Fast Forward

North American automotive CXOs set a bold innovation agenda
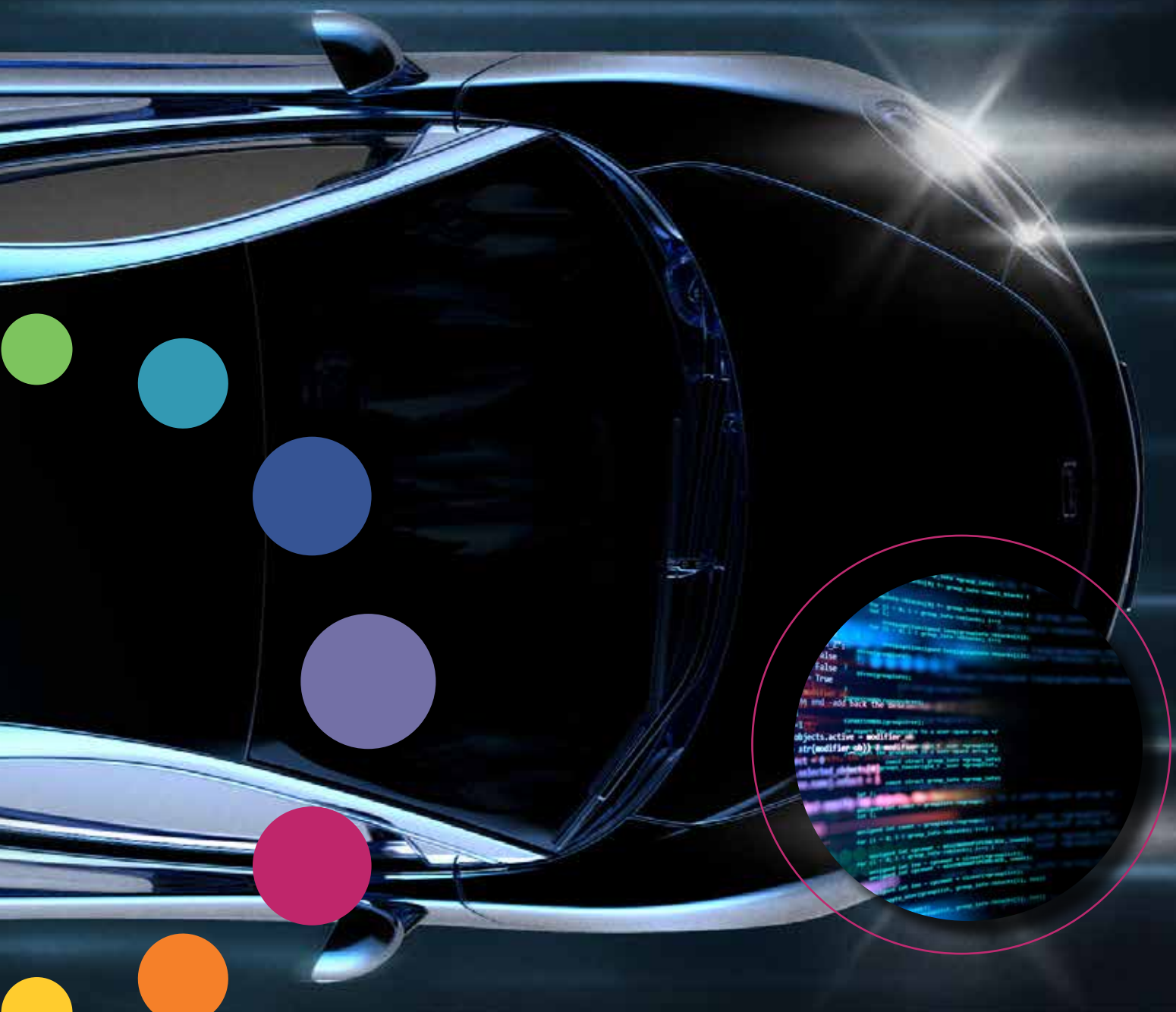
wipro

Foreword

The Race is ON to design, build and monetize the software-defined vehicle of the future.

The North American auto industry is undergoing a tumultuous paradigm shift. The EV transition is ongoing but far from complete, software-defined vehicles are challenging OEMs to think like tech companies, and customers expect both a smart, digital-first retail experience and an instantly updatable vehicle that has the potential to feel like a brand new car every day.

Still, the CXOs that Wipro heard from during its recent survey of auto industry leaders seemed largely invigorated by the complexities of the feats they are being asked to pull off.

As components become smaller and lighter and batteries become cheaper, we envision a not-too-distant future in which electric vehicles (EVs) attain price parity with internal combustion engine (ICE) vehicles. At the same time, we believe that the app-driven software revolution that transformed mobile devices into economic powerhouses is turning its sights to the automobile. And amid these shifts, the sales and marketing teams of all major automakers are rapidly adapting to new digital ways of doing business to track the pulse of today's demanding consumer.

Today's industry leaders are advancing a bold innovation agenda, and we share their passion for driving the digital transformation and connectivity that will unlock immense value from this new software-defined vehicle ecosystem.

As you consider what your industry peers are saying, doing and thinking, we hope that this report provides an opportunity to look beyond the unavoidable roadblocks toward the end goal: a powerful, software-defined EV that is sustainable, endlessly customizable and a lot of fun to drive.

Deepak Parameswaran
Vice President and Sector Head
Energy, Manufacturing &
Resources (EM&R).

Jaydip Mukhopadhyay
Vice President, Automotive
North America

"There is a noticeable difference between what we want the vehicle to be and what it is currently, but we are getting there. There are challenges in both hardware and software systems: computational power, lack of data, legacy architectural setups, transitional inefficiencies... But the developments being made will be felt in a couple of years."
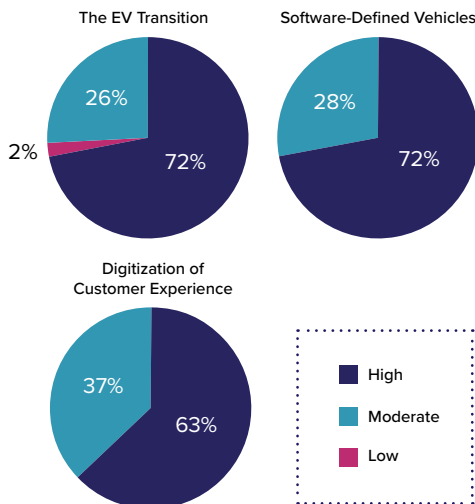
—Chief Marketing Officer at an OEM

Three Pillars of the Automotive Future

The future of the automotive industry no longer depends on hardware alone. Technology advances in the connected, autonomous, shared and electric (CASE) mobility domains have thrust manufacturers and Tier 1 suppliers into discussions about new revenue streams, new business models, reimagined supply chains and transformed approaches to innovation and R&D.

Achieving profitable, scalable, differentiated versions of a software-defined "car of the future" requires automotive leaders to overcome numerous complex barriers. Most fundamentally, it requires a shift in mindset from hardware-centric to software-centric design.

Wipro surveyed North American automotive CXOs about their vision for the industry (see Survey Methodology). What urgent shifts must take place in the short term to enable a compelling mobility future? Where are the opportunities for competitive differentiation? Where is collaboration essential to drive a profitable, sustainable future?

Reported CXO preparedness to execute the core components of the automotive future:

The EV Transition

Software-Defined Vehicles

26%

2%

72%

28%

72%

Digitization of Customer Experience

37%

63%

High

Moderate

Low

Our survey identified three crucial factors that will drive this future: the EV transition, software-defined vehicles and digitalized customer experiences.

The **EV transition** depends on a comprehensive foundation for the entire value chain, from next-generation battery technology to end-user charging

solutions. Automotive CXOs understand this dynamic, and know that OEMs will need to adopt a more efficient, data-driven supply chain that balances and manages global, local and DIY sourcing strategies.

Auto manufacturers must also achieve fully **software-defined vehicles**, creating a "cloud car" that is continuously updated and remains digitally relevant for more than a decade. To succeed in this software-defined paradigm, automotive companies need to adopt the iterative mindset for which technology companies are best known. Open-source software, along with new electronic and electric architectures (EEA) based on disaggregated hardware and software, present unique opportunities for OEMs to differentiate themselves as they decouple critical safety and performance features from monetizable experience features.

Additionally, automakers must design, develop and monetize a new suite of **customer experiences**, including intuitive digital marketplaces for in-vehicle and driving features. This digital marketplace will need to engage with other cross-sector stakeholders to build a dynamic coopetition-based ecosystem that serves customers across the full lifecycle of a vehicle.

By the end of this decade, Wipro expects automotive manufacturers to compete and differentiate based on proprietary software and customer experience while also collaborating with cross-sector partners to advance EV infrastructure and enable software innovation. Ultimately, a strong bonding in the extended ecosystem, effective digital leadership and customer-centricity will drive the North American automotive transformation agenda.

> **"Shifting to a software- and cloud-driven mindset enables OEMs to develop and release innovations faster, with the added benefits of exploring new revenue streams, reducing costs and boosting residual values."**
>
> **—Thomas Mueller, CTO and Global Head of Automotive, Wipro Engineering**

The EV Transition: Navigating a Paradigm Shift
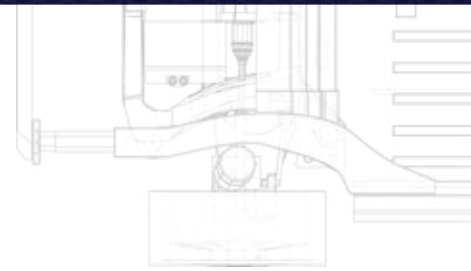
In our survey of auto industry CXOs, the EV transition emerged as the top industry priority. This electric vehicle transition will be driven by the seamless integration of a robust **EV supply chain** and **new EV battery solutions** that synthesize improved battery performance with innovative new business models. With a focus on accelerating both environmental and economic sustainability, automakers must push for **ecosystem-wide collaborations**, creating gigafactories and battery health monitoring systems and enabling vehicle-to-grid integration for mass electrification of both private cars and commercial fleets.

- **53%** of the OEM CXOs we surveyed are prioritizing vertical integration to solve supply chain issues.
- **51%** of all CXOs we surveyed view digitization as key to the new EV supply chain.
- **81%** expect battery tech costs to decrease between now and 2025.

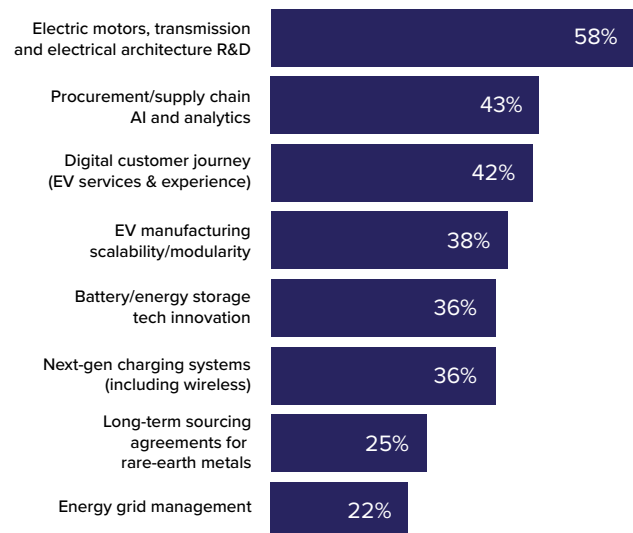## An EV supply chain built on data-driven hybrid sourcing

In the coming decade, OEMs will need to reimagine their manufacturing processes and supply chains, carefully allocating resources as they seek an optimal strategic ratio between legacy internal combustion engine factories and newer EV factories.

To ensure the reliability of the EV supply chain and mitigate bottlenecks as they negotiate this EV transition, OEMs are variously prioritizing vertical integration of raw materials and/or components (53%), dual sourcing of critical commodities (24%), increased inventory levels (18%), and near-shoring/on-shoring (15%).

The exact breakdown of individual sourcing portfolios, however, is not as important as having a technology-driven strategy for supply chain visibility. To that end, more than 50% of the CXOs we surveyed are looking to digitalization (i.e., predictive analytics and blockchain) to solve key supply chain challenges in the coming years. The CDO of a leading US-based OEM also singled out AI's capacity to improve supply chain management in the automotive industry: "We are using AI for predictive analytics and real-time traceability."

As they double down on AI, industry leaders must also adopt next-generation supply-chain management (SCM) solutions such as blockchain-based smart contracts systems to further enhance supply chain visibility, transparency and predictability.

How will EV value chain leaders create the most opportunities for superior ROI? (ranked choice)

Category	Value
Electric motors, transmission and electrical architecture R&D	58%
Procurement/supply chain AI and analytics	43%
Digital customer journey (EV services & experience)	42%
EV manufacturing scalability/modularity	38%
Battery/energy storage tech innovation	36%
Next-gen charging systems (including wireless)	36%
Long-term sourcing agreements for rare-earth metals	25%
Energy grid management	22%

What will be the most critical attributes of EV battery technology evolution? (ranked choice)	
Performance	53%
Safety	53%
Fast-charging capabilities	52%
Cost	40%
Battery lifespan	40%
Recyclability	32%

R(EV)olutions in battery technology and charging solutions

The battery ecosystem is focused on reducing cell production costs (currently 30% of total EV cost) while at the same time catering to evolving customer needs. In our survey, we found that performance, safety and fast-charging capabilities are perceived to be the top priorities for EV buyers. A majority of OEMs (74%) believe that in-house R&D capabilities will be the key competitive differentiator as EV battery manufacturers seek to create and sustain competitive advantage and develop the "battery of the future." The focus is on all-solid batteries, use of alternate rare materials, lithium iron phosphate, high-nickel, silicon additives, cathode/anode chemistry mix and large cell systems.

In the downstream side of the equation, nearly 70% of industry CXOs are enthusiastic about new battery business models such as battery-as-a-service, swapping and state data monetization from battery health monitoring systems. The CTO of a Tier 1 auto supplier commented: "We are collaborating with AI and IoT providers for predicting EV battery health." OEMs must develop a data-driven model that addresses the EV battery lifecycle with 5G and cloud connectivity in multiple use cases such as dealer inventory management and product quality improvement.

A collaborative EV ecosystem

As the CEO of a leading US-based OEM observed, "The future of the automotive EV transition will be determined by the potency of the bond between manufacturer, supplier and the wider ecosystem." While EV stakeholders agree on the need for ecosystem collaboration, they range widely in their integration strategies, variously citing joint ventures, mergers and acquisitions, and joint R&D as their key strategies. Certainly, fierce competition will also play a role. OEMs, for example, are working to address the power imbalance with battery manufacturers by adopting vertically integrated EV business models, including battery cell production. However, as the CDO of one auto-tech firm explained, competition will need to be balanced by cooperation: "Digital solution providers, software suppliers and OEMs— we all work together to make EVs safe, dependable and energy-efficient."

Wipro's survey throws light on multiple coopetition-driven opportunities in the EV ecosystem. When it comes to the gigafactories of the future, cloud-enabled battery management systems, vehicle-to-grid integrations, wireless charging and commercial EV fleet solutions, a collaborative approach by OEMs and technology partners will ultimately deliver the greatest value to all parties. Together, all ecosystem stakeholders must cohere around common global sustainability goals and charge ahead to capture the EV transformation opportunity.

"The scalability of electric vehicles will be dependent on effective supply chain management. The battery and sensors are critical elements for electric vehicles; effective logistical support will allow them to be produced at the same rate as the external car body in the plant."

—Chief Digital Officer at an OEM
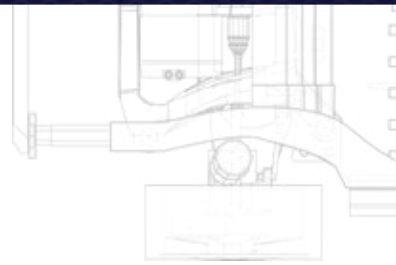
Software-Defined Vehicles: Achieving the Open-Source Cloud Car

In the past, safety and mechanical performance were the core differentiators for OEMs. In the future, the differentiator will be software. As the code empowering software-defined vehicles (SDVs) becomes more and more complex, **AI/ML and cloud solutions** will be essential when it comes to enabling a seamless progression from design to drivetrain to driveway. **Open-source innovation** will bring app-like development and architecture to the automotive platform, creating new opportunities for automakers and customers alike. A software-centric mindset will also enable **hyper-personalization** that strengthens the long-term customer-vehicle relationship.

- **72%** of the CXOs we surveyed cite AI/ML as a key value-driving technology for SDVs.
- **53%** cite regulatory issues as a key challenge when it comes to developing future vehicles.
- **44%** feel highly prepared to implement open-source IP with innovation hubs.

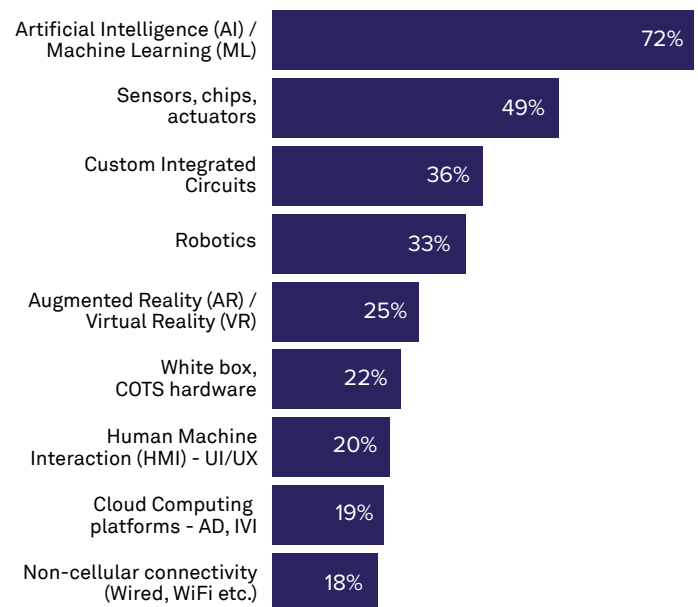## Cloud transformation to overcome software complexity

Modern vehicles are racing towards a future in which they will become hyperconnected supercomputers on wheels with active safety features, advanced infotainment options and fully autonomous capabilities. However, nearly 50% of the OEMs we surveyed pointed to software complexity (100+ million lines of source code across 30-40 platforms) as a growing concern when it comes to developing the vehicle of the future. Cybersecurity challenges also ranked highly as an area of concern.

When it comes to software, the industry currently finds itself torn between often-incompatible OEM-developed legacy software and newer applications and OS architectures built on open-source platforms. Integrating and updating these multiple applications and harmonizing cross-

sector stakeholders will require a shared cloud car ecosystem. In this emerging ecosystem, the hardware-software relationship will be largely decoupled. Critical apps can be isolated for faster certification and maintenance, while non-critical apps can take full advantage of agile software development speeds using microservices, containers and edge computing.

Softwarization will dramatically impact not just the vehicle itself, but the vehicle development process. Currently, vehicle development remains dominated by a hardware-centric mindset, and product development cycles take years. Softwarization of the development process will dramatically reduce time-to-market and drive rapid responses to consumer demands, though OEMs will need to evolve new manufacturing and certification processes both for themselves and their partners to achieve a more rapid, software-defined development loop.

What do you see as the key technologies/components that will drive value-creation across the software-defined vehicle value chain? (ranked choice)

Technology/Component	Percentage
Artificial Intelligence (AI) / Machine Learning (ML)	72%
Sensors, chips, actuators	49%
Custom Integrated Circuits	36%
Robotics	33%
Augmented Reality (AR) / Virtual Reality (VR)	25%
White box, COTS hardware	22%
Human Machine Interaction (HMI) - UI/UX	20%
Cloud Computing platforms - AD, IVI	19%
Non-cellular connectivity (Wired, WiFi etc.)	18%

What do you see as the key strategies or tech innovations to overcome complexity in software architecture and engineering for SDVs? (ranked choice)	
Harmonized safety/security-related R&D across the supply chain	48%
Consolidated hardware, software and cloud services	45%
Centralized, consolidated ECU structure	44%
Closed-Loop SiL (Software in the Loop)	39%
Extended digital twin from manufacture to scrapping	38%
Open-source IP with innovation hubs	34%
Integrated OTA architecture in the software lifecycle	25%

In the near term, software vendors with end-to-end solutions across system software, cockpit and autonomous driving functionalities are likely to gain market share. To execute a successful software pivot, OEMs must integrate with the cloud car ecosystem to develop scalable and standardized platforms powered by open-source innovation and enabled by partnerships between software vendors, Tier 1 suppliers and technology majors.

Converged open-source software (OSS) innovation

Currently, automakers take varied approaches to developing car operating systems (OS), ranging from in-house R&D to purchasing integrated solutions to developing technology partnerships. To continuously improve the quality of the OS, auto manufacturers will need agile methods of ensuring sustained development and delivery. They will need to seamlessly onboard new technology vendors and deploy new tooling systems to developers. To ensure a sustained pipeline of software updates and innovations, automakers must develop a standardized white box, open-source vehicle OS using shared developer resources. As a CDO of an OEM observed, even a largely in-house model requires a highly collaborative development ecosystem: "Auto manufacturers are bringing more complicated and high-value-add technologies in-house and engaging with technology providers regularly. The costs and benefits of developing and assembling technological products are shared by collaborations." An OEM CTO echoed this sentiment: "Collaboration with tech behemoths is the best way to outperform the competition, leveraging their tools and expertise to expedite time-to-market for digital products."

Hyper-personalization powered by AI

As the CEO of an auto-tech firm stated in our survey, "The industry must aspire to a revolutionary shift, moving away from product engineering and toward customer-centric innovation."

The relatively high price point of new software-enabled vehicles is allowing OEMs to become some of the leading early adopters of AI-driven hyper-personalization. The CTO of a leading OEM noted: "We've been working on in-house intelligent tech using artificial intelligence, machine learning and data analytics to assist customers via automated reminders about vehicle health, battery consumption and maintenance."

To enable hyper-personalization through the entire customer experience, automotive retailers must join OEMs, suppliers and technology partners in embracing this software-defined revolution. They must tackle a long-standing issue of interoperability that will otherwise prevent sales and marketing functions from supporting the full lifecycle of SDVs. Currently, CRM systems, automated marketing and dealer management systems are not sufficiently integrated to reap the complete benefits of all the available data. Automotive retailers must embrace AI, big data analytics, IoT and cloud technologies to overcome data privacy and misuse challenges so they can deliver mass customization at scale and across a vehicle's lifetime.

> **"Artificial intelligence, the internet of things and cloud computing have enhanced the automotive industry by helping manufacturers better understand and satisfy client requests. SDVs represent the growth of vehicles as electronic terminals that are more sophisticated, extensible, adaptable and moveable."**
>
> **—Senior leader at a components manufacturer**
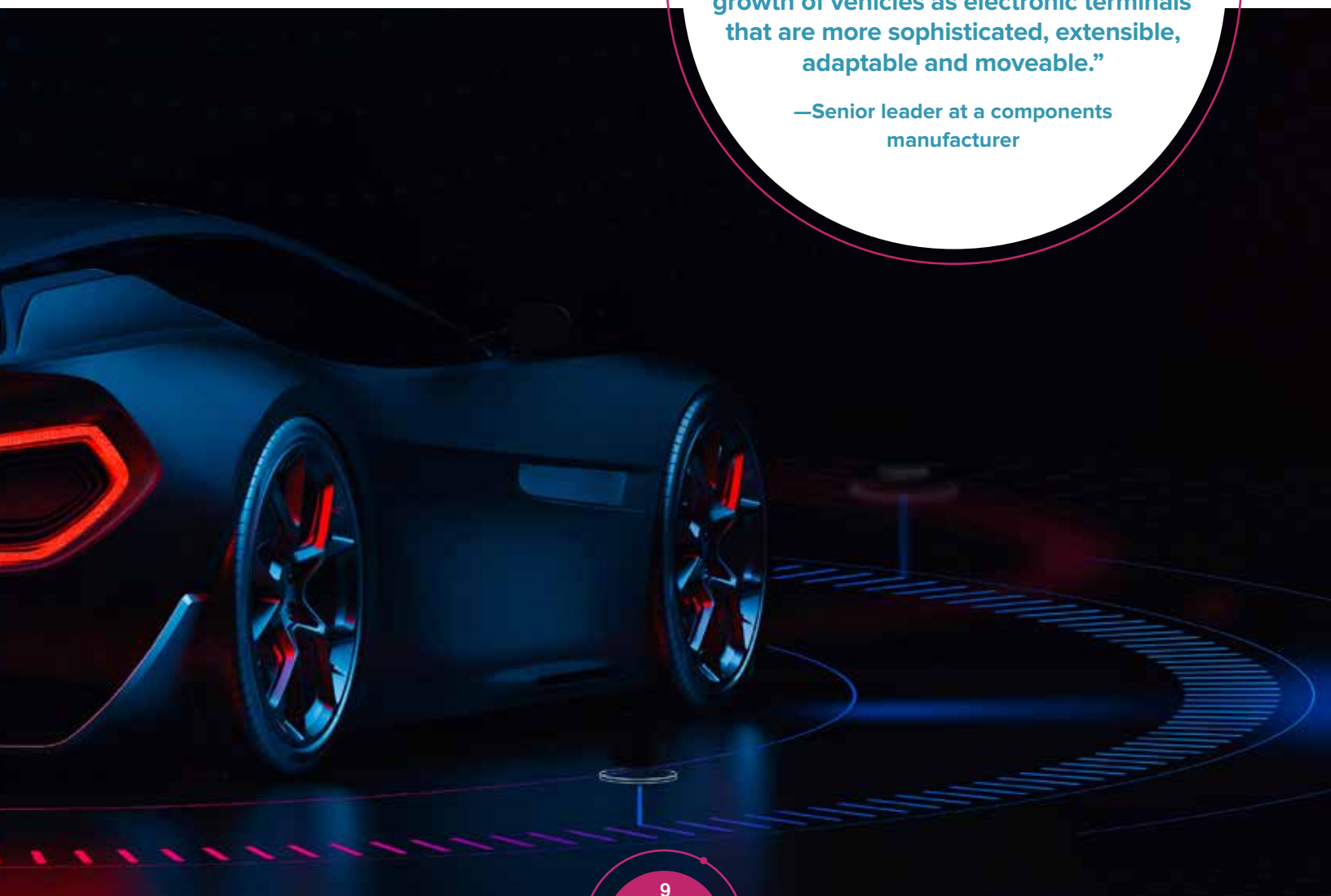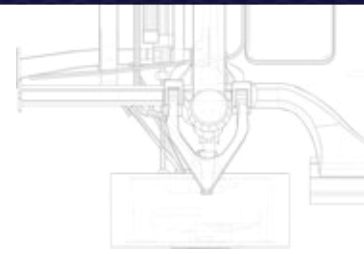
Customer Experience: Innovating to Enable Monetization

Fundamentally, OEMs must create a longer tail for vehicles, building customer relationships that begin with an evolved retail experience and extend far beyond the point of sale. **Digital transformation of automotive retail** will enable direct consumer relationships and new sales models. Automakers must pave the way for **SDV monetization** with services that make it worthwhile for customers to share their data. The sector will also witness a convergence of cross-sector companies that enable a new **integrated digital marketplace** for vehicles and transportation services—essentially an auto-to-mobility Amazon.

- **55%** of the auto CXOs we surveyed believe digital vehicle configurators will be a significant source of differentiation with customers.
- **60%** see a lack of cross-functional data monetization units as a key barrier to data monetization.
- **45%** think tech giants will take the lead in automotive retail in the future.

Digitalized automotive sales and marketing

Transforming CRM data into digital sales solutions will be a game changer for automotive retail. In Wipro's survey, CXOs highlighted AI, IoT/sensors and RPA as the top digital technologies/applications that are transforming sales and marketing.

In a digitalized sales and marketing landscape, interactivity will be paramount. The CMO of one leading OEM highlighted "an interactive digital experience that includes virtual tests such as hearing sound effects, opening doors and peering inside." Further, 55% of the CXOs we surveyed expect that digital vehicle configurators will enable customer co-creation opportunities and become the greatest sales and marketing differentiator. In step with OEMs themselves, retailers must also leverage insights-driven brand management, digital lead sharing, digital field force enablement and interoperable CRM systems to engage customers across the research, purchase and use phases.

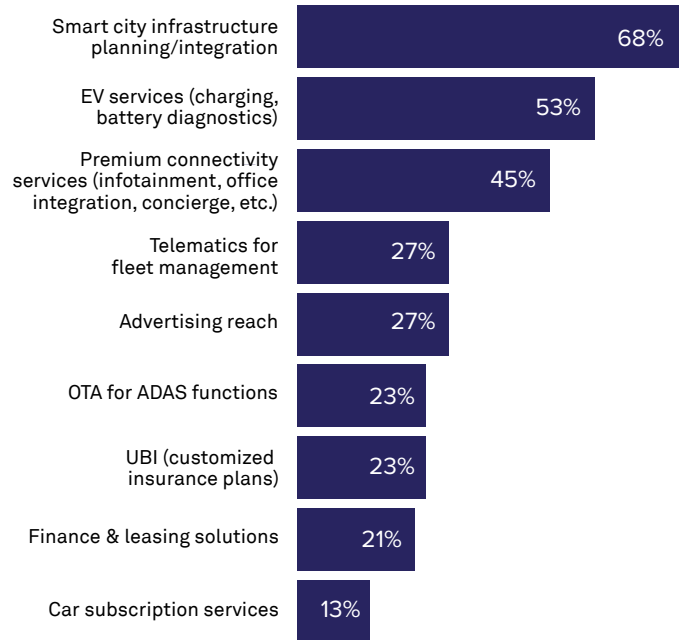| Which auto sales and marketing digital solutions/ services will be the greatest differentiators for customers? (ranked choice)	
Digital vehicle configurators	55%
Predictive vehicle service	37%
Virtual showrooms	31%
Digital payments	22%
Multi-brand comparison tools	22%
360-degree experience	21%
Online deals	21%
Virtual private assistants	20%

The pivot to a data monetization model

The road to data monetization in the automotive industry has been riddled with barriers, including customer unwillingness to pay for software-led services and the complexities of moving from siloed data sets to interoperability (a challenge cited by 60% of the auto CXOs we surveyed). The industry must focus on V2X connectivity, customer usage analytics and cross-functional data flows to uncover data monetization opportunities across the customer lifecycle. As the CDO of an OEM stated, "With SDVs, we need to create a credible array of services that encourages customers to contribute their data and preferences." To initiate the network effects flywheel that will drive data monetization, the auto industry must lead with services that can attract early adopters—both consumers and enterprise users like transportation and shipping companies.

On the technology side, cloud engineering principles are already enabling frequent OTAs. Increasingly, customers will experience what feels like a new vehicle every day—and pay for that experience. By 2030, customers are expected to spend US$2,000-6,000 per year on new software-enabled automotive services, plus additional fees for flexible and customizable post-purchase solutions like usage-based insurance and digital maintenance. Automakers must adopt a data-as-a-service (DaaS) model with a centralized and connected service-oriented architecture consisting of smart actuators, intelligent sensors and fewer but higher-performing controllers.

Security, in particular, will become an increasing concern as EVs connected to the physical grid become full-fledged, monetized SDVs. As one auto tech CDO commented in our survey: "Securing customers' data is a significant problem, because a data breach can impact physical hardware and software.... To decrease the risk, it's critical to make sure that network segmentation technology is in place for EVs and charging stations."

What do you believe are, or will be, the top data monetization opportunities via SDVs? (ranked choice)

Smart city infrastructure planning/integration	68%
EV services (charging, battery diagnostics)	53%
Premium connectivity services (infotainment, office integration, concierge, etc.)	45%
Telematics for fleet management	27%
Advertising reach	27%
OTA for ADAS functions	23%
UBI (customized insurance plans)	23%
Finance & leasing solutions	21%
Car subscription services	13%

Integrated auto-to-mobility marketplaces

The future automotive retail model will need to be agile by design—accessible to consumers anytime and anywhere. It will need to integrate physical and digital platforms to deliver a unified and personalized customer experience. This retail transformation is likely to rely heavily on

> **"The next-generation customer experience will begin with reimagined, digital-first sales and marketing approaches and extend into adjacent offerings like mobility-as-a-service."**
>
> **—Jayasree Natarajan, Manufacturing Domain & Consulting, Wipro**

collaborations and even mergers between OEMs and tech players to support advancements like AI-driven personalization.

OEMs and tech companies must adopt a coopetition model to create a robust integrated digital marketplace that extends from initial customization and purchase through the entire lifecycle of the vehicle. A senior leader at a component manufacturer commented: "The greatest benefit will come from implementing and improving digital connectivity tools such as sensors, digital maps, GPS and user-friendly monitoring devices and applications. Customer satisfaction and preferences in automobiles are heavily influenced by convenience and safety issues. Most customers nowadays want to save money, time and the environment all at once, and digital solutions, along with technology, can help them do so."

Even as they pursue a retail-driven transformation agenda, automotive stakeholders should not lose sight of ways in which retail will eventually merge with an extended auto-to-mobility marketplace. The integrated marketplace will also address adjacent opportunities in the customer lifecycle such as micro-mobility, vacation rentals and mobility-as-a-service packages. Developments in autonomous vehicles, in particular, will enable new relationships between OEMs and regional transit systems and solutions, delivering further innovations in the mobility marketplace. In most contexts, OEMs will seek to take charge of customer relationships post-purchase, thereby re-defining the roles not just of dealers and sales agencies, but also of fintech companies, charging infrastructure providers and e-commerce partners.

"We can already see how the automobile industry is revolutionizing the customer experience when researching and buying a car. AR and VR technology, as well as 360-degree views, are allowing customers to experience everything online without physically visiting a store—and they have access to an extensive range of options."

—Senior leader at an auto technology company
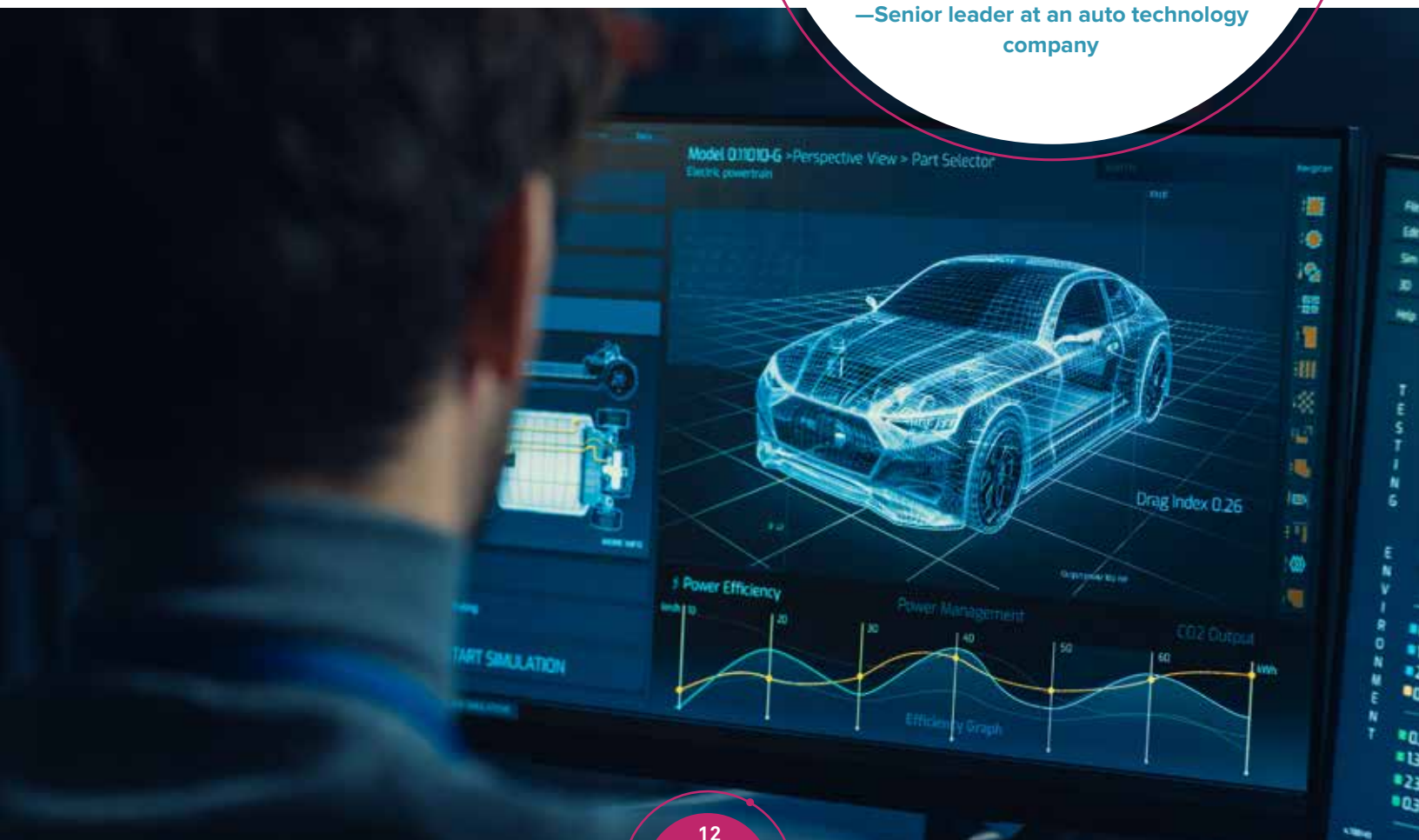
Methodology

Insights shared in this report are based on a survey conducted for Wipro in January-March 2022 by Coleman Parkes with 100 automotive CXOs in North America.

All respondents are lead decision makers, part of the executive team and key influencers for their organization's automotive transformation strategy and implementation. In addition to interview discussions, respondents provided their views through an online multiple choice survey questionnaire.

Respondent Profile

JOB ROLE

- CTO and CIO: 66%
- CEO: 12%
- COO, CDO, SVPs: 22%

REVENUE (US$)

- >20 billion: 29%
- 1-20 billion: 37%
- <1 billion: 34%

SECTOR

- Auto OEMs: 34%
- Tier 1 Suppliers: 33%
- Auto-Tech Providers: 33%

Please visit wipro.com/automotive to learn how Wipro enables automotive clients to achieve digital transformation.

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