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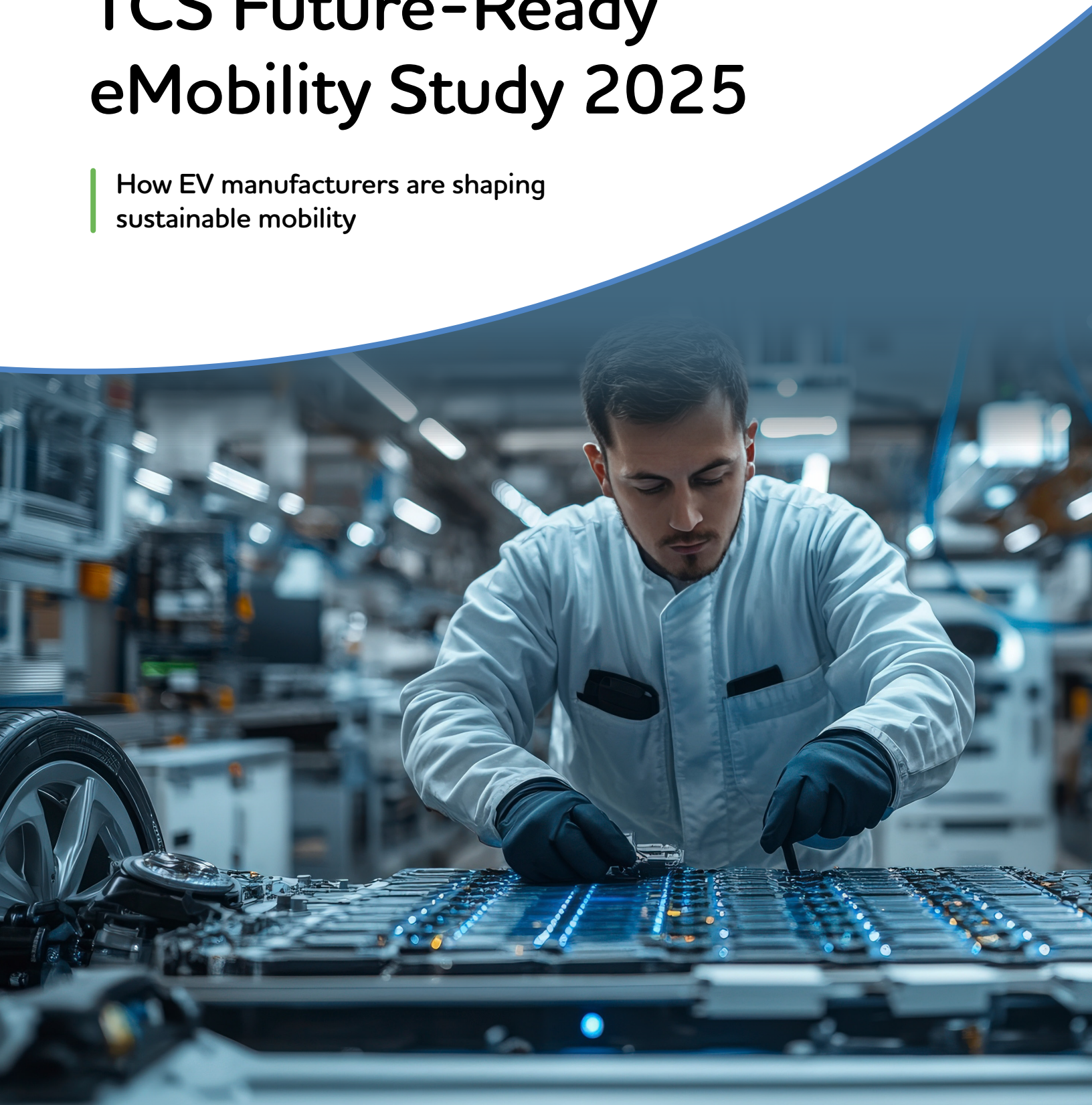
TCS Future-Ready eMobility Study 2025

How EV manufacturers are shaping sustainable mobility



Executive summary

Of all stakeholders involved in the EV shift, manufacturers have perhaps the most to win or lose in balancing the trade-off between opportunity and risk. Automakers have had to reimagine their entire operations and invest heavily in technology, infrastructure, and workforce training. In many cases, these investments have not yet yielded anticipated returns.

To better understand how manufacturers and other key stakeholders are navigating the EV transition, TCS conducted a global survey in August – September 2024 of five segments that play a critical role in shaping a successful EV transition.

Our survey results show that many manufacturers are clear on the challenges they face, including rapid technological advancements, fluctuating market demand, complex supply chains, and uncertain ecosystem dynamics.

Despite these hurdles, they're investing heavily in R&D and reimagining vehicle design to accelerate EV adoption. This report sheds light on the perspectives of EV manufacturers, and provides fresh insights on their strategic shifts in innovation and investment.

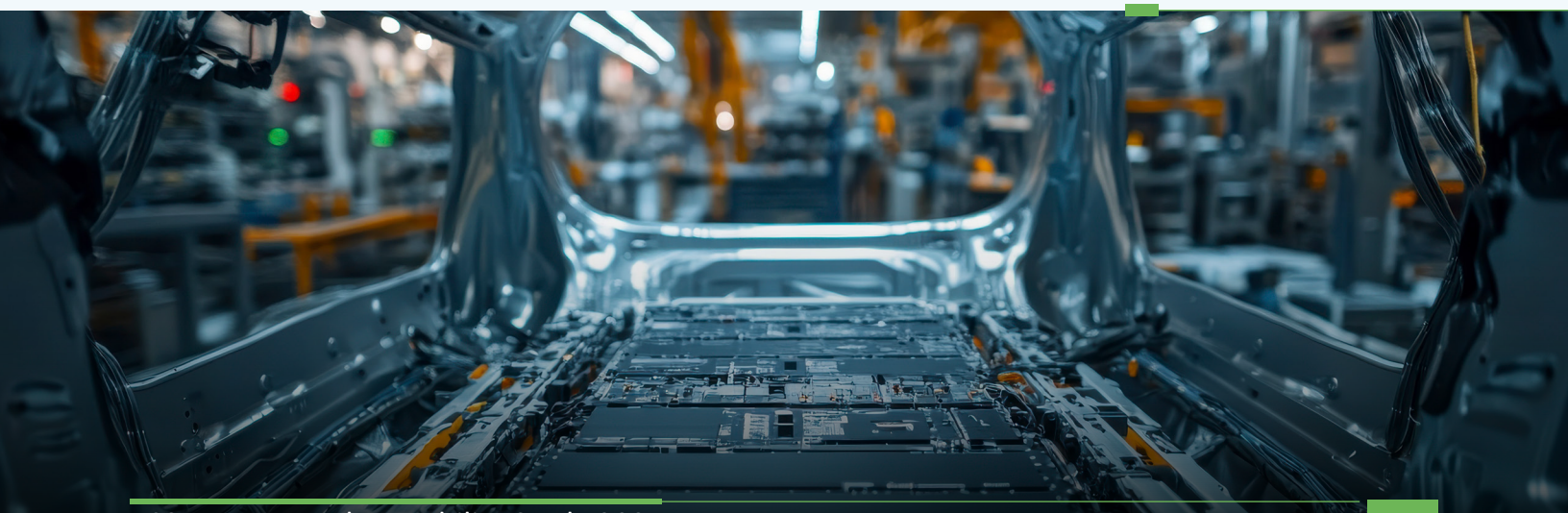
Essential takeaways

More than half (54%) of automotive manufacturers see demand for EVs cooling

Yet two-thirds of all EV manufacturers surveyed say they are maintaining or even accelerating their current EV investments in the next 1-2 years

Only 35% say they’re satisfied with the current level of collaboration and coordination among stakeholders across the EV infrastructure ecosystem

Charging infrastructure tops the list of manufacturers’ challenges and priorities to accelerate EV adoption



Evolving manufacturer sentiment on the EV market

The TCS Future-Ready eMobility Study revealed that of all the segments surveyed, manufacturers alone tended to tilt negative on EV outlook. However, the majority of EV manufacturers we surveyed did not expect industry outlook to worsen. More than a quarter even expect it to improve (see Figure 1).

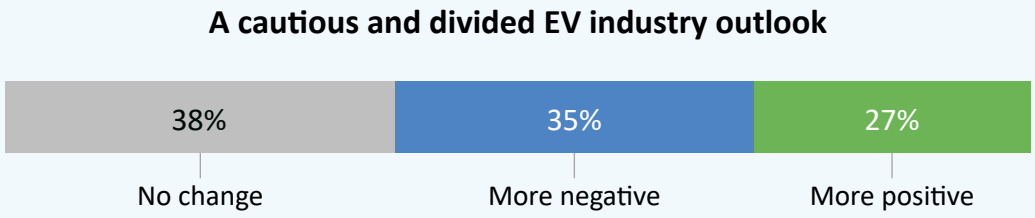


Figure 1. How do you expect the EV industry outlook to change over the coming 12-24 months?

Given the stakes involved, it is understandable that EV manufacturers are grappling with well-founded fears of slowing demand. Our survey found that more than half (54%) of automotive manufacturers see demand for EVs cooling. Of the 54%, 26% anticipate cooling demand to extend past two years (see Figure 2).

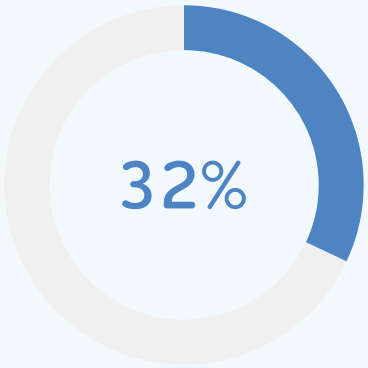
Figure 2. How do you see the EV market demand changing the most in the next 12-24 months?

Manufacturers and the mobility ecosystem

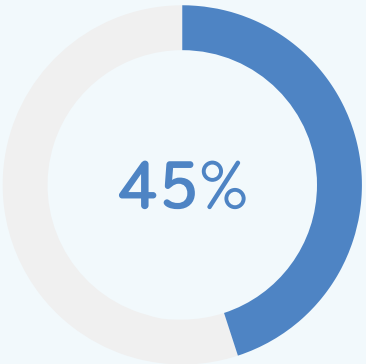
The pandemic exposed the vulnerabilities of global supply chains, especially those that depended on international supply networks. The availability of components that go into batteries and chips used in EVs depend on these networks and it is no surprise that manufacturers have spent substantial efforts to improve the resilience of their supply chains. Only a small minority of EV manufacturers surveyed (18%) expect disruptions in the supply chain to be a major challenge for the EV manufacturing industry overall.

Yet cost pressures do not always allow for eliminating reliance on international supply chains. The cost of raw materials and its availability will continue to be a challenge for manufacturers, as attested by a significant proportion of those we surveyed.

Nearly a third (32%) say increased raw materials costs is the greatest challenge facing the EV manufacturing industry overall, and 45% say the availability of raw materials and minerals is the greatest challenge (see Figure 3).



of EV manufacturers surveyed consider increased raw materials costs the greatest challenge facing the EV manufacturing industry overall



consider the availability of raw materials and minerals the greatest cahllenge facing the EV manufacturing industry overall

Figure 3. What do you consider the greatest challenge facing the EV manufacturing industry overall?

Until EV becomes a dominant part of the portfolio there will be additional pressure to balance supply chains between ICE and EV. This will require robust capabilities to track and trace supplies, identify suppliers, and adapt to constantly changing volumes and mix between changeovers, inventories, and fulfillment.

Charging infrastructure collaboration

Further downstream, the EV ecosystem has shown promise with energy companies, manufacturers, new entrants from the tech and utility sectors, and even retailers powering an emergent charging landscape. However, with demand far outstripping supply, it is not surprising that there is a high sense of dissatisfaction among manufacturers surveyed for current collaboration levels among EV stakeholders.

What is surprising is that EV manufacturers say they are neither greatly satisfied with, nor seeking partnerships and collaborations among stakeholders in the EV infrastructure ecosystem (e.g., manufacturers, local government agencies, utilities, charging network operators). Achieving their transition goals, however, will likely require a more collective approach (see Figure 4).

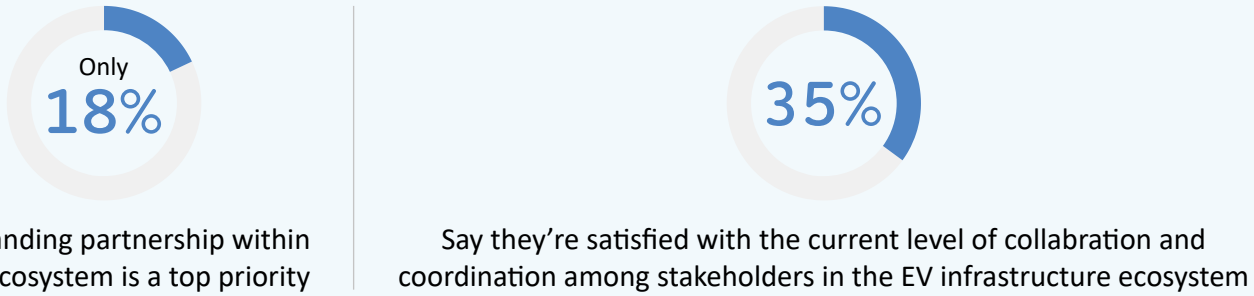


Figure 4. What do you consider the key priorities of EV production and development? Are you satisfied with the current level of collaboration and coordination among stakeholders in the EV infrastructure ecosystem?

When it comes to green mandates to encourage adoption, only around a quarter of EV manufacturers surveyed say they are outright dissatisfied with government policies and incentives, with the notable exception of EV charging infrastructure support: Half of EV manufacturers are dissatisfied with government support for charging infrastructure (see Figure 5).

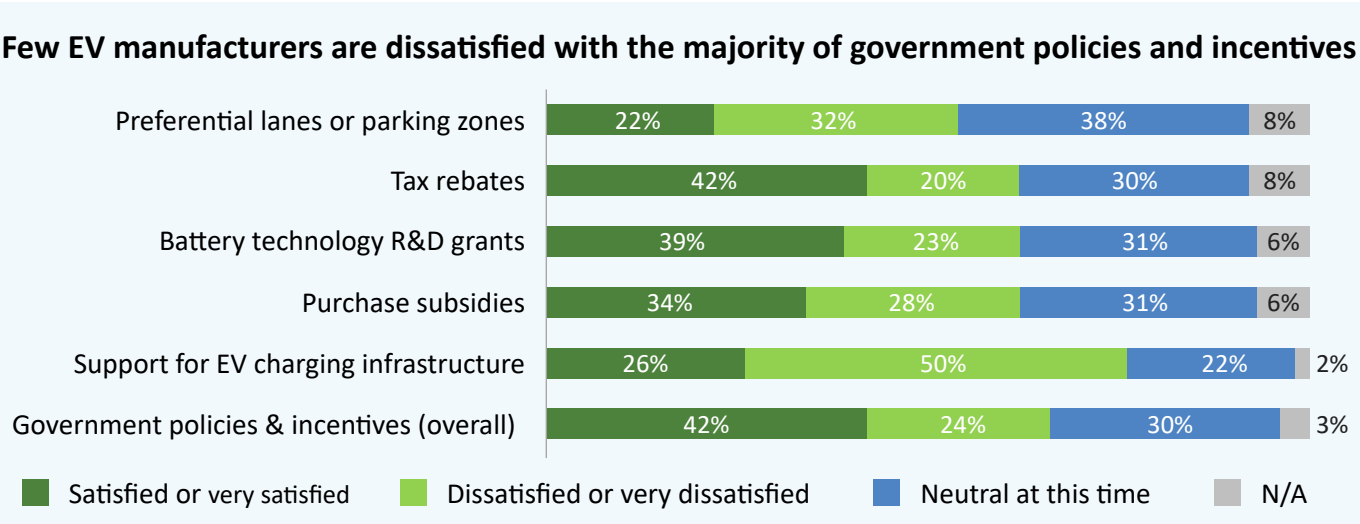
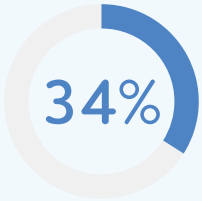
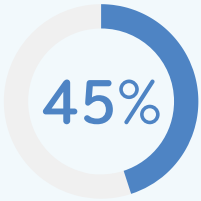


Figure 5. How satisfied are you with government policies and incentives aimed at promoting the growth of EV industry?

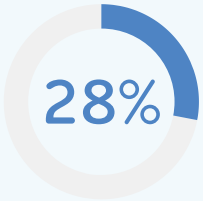
EV manufacturer respondents also say the “stick” aspect of EV policies is unlikely to drive meaningful progress toward widespread EV adoption, with room for improvement around regulations and penalties aimed at promoting EVs (see Figure 6).



Say they’re satisfied or very satisfied with their government’s regulations & permitting processes



Say they’re satisfied or very satisfied with their government’s implementation of tighter fuel use and emission regulations



Just over a quarter of EV manufacturers surveyed think their government’s latest regulatory changes will significantly boost growth in the next 12-24 months

Figure 6. How satisfied are you with government policies and incentives aimed at promoting the growth of the EV industry? How do you think the latest regulatory changes will impact EV growth in the next 12-24 months?

Reshaping EV strategies

Even in the face of uncertainty, most EV manufacturers remain undeterred. Two-thirds of all EV manufacturers surveyed say they are maintaining or even accelerating their current EV investments in the next 1-2 years.

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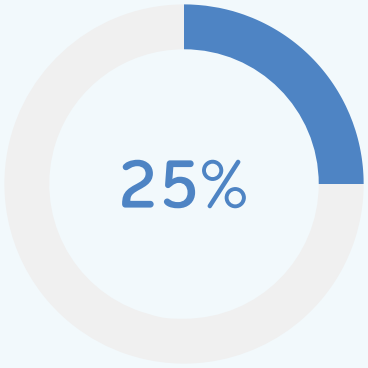
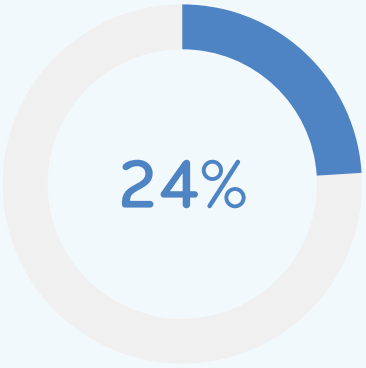
say they are maintaining or even accelerating their current EV investments in the next 1-2 years

However there has been a re-alignment in strategy. For one, there is an expected scaling back of production to reflect the more cautious targets and a renewed focus around hybrids entering the product lineup along with BEVs.

Of the 54% that anticipate slowing demand and are actively changing their current EV production levels, around a quarter are planning to either scale back production or shift focus to hybrids (see Figure 7).



of EV manufacturers adjusting production in response to cooling demand say they plan to scale back to cautious production



say they plan to switch their focus to hybrids

Figure 7. How are you adjusting your investments based on perceived EV market demand in the next 12-24 months?

Investments and priorities

With the tide shifting in the EV market, many automotive manufacturers are re-channeling their investments and efforts. Our survey indicates that charging infrastructure tops the list of challenges and priorities to accelerate EV adoption (see Figure 8).

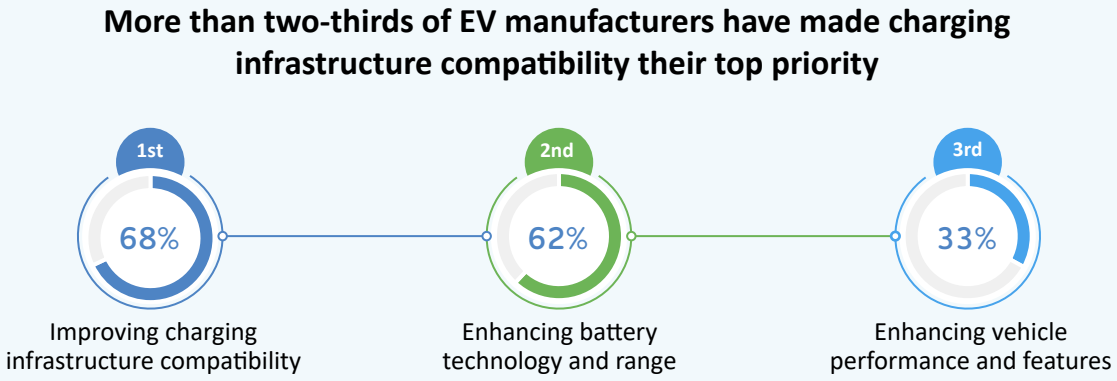


Figure 8. What are your key priorities when it comes to EV production and development?

However, manufacturers' investments are heavily prioritizing cost. This is understandable given the sizeable investments made by manufacturers for production and the consumer sentiment on acquisition cost. A majority of manufacturers surveyed indicate that they will prioritize allocation of budgets to vehicle cost reduction and advancements in materials and efficiency (see Figure 9).

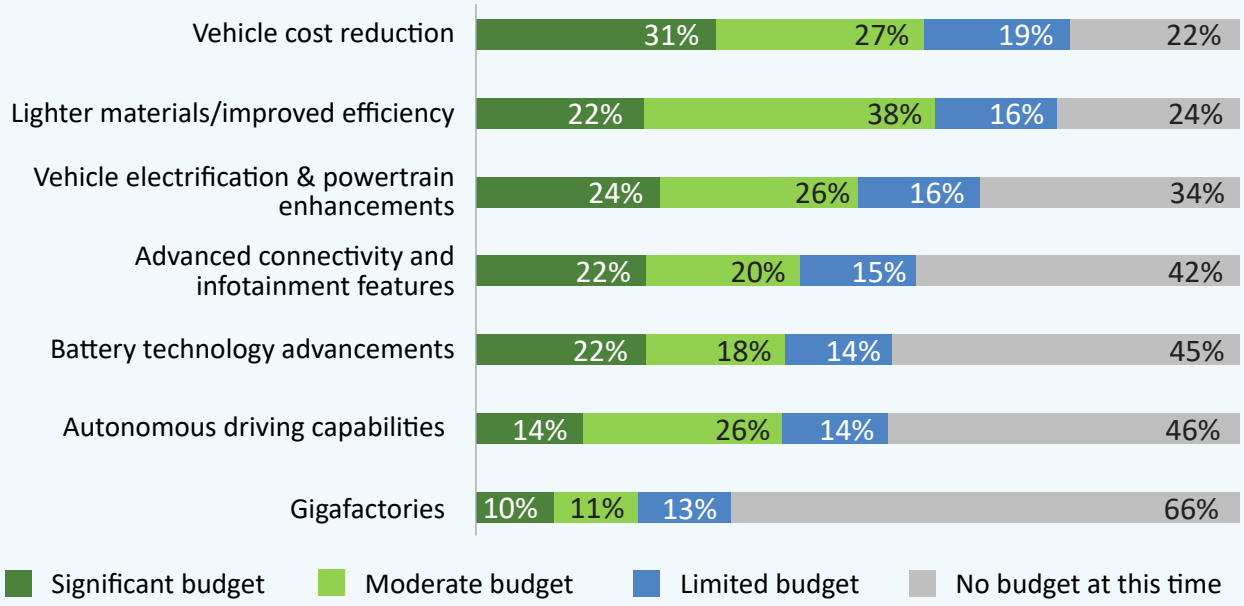


Figure 9. How is your organization allocating investments for research and development (R&D) efforts for EVs?

Battery technology

An obvious area of interest for EV adoption has been battery technology. Developments in EV battery chemistry offering higher capacities and energy densities hold out the promise of increased ranges and reduced charging time.

A near-unanimous majority of EV manufacturers surveyed agree that battery technology advancements offer the biggest potential for impact on the design and performance of EVs (see Figure 10).

Which technological advancements do you expect to have the greatest impact on the design and performance of EVs in the near-term?

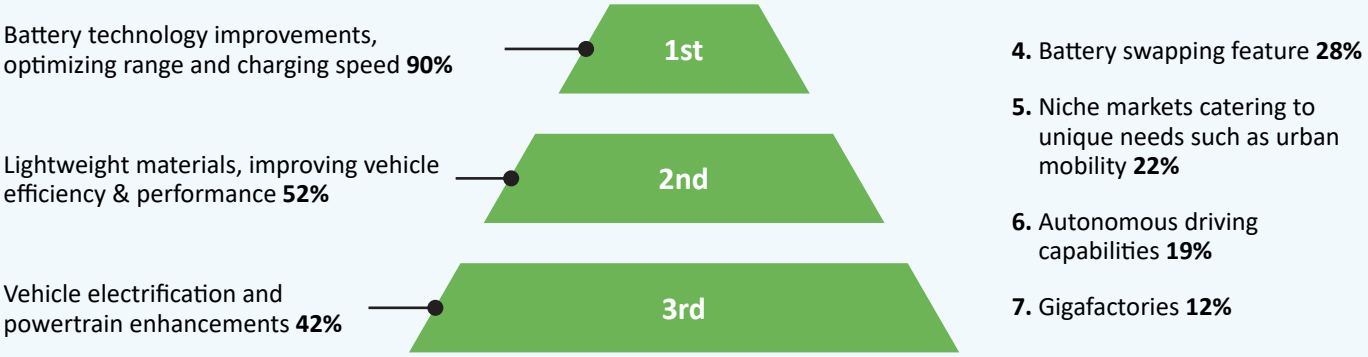


Figure 10. Which technological advancements do you expect to have the greatest impact on the design and performance of EVs in the near-term?

The majority (70%) also say significant breakthroughs will take at least another two years. This timeline may be one of the reasons that investments on battery technology advancements, though significant, trail those for cost reduction and improvement in vehicle features and design (see Figure 11).

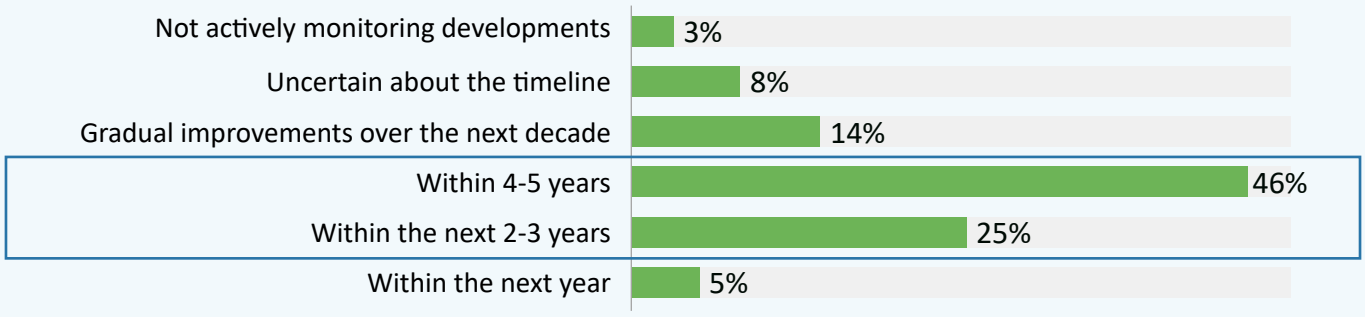


Figure 11. What are your expectations for achieving significant breakthroughs in EV battery technology?

Next steps: Strategic focus areas for EV manufacturers

EV manufacturers have a distinctly pragmatic outlook, acknowledging the realities of cooling demand and the challenges of industry growth. This perspective is driving their focus on strategic investments and next steps, which include prioritizing vehicle cost reduction, charging infrastructure, and advanced battery technology to position themselves competitively in a rapidly evolving market.

However, critical challenges persist, including the need to bolster collaboration. We see five imperatives that could significantly influence EV manufacturing over the next few years.

Optimize performance through the potential of software-defined mobility
When a car's functionality and features are primarily controlled by software, rather than built-in as hardware, continuous updates and customizations can be made "over-the-air," much like smartphones which can introduce new features and efficiencies with each operating system release.

Software-defined mobility brings substantial benefits to the EV transition. A zonal architecture (where the vehicle's electrical and electronic systems are organized into distinct zones or regions) offers efficient power management while also reducing the weight and complexity of wiring harnesses. However, this interconnectedness underscores the need for adopting existing cybersecurity frameworks and measures to safeguard critical components, ensure passenger safety, and maintain data integrity. Integrating AI in software-defined vehicles (SDVs) can enable dynamic performance optimization by monitoring the vehicle in real-time, and adjusting the power consumption based on driving conditions or user behavior. SDVs also have an enhanced ability to generate insights that combine data from different domains to improve system performance and battery life, while ensuring secure operations.

Drive product demand and profitability through 'design to target cost'
As the study shows, consumers are willing to pay only a small premium for EVs over ICE vehicles. However, the cost of assembling an EV remains proportionally higher. Analytical and visual models can highlight cost gaps with respect to customers' willingness to pay, enabling the comparison of different models along with competitive data. Already streamlined in ICE vehicles today, detailed value analysis and value engineering models can reduce cost, driving both EV adoption and EV sellers' profitability.

Enhance battery performance through AI and quantum technologies

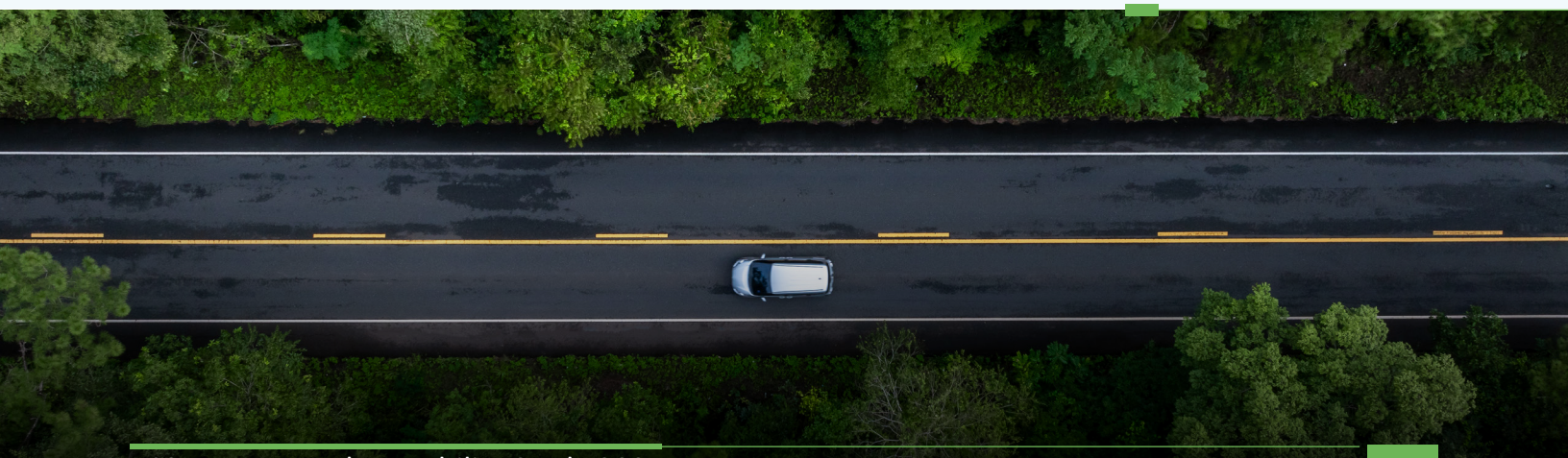
AI paired with quantum intelligence (QI) is revolutionizing battery development by uncovering insights into atomic processes that boost performance. QI can significantly shorten development cycles and help reduce manufacturing costs, leading to faster innovation and cost-effective production. Large datasets from quantum simulations can be analyzed to optimize materials for conductivity, stability, and energy density.

Enable charging ecosystems through collaborative business models

Rapid adoption of EVs is incumbent on concurrent expansion of EV charging infrastructure. The expansion in turn demands broader cross-industry collaboration to address challenges like standardization, grid integration, and customer experience. While consolidation is highly likely, partnerships between automotive, energy, retail and commercial property owners, government bodies, etc. will be crucial in scaling infrastructure efficiently. Equally critical is the need for robust cybersecurity measures to fortify the interconnected EV ecosystem, ensuring resilience against physical and cyber threats that could undermine adoption at scale. There is a pressing need for frameworks and business models that can enable mutually beneficial partnership between these parties.

Design for sustainability through principles of circular economy

A circular economy is based on the idea that products, materials, and resources should be designed for disassembly, remanufacturing, reuse, and recycling. Containing various components and materials that can be recycled and reintroduced into the production cycle, EVs pose a unique challenge with respect to precious metals and opportunities over their lifecycle to reduce the carbon footprint. By analyzing the various components of the EV including the battery pack for regulatory needs, the industry can promote sustainability while also driving down lifecycle costs.



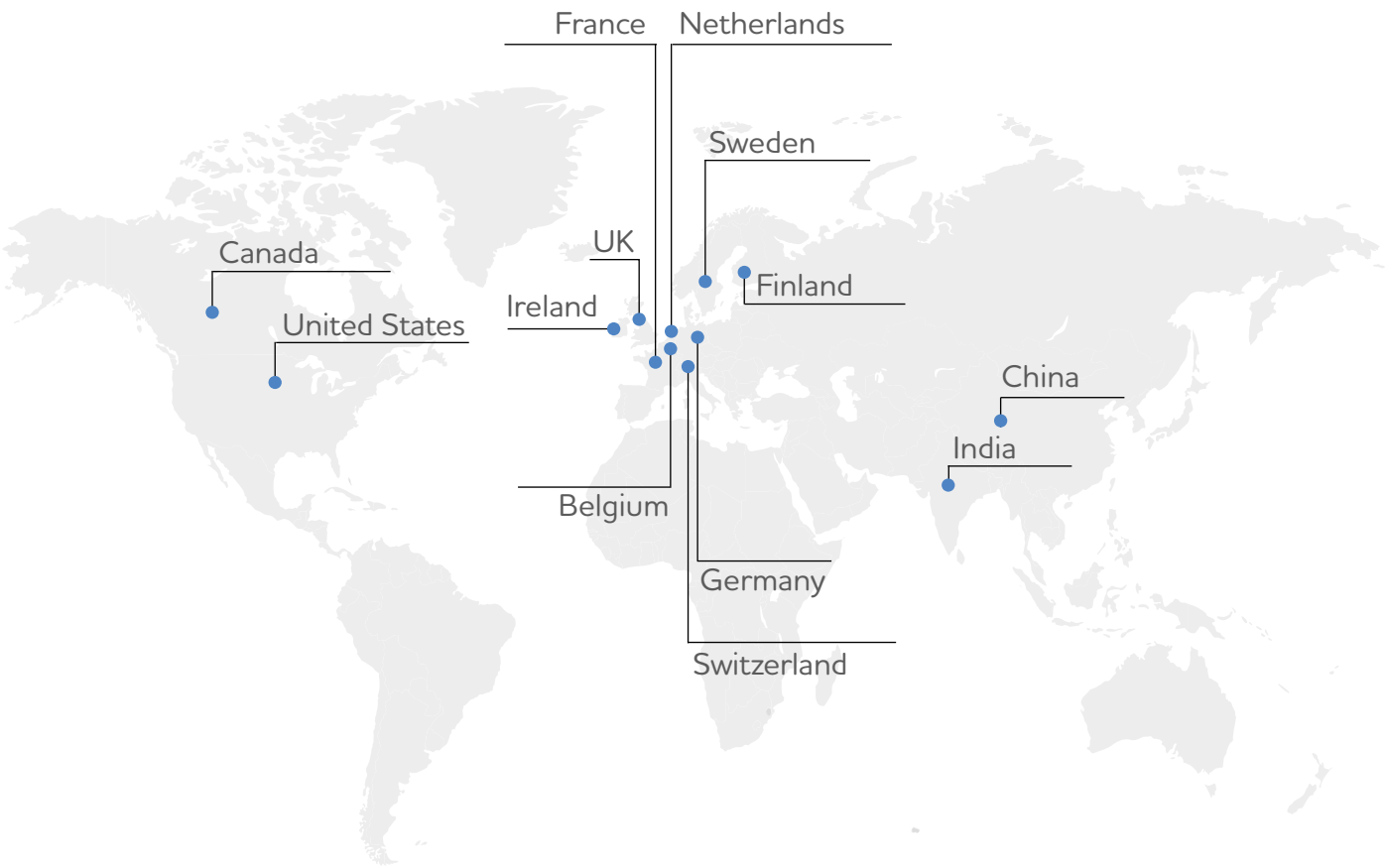
Study Demographics

EV Manufacturers

Manufacturers "the Makers"
(n=125)

- Automotive OEMs & Tier 1 suppliers
- Trucks & buses
- Offroad vehicles & farm equipment
- Connectivity components manufacturers
- EV component suppliers
- Tire manufacturers
- BEV, HEV & non-ICE alternate fuel vehicle manufacturers
- Two-wheeler manufacturers

Country representation



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About the study

The 1,300+ respondents from across 18 countries and 12 industries ranged from manufacturers and charging infrastructure builders to consumer and commercial adopters and industry influencers. The EV manufacturers – the 'Makers' – surveyed for the TCS Future-Ready Mobility Study span a broad range of traditional automotive giants, agile startups, and crucial component suppliers. Comprising 125 of the 1,308 total survey respondents, the Makers include:

- Automotive OEMs and Tier 1 suppliers
- Trucks and buses
- Offroad vehicles and farm equipment
- Connectivity components manufacturers
- Electric vehicle component suppliers
- Tire manufacturers
- Battery Electric Vehicle (BEV), PHEV (Plug-in Hybrid Electric Vehicle), and non-ICE (Internal Combustion Engine) alternate fuel vehicle manufacturers
- Two-wheeler manufacturers

TCS Future-Ready Mobility

As the world accelerates toward electric mobility, TCS is committed to enabling manufacturers and other EV stakeholders to navigate the evolving landscape and thrive in this defining era. Our future-ready mobility vision is rooted in technological innovation, strategic collaboration, and deep domain expertise.

TCS drives transformative change across the mobility value chain, spanning vehicle design and development, gigafactory planning and execution, digital platform enablement, deployment of generative AI solutions, and hyper-personalized customer experiences. With a focus on driving sustainable mobility and delivering measurable value, TCS partners with customers to shape a bold and sustainable future. For more information, visit: tcs.com/what-we-do/industries/manufacturing

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A part of the Tata group, India's largest multinational business group, TCS has over 601,000 of the world's best-trained consultants in 55 countries. The company generated consolidated revenues of US $29 billion in the fiscal year ended March 31, 2024, and is listed on the BSE and the NSE in India. TCS' proactive stance on climate change and award winning work with communities across the world have earned it a place in leading sustainability indices such as the MSCI Global Sustainability Index and the FTSE4Good Emerging Index. For more information, visit www.tcs.com