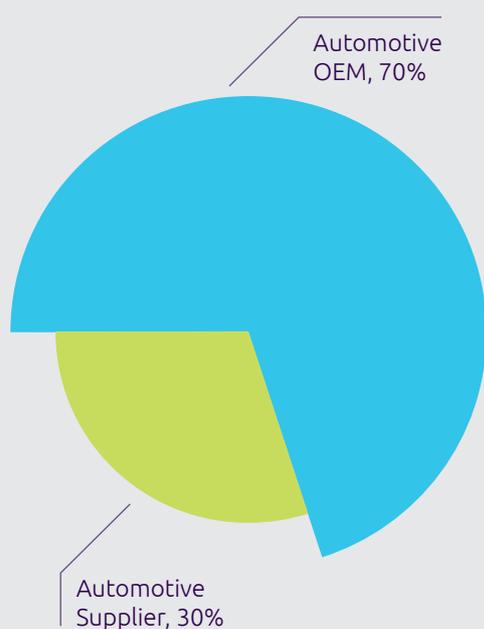
Research Methodology

During November-December 2019, we surveyed 503 automotive organizations along with 11 in-depth interviews of executives working on sustainability.

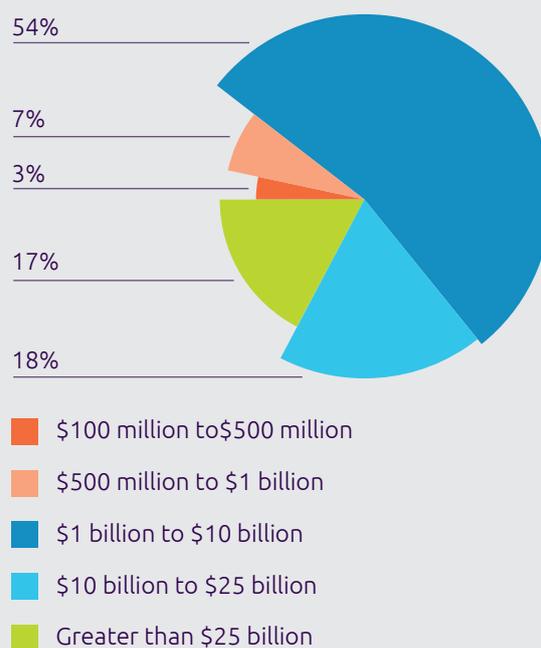
Organizations by country of respondent



Organization by type

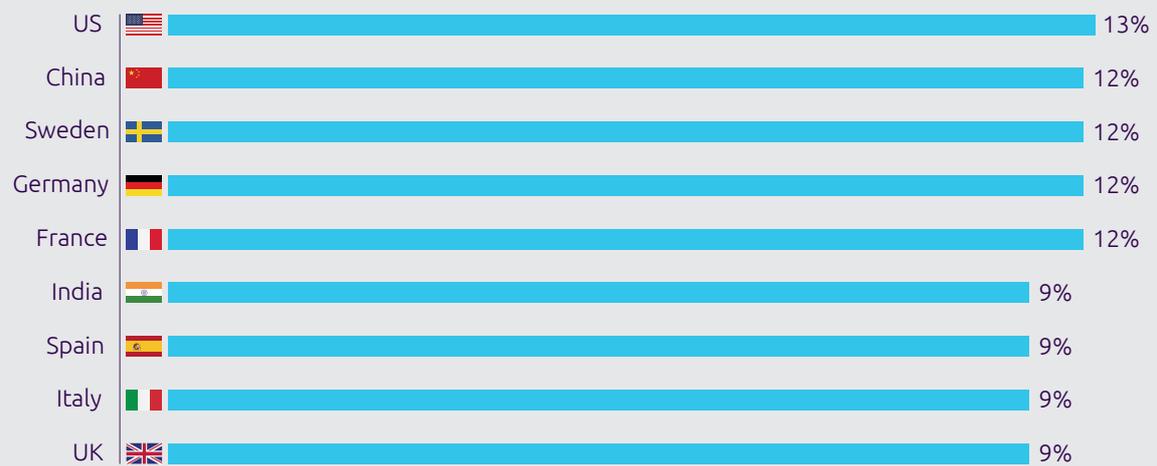


Organizations by revenue

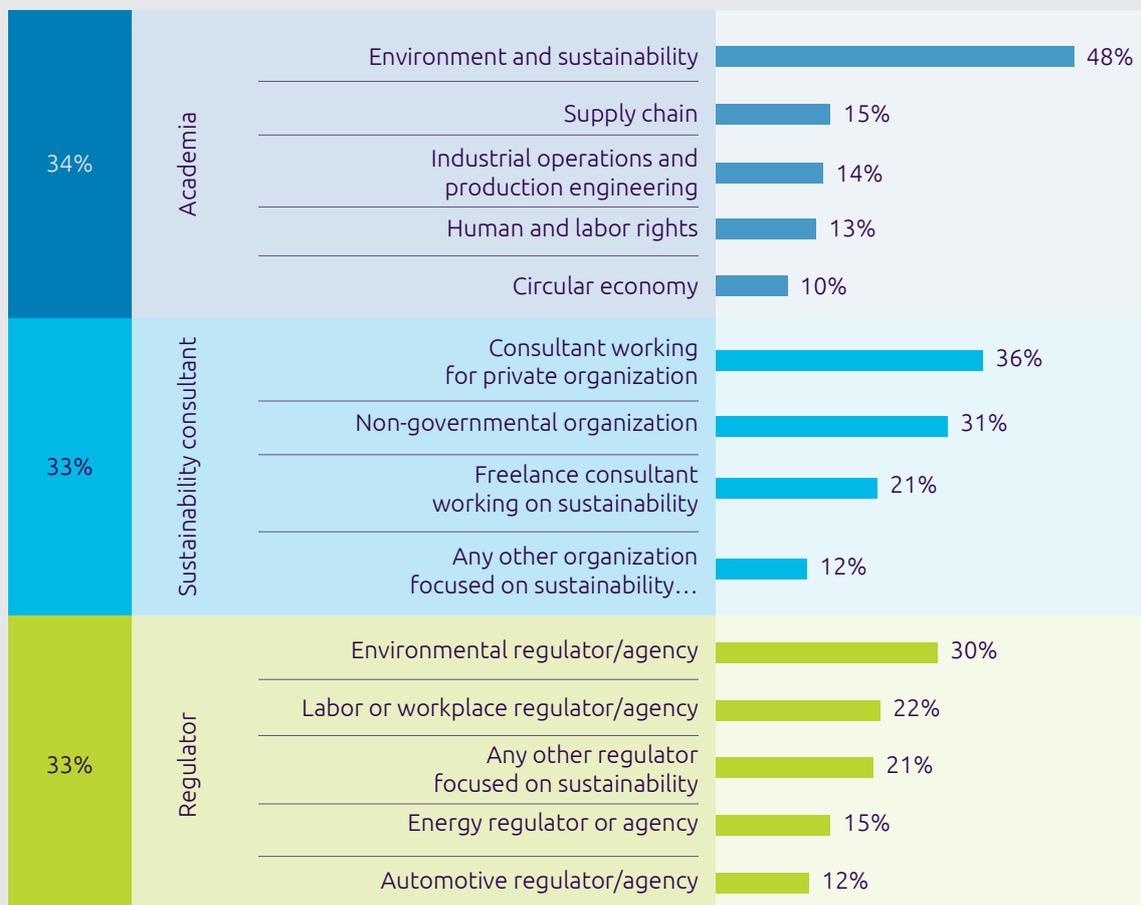


We also surveyed 317 sustainability experts who are well versed with sustainability. This includes NGOs, academia and regulators. We supported this with 9 in-depth interviews.

Country of respondent



Domain of experts surveyed



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About the Authors



Markus Winkler

Executive Vice President, Global Head of Automotive & Mobility
markus.winkler@capgemini.com

Markus Winkler has been with the Capgemini Group since 2005 and leads the Global Sector Automotive and Mobility. He has gained wide ranging experience in delivering major business and technology transformation programs in the automotive industry with a focus on consumer experience, connected services, and digital excellence, notably at BMW Group, Volkswagen Group, Volvo Cars, Toyota, etc. He is a recognized expert in digital transformation and works with our delivery teams for leading automotive clients.



Caroline Segerstéen Runervik

Vice President and MU Head, Industries & Public in Sweden | EUC, MALS, Public, TMT and Services

caroline.segersteen-runervik@capgemini.com

Caroline Segerstéen Runervik is Head Industries & Public business in Sweden with automotive as the largest segment. Caroline has been part of the Capgemini group since 2006 with extensive experience from strategy to implementations of business and IT transformation initiatives together with global Capgemini clients. She has also been part of the Capgemini global digital leadership team driving digital transformation initiatives across the group.



Dr James Robey

Global Head of Environmental Sustainability, Capgemini
james.robey@capgemini.com

Dr James Robey has led the sustainability agenda at Capgemini since 2008, creating and driving a broad ranging program to reduce the Group's own environmental impacts whilst identifying opportunities to support Capgemini's clients with their own sustainability challenges. In addition, he teaches at a number of leading universities on the topic of Sustainable Business.



Philippe Vié

Vice President, Capgemini group Energy, Utilities and Chemicals sector leader
philippe.vie@capgemini.com

Philippe has over 25 years of Energy and Utilities industry experience and dedication, with a strong focus on Utilities transformation projects, including sector and digital technologies levers. Philippe leads the Capgemini landmark publication, the World Energy Market Observatory (WEMO).



Sebastian Tschödrich

Vice President Automotive
sebastian.tschoedrich@capgemini.com

Sebastian Tschödrich has been with Capgemini Invent since 2016. As a Vice President Automotive, he leads the global offering Smart Mobility Connect as well as the global business with a strategic client. Sebastian is specialized in advising and supporting organizations in significant transformations. He collected deep experience with Automotive OEMs in Europe and APAC and is specialized in digital business, performance improvement and sales.



Florent Andrillon

Vice President, Energy Transition Global Leader, Capgemini Invent
florent.andrillon@capgemini.com

Florent Andrillon is the energy transition global lead for Capgemini Invent, where he advises companies from different sectors on their energy and low carbon transformation projects Florent graduated from EM Lyon in 2001. He started his career at Schlumberger, the giant oil services company, before joining Capgemini Invent in 2005. Since then, he has worked in France and abroad with players in the Energy and Utilities sector: large companies, players wishing to enter this market or parapublic organizations. He has supported these organizations since 18 years now in their strategic projects of energy transition, acceleration, and global transformation. More recently, Florent worked a lot with clients willing to leverage digital technology to accelerate their energy transition projects, especially in the area of smart building, e-mobility and smart energy.

**Amol Khadikar**

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

Amol is a senior manager at the Capgemini Research Institute. He leads research projects on key frontiers such as artificial intelligence, sustainability and the future of work to help clients devise and implement data-driven strategies.

**Jerome Buvat**

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

Jerome is head of Capgemini Research Institute. He works closely with industry leaders and academics to help organizations understand the nature and impact of digital disruptions.

**Shahul Nath**

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

Shahul is a consultant at the Capgemini Research Institute. He keenly follows disruptive technologies and its impact on industries and society.

**Gaurav Aggarwal**

Manager, Capgemini Research Institute
gaurav.aggarwal@capgemini.com

Gaurav is a manager at the Capgemini Research Institute. He likes to assess how technology impacts businesses and understand how they respond to it. He is eager to learn about emerging business models, technologies, and trends across sectors.

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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, 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/

Capgemini addresses the sustainability challenge

Automotive and mobility companies worldwide are facing increasing pressure from consumers, governments, regulators, investors, etc. to prioritize their sustainability efforts. Our ambition is to enable our clients to lower their carbon footprint towards in accordance with the Paris Agreement and to address and implement a truly end-to-end sustainability vision. We are working with automotive manufacturers, suppliers, retail, and mobility companies as well as with energy and utility companies, and the public sector towards the new age of sustainable mobility.

Our offerings comprise industry-specific consulting and technology solutions that address end-to-end sustainability transformation, including:

- **Smart Mobility Connect & WLTP**

We empower automotive and mobility companies to create a future, sustainable mobility solution designed with people at the heart of it. Our consulting and technology solutions are based on three core pillars:

- **Connected Customer:** Cutting-edge technology solution to reimagine customer experiences
- **Connected Services and Products:** New capabilities to monetize connected vehicle and services data
- **Connected Ecosystem:** Creating the business of the mobility future by connecting automotive companies and consumers to the wider ecosystem
- Our technological framework Customer Engine helps our clients deliver a comprehensive sustainable mobility solution, connecting these pillars and integrating intelligence into the stages of the journey.
- Our solutions address the ecological footprint of mobility customers as well as electric and alternative mobility. Based on AI, OEMs and dealers are able to manage their sales and fleet with respect to emission goals and WLTP regulations.

- **Green Lean Digital Factory**

The current lean thinking on eliminating waste focuses on reducing cost while at the same time achieving more sustainable (zero waste) processes. Digital technology – specifically related to data and analytics – supports this by providing the necessary insights on where to find opportunities. Capgemini combines extensive experience with lean manufacturing and leading competency in digital transformation to achieve more sustainable production in the most efficient way. In our approach to addressing the challenge of being efficient and sustainable, we consider five major factors: the use of renewable energy, process optimization, innovation in product creating (new materials), closed-loop systems, and energy management optimization.

As a globally renowned technology and digital leader, Capgemini inherits the responsibility, the ambition, and the means to contribute to solving major societal questions that shape our world.

Capgemini Invent: a preferred partner to help you solve sustainability challenges within the automotive industry

Value proposition and approach

Our ambition is to help our automotive clients (and many more) design and execute their transformation to achieve their low carbon ambition, enabling the Paris Agreement's 2°C scenario. We already work with:

- **Equipment manufacturers' new business model for energy transition** – we helped set up a global battery manufacturer to produce battery cells enabling the transition from fossil fuels to clean energy, and we've developed a user-friendly electric vehicle (EV) charging app.
- **New market entrants to create energy transition offers** – we're defining new business models on the energy storage market, as well as a sustainable financing offer. Our green/clean offers have seen us entering the gas and power retail markets, and we're helping brands to reposition in the context of how leaps in battery technology can help the planet and human society moving forward.
- **OEMs and energy providers to increase their share of renewables** – we're helping to develop the growth strategy for a leading firm's renewable offering, enabling it to be a European renewable leader. We're also supporting the development of biogas in selected companies, and setting up an e-mobility business unit for a client, for whom we're defining the digital vision to support the development of its renewable activities. In the UK, we're defining the governance model for the partnership management of a firm's domestic solar business, and we're designing and building operational services to enable 5% of the UK population living in high-rise buildings and large properties to have access to Smart Meters, leading to a reduction in energy consumption. Some of the largest energy providers are also making energy savings as a result of our support.
- **Investors to accelerate funding for energy transition** – we're identifying and scouting start-ups and innovation projects, as well as supporting the development of a dedicated cleantech acceleration program.
- **Energy consumers to reduce their energy and CO2 footprint** – we set up the first French renewable power purchase agreement, helped to qualify and select providers for renewable energy, and defined the 2030 climate strategy and project set up. We are also helping a client to optimize energy mix consumption leveraging data and AI. And we're building green IT reporting, helping cities to develop a new mobility concept, and enabling some countries to run carbon free for weeks at a time.

Why us ?

As a globally renowned technology and digital leader, we have the responsibility, the ambition and the means to contribute to solving major societal questions that are shaping our future world – and at Capgemini Invent we are contributing to realizing this ambition. Invent for Society showcases how social impact is part of the fabric of what we do every day for our clients.

For more information, please contact:

Capgemini Group

Markus Winkler

markus.winkler@capgemini.com

Capgemini Invent

Dr. Rainer Mehl

rainer.mehl@capgemini.com

Belgium, Luxembourg

Robert van der Eijk

robert.van.der.eijk@capgemini.com

China

Yan Chu

yan.chu@capgemini.com

France

Stéphane Houette

stephane.houette@capgemini.com

Germany

Henrik Ljungström

henrik.ljungstroem@capgemini.com

India

Ajinkya Apte

ajinkya.apte@capgemini.com

Italy

Eraldo Federici

eraldo.federici@capgemini.com

Japan

Hiroyasu Hozumi

hiroyasu.hozumi@capgemini.com

Mexico

Miguel Augusto Fonseca Perez

miguel.fonseca-perez@capgemini.com

Nordics

Stephan Hedborg

stephan.hedborg@capgemini.com

Spain

Agustín Gonzalez Rodríguez

agustin.a.rodriguez@capgemini.com

UK

Satish Kumarasamy

satish.kumarasamy@capgemini.com

US

Michael T Hessler

michael.hessler@capgemini.com

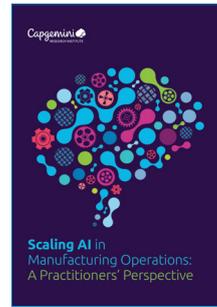
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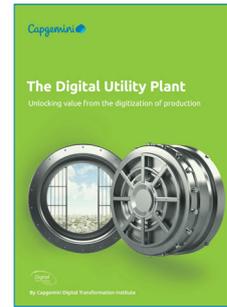
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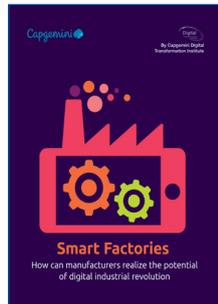
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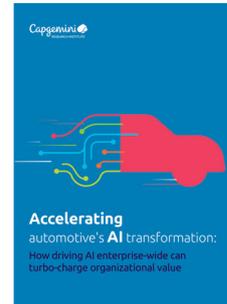
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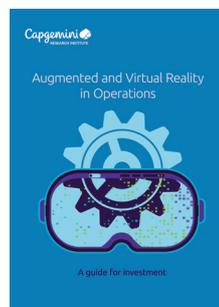
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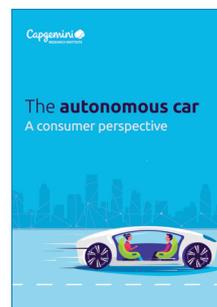
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www.capgemini.com

People matter, results count.

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