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Confederation of Indian Industry

Business and Beyond

125 Years: 1895-2020

Future of Mobility in India

Envisioning the future of the Indian mobility ecosystem

February 2020

Contents

Foreword

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I am happy to share with you the CII-Deloitte report on The Future of Mobility in India to be released at the conference on Modern Automotive Technologies for Mobility in India, which is organised by Confederation of Indian Industry (CII).

India has been one of the fastest growing major economies in the past five years, and is expected to become the world's second largest economy after China by 2030. To support this economic growth, the constituents of the mobility ecosystem (original equipment manufacturers [OEMs], ancillary manufacturers, energy companies, etc.,) must make a significant contribution.

While the demand for mobility will continue to grow at a rapid pace, the industry is increasingly becoming cognizant of the challenges that are arising because of this rapid growth—increased road congestion and dependence on fossil fuels leading to high air pollution.

Efficiently managing the rapidly changing mobility landscape in a sustainable manner is the biggest question in front of various players across the mobility value chain. Multiple drivers such as electrification, ride sharing, data monetisation, and connected cars are likely to change the way we perceive mobility today. These drivers will disrupt the current mobility ecosystem and provide new opportunities for disruptors to establish their presence in the market.

The conference on Modern Automotive Technologies for Mobility in India aims at laying out the roadmap for the future, driven by a vision to provide and create a cleaner, safer, and efficient mobility ecosystem. The conference will focus on four core topics: electrification of vehicles, data-driven innovation in the automotive industry, the emergence of automotive R&D landscape in India, and connected mobility.

As a "knowledge partner" for the event, Deloitte has prepared a background paper covering each of these aspects. The CII-Deloitte report on The Future of Mobility in India highlights the way forward for various stakeholders to shape the key agendas of the sector today across these four core topics.

The report has been prepared using detailed analysis and study of multiple parameters influencing the mobility industry in India and globally. I hope you will find this report useful.

Preface

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The recent slowdown notwithstanding, India is expected to be one of the world's fastest growing economies, with increase in demand for personal and commercial mobility as one of the key growth drivers. A combination of prosperous consumers, increased government spending on infrastructure, and growing demand for freight movement is likely to drive this demand. At the same time, the global and Indian automotive industry is undergoing significant changes across the value chain. The industry is ripe with disruptions across new technologies, business models, and rapidly evolving policies around emissions and incentives.

With several fundamental shifts impending the sector, industry stakeholders in Indian automotive sector face pragmatic questions. Primarily, the questions revolve around how the traditional means of conducting business remains competitive in the face of imminent technological disruptions, fast evolving customer preferences, and uncertain regulatory changes.

Some of the most critical changes that are likely to have a significant impact on how various stakeholders conduct their business across the mobility ecosystem include the following:

- Development of the electric mobility ecosystem by bringing together multiple stakeholders (OEMs, component manufacturers, policymakers, etc.)
- Role of innovative and new business models using data analytics
- Rapidly changing automotive R&D landscape
- Proliferation of connected mobility (sharing mobility, SIM-powered telematics, personalised infotainment, autonomous cars, etc.)

The CII-Deloitte report titled The Future of Mobility in India is an endeavour to explore some of the major trends and factors that are expected to influence the future of mobility in India, and layout the key implications for various stakeholders across the mobility ecosystem.

Powering the electric mobility ecosystem

Adoption of electric vehicles in India has the potential to disrupt the automotive market; however, opportunity exists for players to build an early advantage

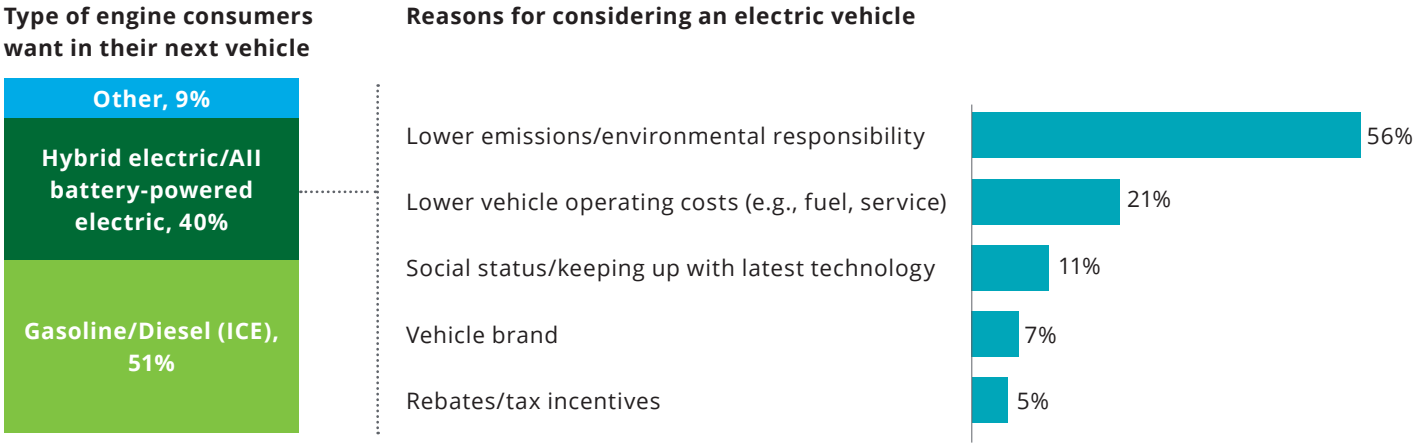
The global automotive industry is undergoing significant disruptions across the value chain. One such disruption that is expected to have a significant effect on stakeholders across the mobility ecosystem is the electrification of powertrain.

The case for electrification in India

Driven by urbanisation; growing workforce; increasing income levels; and investments to improve infrastructure, the demand for mobility in India is likely to grow at a faster rate than ever over the next decade. If this growth continues to depend on petrol and diesel-powered internal combustion engines (ICEs), it may significantly affect the economy (82 percent of India's crude requirement is fulfilled by imports; automobile sector contributes ~55 percent of India's crude consumption[1]) and environment (India was the third largest greenhouse gas emitter in 2019[2] and had 22 of world's 30 most polluted cities[3]).

The need to sustainably grow the mobility ecosystem, both from an economic and environmental perspective has led to the electrification of powertrain and the introduction of electric vehicles (EVs). EVs are much cleaner (~67 percent less emissions than ICEs[4]), and are potentially much more economical than ICEs (recent EV launches claim up to 80 percent lesser running costs[5]). The Indian consumers have become increasingly aware of this benefit, and demonstrated strong preference for adopting EVs.

Figure 1. Consumer preference of powertrain for next purchase and the key reasons

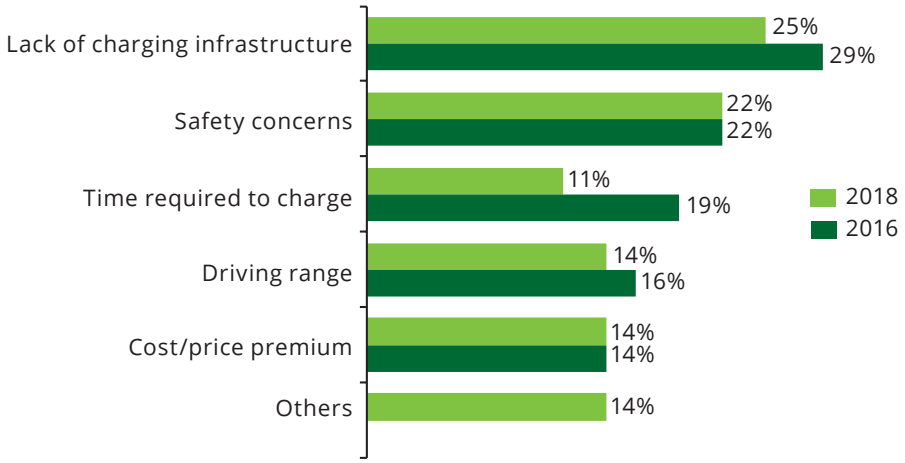


Source: 2020 Deloitte GACS (n=2,699)

In the Deloitte Global Automotive Consumer Survey, 2020 (GACS) for India, 40 percent Indian consumers demonstrated a preference for hybrid electric vehicle (HEV)/all battery electric vehicle (BEV) for their next purchase[6]. The primary reason for considering an electrified vehicle is lower emission/ environmental responsibility, and lower vehicle operating costs.

The key roadblocks are likely to be lack of charging infrastructure, safety concerns pertaining to powertrain technology, time required to charge, driving range, and upfront cost/ premium. Availability of EVs in the preferred car type/brand, which was one of the major reasons in 2018 contributing to 14 percent of the concern, has reduced to 0 percent[6].

Figure 2. Consumer concerns regarding EVs



Source: 2020 Deloitte GACS (n=3,022)

Implications for the mobility ecosystem

In the present age, the automotive industry is centred across the vehicles. With over 2,000 moving parts[7], the ICE-powered automobile remains as one of the most complicated technologies in the transportation ecosystem. As a result, vehicle manufacturers (OEMs) dominate the automotive value chain and possess high bargaining power. Most other value chain stakeholders—auto component manufacturers (ACMs), aftersales service providers, and technology providers—remain relatively marginal.

EVs (relative to ICE-powered vehicles) are considered to be much simpler to manufacture, with only about 20 moving parts[8] and battery-related components (battery pack, battery management system, electric motor, power electronics, etc.) alone contributing to over 50 percent of the car value[9]. Vehicle bodies and traditional components may become a commodity in the near future. Battery technology, on the other hand, will require specialised competencies, (largely absent in most global OEMs). As a result, traditional OEMs and powertrain component suppliers might lose their market share and control of the value chain to technology and engineering firms that manufacture batteries and related components.

The rise in EV sales is expected to hurt other stakeholders as well. ACMs are likely to see significant shift in value pools, with some component segments experiencing value creation at the expense of growth of other segments. Electronics and electrical components will see their share of content increase substantially given the penetration of electric vehicles, increased dependence on electronics (i.e., advanced electronics control units and powertrain control modules), and greater use of sensors. Advanced electronics will also be required to meet increases in emissions and efficiency standards. EVs with wheel-based motors will reduce the demand for conventional axles and the entire power unit as well (fuel system, ICE, transmission, and exhaust system). However, not all traditional components may meet the same fate. Braking, suspension, and steering will always be necessary as long as vehicles continue to travel on roads, but these features are likely to grow less differentiated. Other components such as tyres, seats, and interiors will survive in the new ecosystem too, albeit with lesser contribution to the car's value.

Beyond the OEMs and ACMs, the after-sales industry may undergo a transformation as well. Due to the significantly lesser moving parts, EVs require up to 60 percent less maintenance than ICEs[10]. For example, regenerative braking in EVs reduces the wear and tear, and may drive down the demand for replacing brake parts considerably. Further, the need for new services in battery lifecycle management will emerge, necessitating workshops and garages to ramp-up their capabilities, or risk losing revenues to new-age start-ups with dedicated battery-related aftermarket offerings.

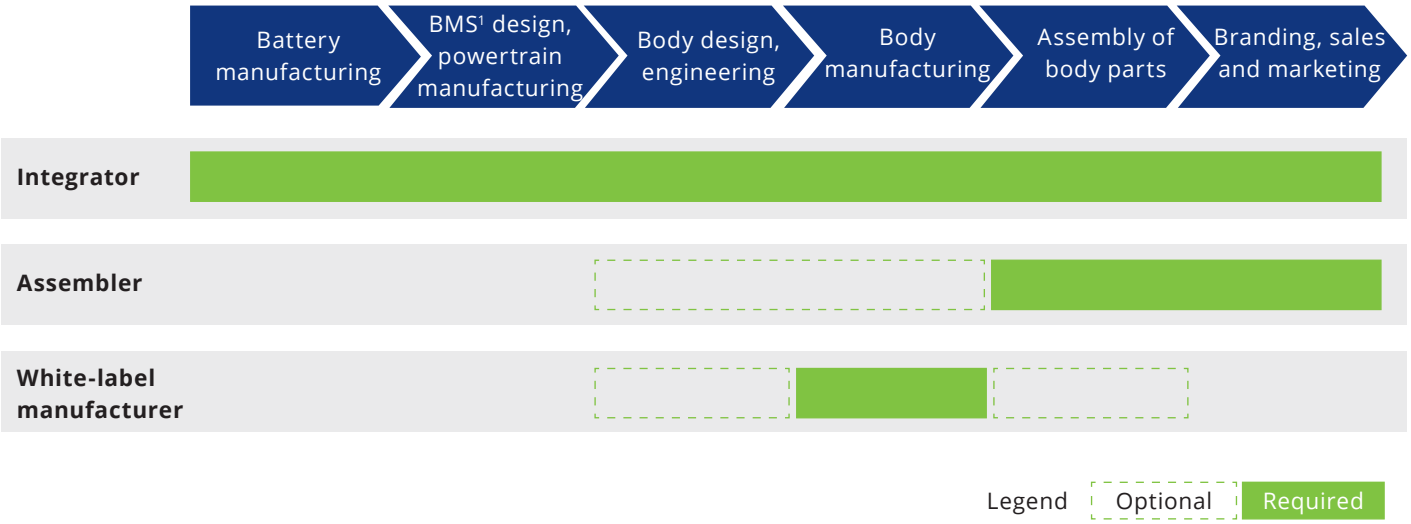
Potential plays for the mobility ecosystem

Given the disruption, OEMs and ACMs need to necessarily consider looking towards new offerings to deliver desired returns. This may mean moving away from today's linear supply chain, and collaborating with multiple players having different skill-sets across a web of relationships to have future-ready assets and capabilities.

While there is a potential to enter new sources of revenue, OEMs will need to first come to terms with vast changes in the nature of their primary existing revenue stream—sale of vehicles, which presently contributes to 85–90 percent of OEM revenues[11]. OEMs will have to make the critical decision regarding their role in the value chain. They will need to determine to what extent they want to move away from their current operations as an integrated designer-assembler-seller role. This choice may represent a profound business model change and the develop¬ment of significantly new capabilities to be competitively and sustainably viable. As a vehicle manufacturer, they may undertake one of the following roles. Irrespective of the role they choose, automakers will need to build new capabilities and supplier collaborations to remain relevant in the ecosystem.

- ***Integrator*** upgrading their capabilities and manufacture all major components in-house (including batteries, powertrain, software, etc.)
- ***Assemblers*** by continuing with their existing skill-set and collaborating with battery suppliers, technology suppliers, software developers, and others to provide an "assembled vehicle", much like the personal computers in the 2000s
- ***White-label manufacturers*** producing and supplying vehicle bodies to technology players in the market, who assemble the body, electric powertrain, software, and other components

Figure 3. Potential plays for OEMs as a vehicle manufacturer



Note: [1]Battery Management System
Source: Deloitte Analysis

Role of the government

For large-scale electrification to be a reality, the availability of adequate charging infrastructure is of utmost importance. Global precedents show that charging infrastructure drives EV adoption, instead of playing a demand-based catch-up. India may require 10–40 lakh public charging points by 2030[12] (~150 public charging stations as of June 2019[13]) to support EV sales of ~20–60 lakh four-wheelers (and two-wheelers, three-wheelers, and buses) by 2035[14]. This entails an investment of INR 0.25–1 lakh crore[15], with a relatively unattractive payback period (12+ years for L1 chargers and 4–8 years for L2 chargers[16]). At least five industry segments have shown active interest in mass-producing charging set-ups—oil & gas companies, power utility companies, OEMs, ACMs, and private equity firms. However, their interest and willingness to invest is subject to the government's support—both from a regulatory and investment perspective.

The government's vision of an electrified future of mobility requires itself to be the largest and most important contributor to its conceptualisation, as it seeks to achieve its key aim of driving a new age of sustainable growth while preserving the Indian ecosystem's legacy and relevance. We define the four key roles that any government, which desires to move towards the future of mobility, should aim to play in the mobility ecosystem:

01

As **policymakers and regulators,** the government can ensure public welfare, safety and security, while enabling various stakeholders to navigate this new territory. The policies and regulations that the government implements should be "tech-agnostic", as they are likely to have a make-or-break affect on the maturity of various mobility innovations.

02

As **researchers,** governments can help foster technological innovation. Where government funds are allocated, and how quickly policy decisions and grants are given can influence the way the market moves. They can serve as important arbiters balancing development with public safety and security as citizens adopt these new technologies.

03

As **designers and developers,** governments can invest to prepare the ecosystem to be future ready—build infrastructure to support new technology, create demand for new mobility services, and build capabilities to be ready to serve new demands in future.

04

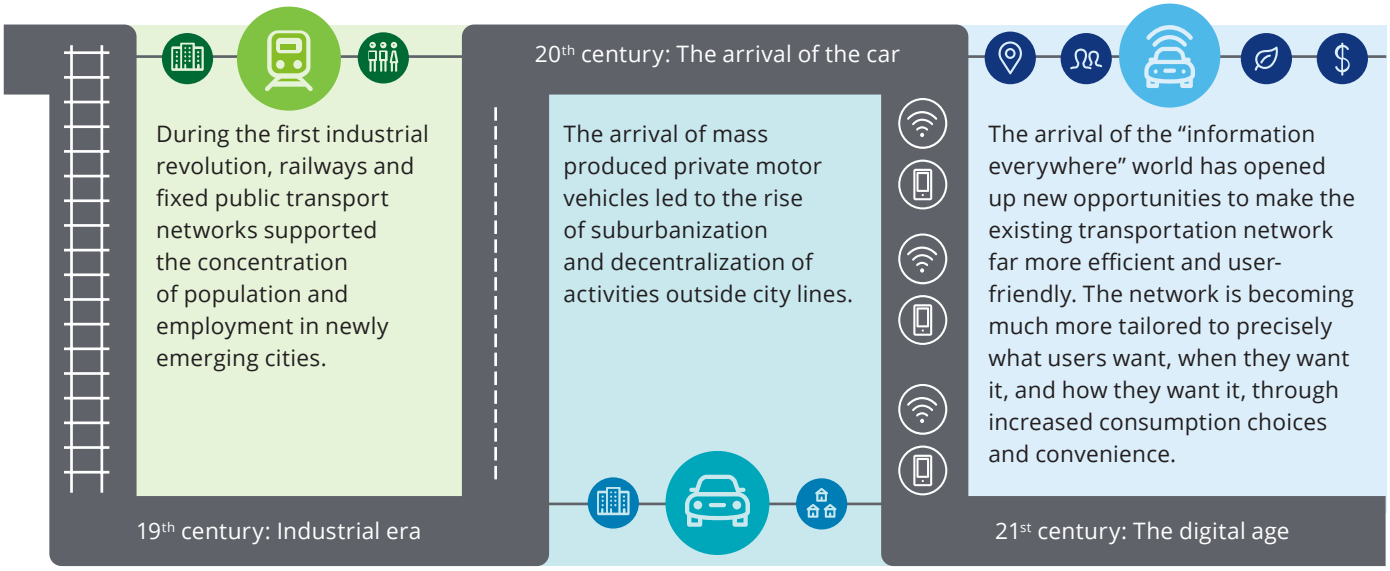
As **end users,** governments can plan increase state-operated fleets, invest in new infrastructure, and spur adoption of shared mobility, electrification, and new business models by their procurement decisions.

Pursuing innovation in mobility using data analytics

Data can create a stream of new opportunities for various stakeholders in the mobility ecosystem; however, capitalising data requires a focused strategy

One major trend emerging in the global automotive sector in the 21st century is vehicle connectivity. With more than 100 million lines of code on average likely in each vehicle by 2023, software and data are likely to become the next "oil". Vehicles are now able to capture and share many types of data, including geolocation, vehicle performance, driver behaviour, and biometrics data. While GPS functionality has supported navigation systems for years, smarter applications of the data are adding significant value in the form of real-time traffic updates and road safety alerts. Uses for vehicle health and operational functionality data are also spreading as vehicle manufacturers continue to develop app-based tools to monitor key maintenance statistics. While the use of advanced biometric data is still in its infancy, new sensors in the cockpit can allow vehicles to monitor key attributes of their occupants, including stress levels, heart rhythms, alcohol consumption, and fatigue.

Figure 4. Mobility through the ages



Source: The rise of mobility as a service, Deloitte University Press - 2017

Roles for OEMs in the data ecosystem

Monetising this tremendous increase in operational and behavioural data is not easy, and OEMs have been lagging behind market disruptors entering this space. One of the first decisions for companies aiming to monetise vehicle data is where to play in the connected vehicle value chain. Potential roles exist for companies to act as:

- **Generators,** making end products capable of capturing data
- **Transmitters,** safely delivering the data to a central repository
- **Manipulators,** aggregating data from different sources into a usable format
- **Developers,** designing end-user offerings that use the data
- **Providers,** marketing the service offerings to both B2C and B2B audiences

Not every company is equipped to succeed in each part of this value chain. For new entrants in particular, it can be difficult to create value further down the chain without access to the data generated upstream. Here lies one of the central issues faced by the vehicle data-monetisation ecosystem from developing to its full potential. Many OEMs have started collecting the data, but because they want to control every point in the value chain—though they may not be equipped to do so—they are generally reluctant to make the data available to anyone else.

Opportunities for OEMs in the data ecosystem

Digital infrastructure enabler: While physical infrastructure has remained the mainstay of the mobility ecosystem in the past, digital infrastructure is likely to become equally important in the near future. OEMs can use this opportunity to not only collaborate with third party providers, but also expand their product offerings to include in-vehicle sensors, operating system provider, and data aggregation and analytics. This can generate large amount of rich data that can help OEMs better understand how customers use their vehicles and help them design better, more customised customer experiences to improve brand affinity and loyalty.

Content provider: Proliferation of shared mobility provides a tremendous opportunity to sell content, entertain, and generally enhance the time spent in transit to make it relaxing, productive, or entertaining. Several automakers have struck deals with content providers to stream audio to vehicles, which could readily extend to video, web browsing, and even more advanced content. Augmented-reality windshields, currently explored as a safety and navigation aid for drivers, could easily be repurposed for a hands-free world. Many capabilities in this space already exist, but will continue to evolve to become even more immersive and interactive—high-quality content creation, effective content sourcing, targeted advertising, and product placement.

In-vehicle services: These services exist too, but could expand in the future, from meals to shopping and beyond. Today, we are seeing the forays into on-demand food delivery operated independently of restaurants. Tomorrow, mobility services could extend directly to the customer, irrespective of the vehicle, for journeys of sufficient duration, transforming the vehicles into digital personal assistants.

Predictive maintenance and ride assistance: The extensive data that the future vehicles will generate can help OEMs improve real-time driving and ownership experience of customers. Features such as preventive care and

service recommendations, customised driving suggestions, collision avoidance, and artificial intelligence (AI)-enabled drive assistance are likely to see widespread acceptance amongst customers. Real-time data sent from vehicle sensors can identify problems early, and predictive analytics can allow companies to get out in front of potential warranty and recall issues. This kind of data can also help OEMs and dealers optimise their parts inventory and technician resourcing strategies. Even today, a number of automotive companies have started offering some of these services at a nascent stage.

External revenue opportunities: In terms of external revenue opportunities, OEMs and other industry players (content providers, in-vehicle service providers, data and analytics companies, advertisers, entertainment equipment providers, and social media companies) are exploring a wide variety of data-based products and customised service offerings, including user-based insurance, mobile commerce, mobility-as-a-service (MaaS), behavioural and geo-based advertising, infotainment, and personal health monitoring.

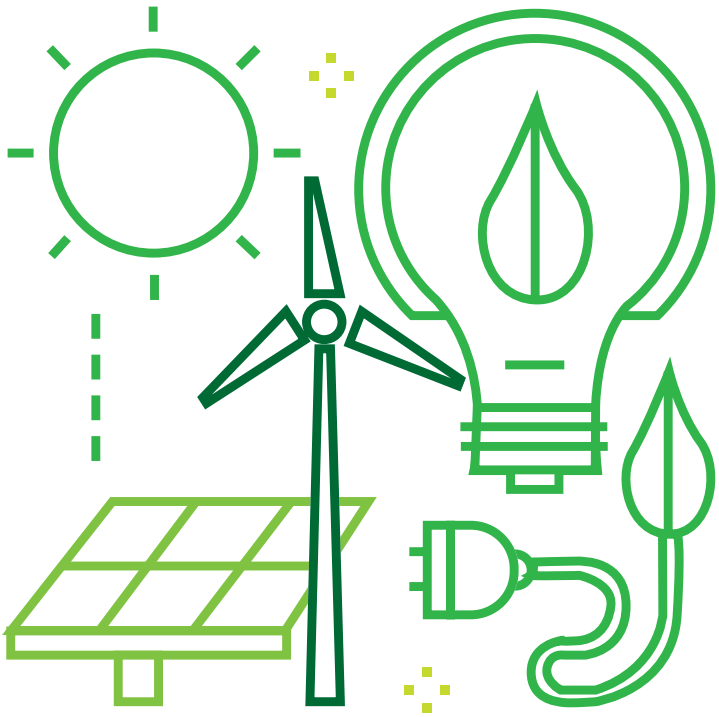
Complications of data handling

In its full potential, data is expected to play an important role across multiple aspects of the mobility ecosystem, especially within the connected car itself. The complexity and dynamism that characterise the emerging connected vehicle industry has made it difficult to make decisions regarding where-to-play and how-to-win, as there are several complications associated with data handling that OEMs must navigate through to crack this code.

- Consumers demand significant benefits in return for sharing data with stakeholders of the mobility ecosystem.
- Consumers are only comfortable sharing specific data with the mobility ecosystem, related to vehicle sensors and driving behaviours.
- Consumers trust OEMs the most to manage their data in a safe and ethical manner, even more than the government agencies.

Figure 5. Data in the connected vehicle

Source: Securing the Future of Mobility, Deloitte University Press - 2017

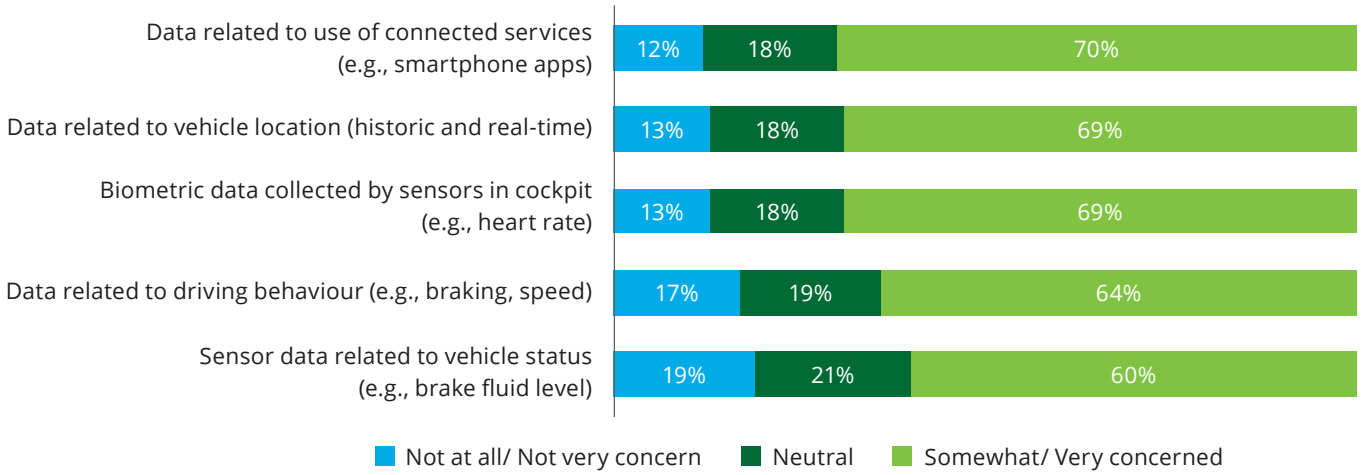


The journey to create new value from the growing amount of vehicle data starts by setting an ambition and charting a path to success. Most OEMs are performing "random acts of science" rather than ambition. They should understand both consumer trends and potential disruptors to uncover winning ideas. With that foundation in place, they can then set new aspirations and establish a portfolio of innovative concepts to guide value creation.

Figure 6. Consumer willingness to share personal information in lieu of 'significant benefit'

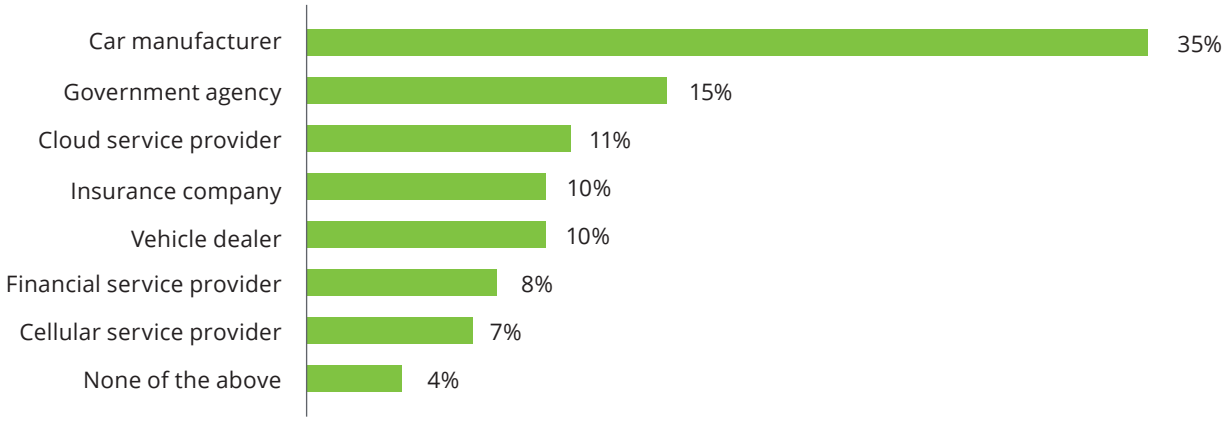
Source: 2020 Deloitte GACS (n=2,931)

Figure 7. Consumer opinions on types of data collected



Source: 2020 Deloitte GACS (n=3,022)

Figure 8. Consumer opinions on whom they trust to manage the data generated by their vehicle



Source: 2020 Deloitte GACS (n=3,022)

Changing R&D landscape in India

With the auto R&D expected to undergo significant overhaul, India may well become the next global R&D hub driven by policy and investment support by stakeholders

Globally, automotive R&D is driven by increasingly stringent emission norms, improving safety standards, highly complex digital technologies, shortening product lifecycle, and emergence of connected and autonomous cars. Automotive OEMs are required to continuously invest in new technologies and drive innovation to be competitive in the market.

The fast-changing technology and policy imperatives, such as BS-VI emission norms, Corporate Average Fuel Efficiency (CAFÉ) norms, and gross vehicle weight (GVW) norms for commercial vehicles, is forcing automotive OEMs to focus on a large number of parallel R&D priorities.

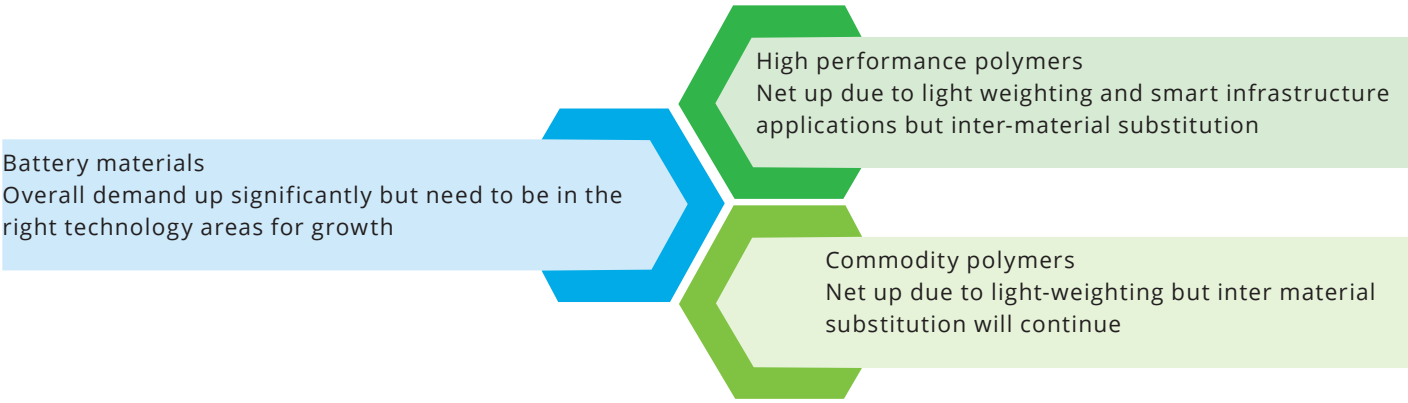
The cost of juggling between multiple R&D projects is seen putting enormous cost pressures on automotive OEMs. Over the past decade, when the sales cycle has been on the upscale, the industry has enjoyed the focus on R&D. However, with recent correction in automotive sales, it is imperative to manage the R&D projects to ensure improved products along with enhanced customer relationship.

Key trends in automotive R&D

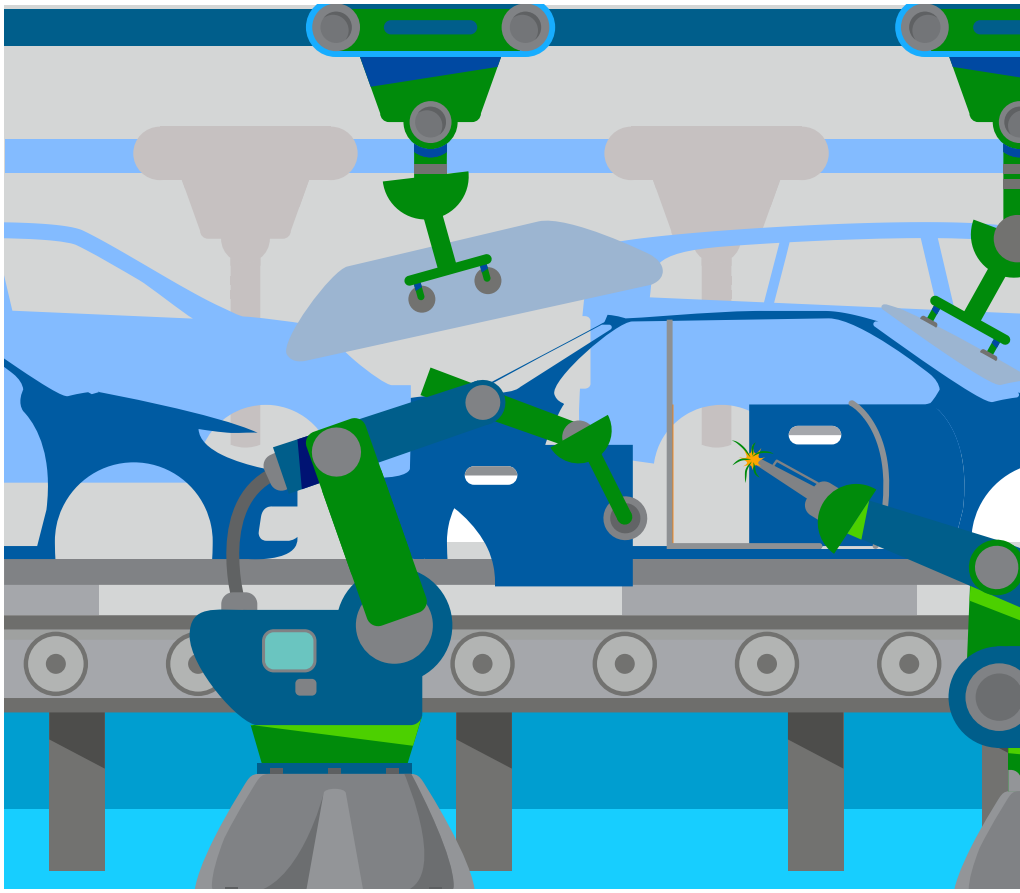
Large number of technology, regulatory, and customer trends are shaping the automotive R&D. However, some of these trends have a far bigger affect on the business for OEMs when compared to others.

Light weighting: The shift towards lightweight materials is likely to continue, influenced by both emerging technologies (EV and electrification) and policy imperatives (CAFÉ norms). The desire to improve mileage or extend the EV range is expected to drive OEMs to scrutinise every source of weight. Alternately, stringent crash test norms are ensuring passenger safety. These trends could collectively drive adoption of polymers, advanced composites, and aluminium and lightweight steel alloys.

Figure 9. Trends in light weighting of vehicles



Source: Making the future of mobility, Deloitte Insights - 2018



Additionally, the advances in battery technology have been tremendous with 80 percent cost reduction between 2010 and 2017[17]. With the focus on EVs increasing, battery technology players are investing their energies and monies in reducing the size of the battery and extending range of EVs.

Chemicals and specialty materials companies are likely to play a critical role in making the future of mobility a reality. Automotive companies will have to quickly adopt these advances, and in cases, work closely with these companies to develop the requisite materials.

Auto electronics: The move to greater electronic content in cars has been underway for several years and responsible for such major innovations, such as security systems, anti-lock brakes, engine control units, and infotainment. These features are so popular that they are now widely available, demonstrating that consumers are willing to pay for technology that enhances their driving experience.

Auto electronics may be divided into four major categories: power controls, safety controls, communications and entertainment systems, and body electronics. Automotive OEMs are generally seen considering auto electronics as a key factor to compete through differentiation.

With improvements in consumer electronics, communications and entertainment functions of vehicles have seen a remarkable rise. Hence, the development of safety control and communications and entertainment electronics is expected to experience rapid growth. The winners in the automotive market are expected to be the ones who are proactive in developing and adopting auto electronics in their vehicles.

Platform sharing: Multitudes of companies are looking to optimise their costs by sharing the platforms. Global companies are not only looking to share platforms within the companies, but OEMs are trying to share platform with companies with whom they have global associations.

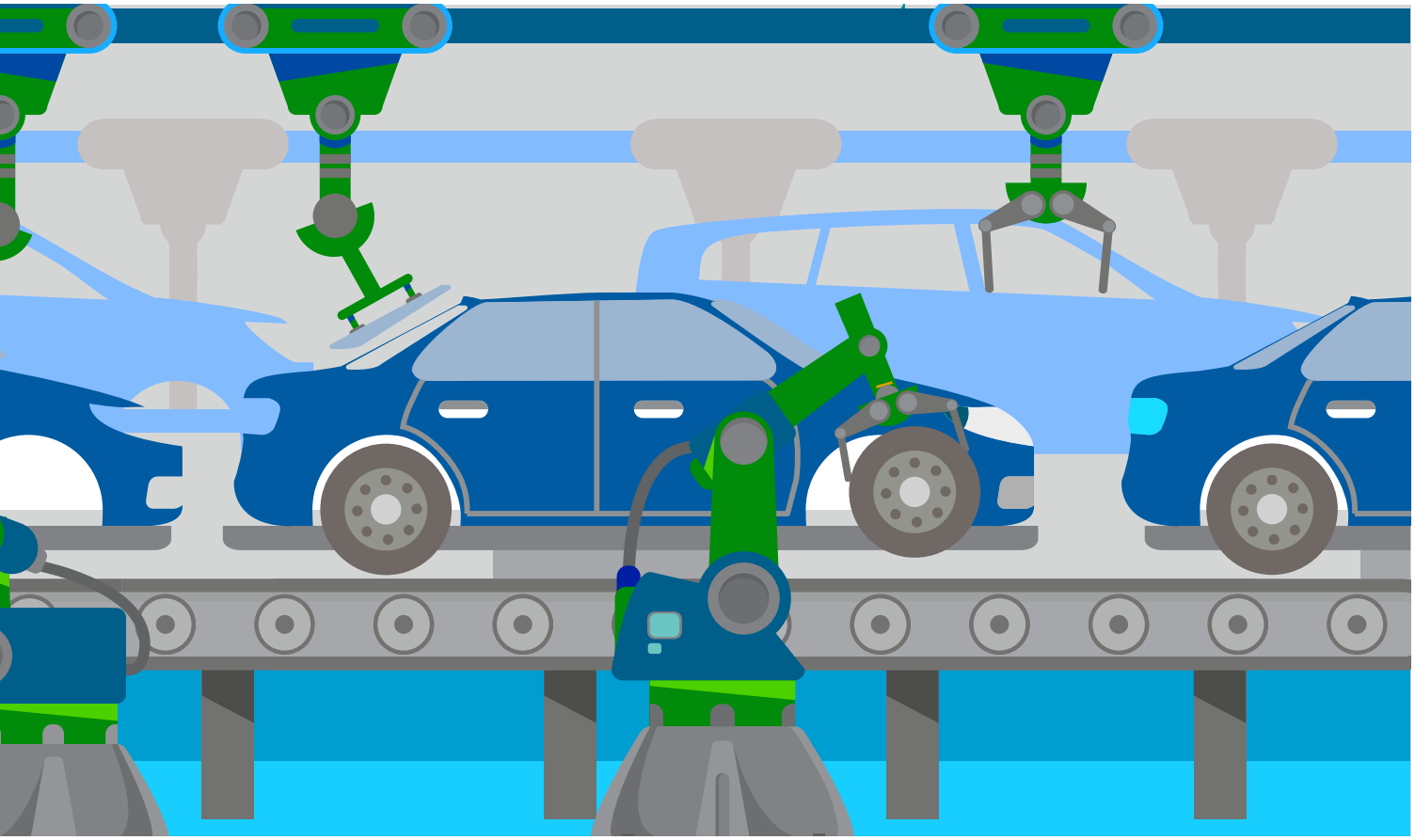
With sharing of platforms, automotive companies are trying to streamline the sourcing and procurement of parts. Due to this manufacturing has become cost efficient as well. Further, when parts are commoditised, it lessens the cost pressures on the automotive OEMs for their R&D costs.

One of the biggest concerns in platform sharing across products and geographies is to ensure that the platform architecture conforms to all the norms for different geographies.

Adoption of AI and machine learning (ML): With shortening product lifecycles and multiple R&D projects to be managed in parallel, there is a need for improved project management in R&D. Introduction of AI for project management is likely to ensure that resources are freed up for promising R&D projects, while non-promising projects are killed in time, thus ensuring productivity gains of 10–15 percent and improved time to market by 10–40 percent[18].

Furthermore, in areas such as designing of products, cross-industry use cases ensure that ML can help design products that are lighter and stronger than the products designed by humans. Similarly, ML can be used to create scalable simulation programmes to derive vehicle test data for a said period.

Connectivity: Connected cars are poised to become a common phenomenon in India in the near future. With advanced connectivity features to be part of the future cars, OEMs can use the data received from customers to improve the existing product design and enhance the way product development takes place in India.



Key challenges in Indian Automotive R&D

Talent and skill gap: India, with its low cost and highly talented workforce, has the right elements to become a major R&D hub. The average cost of hiring a researcher is 20 percent of that of US, with average workforce age of 29 years[19].

However, technical skills remain the biggest gap that the automotive R&D sector face. There is a need for specialised centres similar to National Automotive Testing and R&D Infrastructure Project (NATRiP) centres in an effort to boost auto R&D in the country. Automotive companies use the NATRiP facilities not just for their product development, but also for pushing their global R&D capabilities.

Price sensitivity of consumers: Underlying the massive R&D investments, is the assumption that the consumers are willing to pay for these advanced technologies. However, results from the 2020 Deloitte GACS suggest that achieving a return on invested capital for new technologies may be more difficult than some automakers think. With the need to invest heavily into R&D, automakers need to identify efficient business models to ensure the R&D investments are in alignment to the needs of the consumers.

Figure 10. Consumer's unwillingness to pay a premium (>INR 25,000) for vehicles with advanced tech

Source: 2020 Deloitte GACS (n=3,022)

Role for stakeholders

India automotive R&D landscape in the 1990s focused on product adaptation instead of developing platforms from the ground up. With the need for innovation, Indian automotive OEMs have increased their focus on fundamental research and new product development.

While the overall approach for R&D has improved, the ecosystem maturity and the current skill gap have not made the Indian R&D as good as the mature markets. Although, there is a long way to go, the wheels of change are in motion.

Given their centricity, automotive manufacturers are expected to play the most important role in shaping the R&D ecosystem in India. There are multiple imperatives for the automotive makers that must be addressed to ensure competitiveness of the Indian automotive segment.

- Indian auto R&D landscape requires higher global investment. It is imperative for the auto companies to invest in India not just to receive cost competitiveness, but to also increase indigenisation and localisation.
- Apart from growing organically, the automakers should also consider using collaboration and inorganic growth to stay ahead of the curve for the newer and emerging technologies.
- Automakers need to set up global R&D centres in India to attract not only Indian talent but also the global talent to reduce the skill gap and fast track capability development. Similar use cases have led to the rise in the IP applications registered in the country over the past five years.
- Indian automotive companies need to consider focussing on the need to conduct co-research along with the vendors to fast track the capability development.
- By bringing in veterans in automotive R&D from mature markets to lead the R&D function in India can also fast track the capability development.

To enable Indian automotive landscape compete with the mature markets, the government also needs to play a critical role. Some of the imperatives are as follows:

- Provide additional incentives and fiscal benefits to lower the risk factor involved in R&D.
- Facilitate the efforts of automakers to set up of global R&D centres.
- Facilitate global educational alliances to develop educational institutes that will boost auto R&D and reduce technological skill gap.
- Drive collaboration to work on emerging technology to achieve economies of scale. The government needs to play a major role in facilitating a win-win situation for all the stakeholders to achieve the desired results both as a facilitator (regulator) and as a co-researcher, designer, and developer.

Effective collaboration amongst the stakeholders is likely to be the key towards establishing the Indian automotive sector as a global R&D hub and effectively address the Indian customers' needs.

Transforming business with connected mobility

Connected mobility has the potential to revolutionise the future of mobility in India; however, the ecosystem needs to overcome many challenges to achieve that future

In this chapter, we will discuss the impact of the three potent disruptions arising from connected mobility applications. These disruptions have already made their way into the Indian mobility ecosystem to varying degrees. While shared mobility has achieved scalable operations already, connected services and autonomous vehicle (AVs) technologies are in nascent stages in the market, with few existing vehicles adopting the technology.

Shared mobility

Indian cities face one of the largest levels of congestion in the world. Bengaluru, with 71 percent congestion (additional time taken to cover a particular distance during peak hours), has the worst congestion in the world, followed by Mumbai (4th), Pune (5th), and Delhi (8th) per the TomTom Traffic Index released in 202020. One of the major factors driving this congestion is commuters' preference for using their private vehicles as opposed to the public transportation systems, which they find inefficient, inadequate, and often unsafe.

In response to high congestion, several shared mobility models have emerged over the past three years. Beyond the ride-hailing services of the two largest cab aggregators that have grown multi-fold in popularity (together present in ~250 cities with an average of 36 lakh trips booked daily in 201921), alternate sharing models such as car-leasing, car subscription, car rentals, fleet management, and pooled mobility have also become popular.

The emergence of these models has resulted in a change in consumer behaviour. More than half (56 percent) of respondents in the Deloitte GACS, 2020 stated that they were travelling more because of readily available ride-hailing services. Car ownership, too, has seen an impact, with over 60 percent of respondents now questioning the need to own a vehicle in the future. It is interesting to note that millennials are at the forefront of adopting these mobility solutions, given the reduced importance given by them to car ownership and its traditional association as a barometer of success.

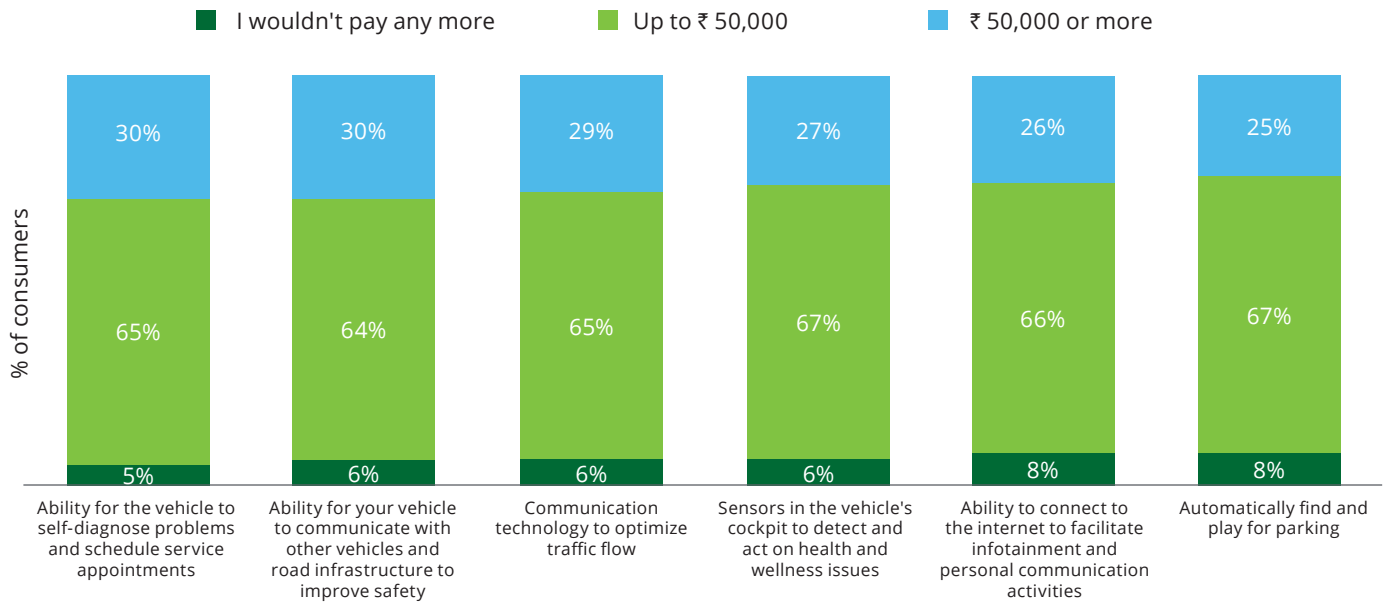
Shared mobility has had a mixed effect on the ecosystem. Through these models, utilisation of cars has improved. Thus, while demand for mobility has increased, it has not necessarily translated into an increase in demand for vehicles. However, with cars running greater distances in a day, the demand for maintenance and repairs has also increased, providing an impetus to the aftermarket.

Connected services

As discussed earlier, the dependence of the mobility sector on data is ever increasing. Data serves three primary applications in this ecosystem—in-car content and services, vehicle diagnostics (performance management, predictive analytics, driving behaviour), and driving assistance (traffic management, vehicle-to-vehicle relationship).

Penetration of these services in India has been nascent, but growing at a steady state, with most OEMs offering in-car connectivity and navigation across all variants, and a bunch of preliminary vehicle diagnostics capabilities and "smart" features (voice-recognition, remote-controlled ignition, and air conditioning) in their higher trims through a mobile application. However, there is a significant scope to develop offerings that can better use vehicle sensor data, e.g., using user driving behaviour to compute insurance premiums and assess driver liability during a claims' process, and using predictive analytics to pre-empt component failure or required maintenance.

Figure 11. Consumer willingness to pay for various connected technologies



Source: 2020 Deloitte GACS (n=3,022)

The need and awareness of the connected vehicle technology's benefits is not just limited to the ecosystem stakeholders, such as OEMs, insurance companies and telecom operators, but is prevalent in consumers as well. Almost three-fourth (74 percent) of Deloitte GACS respondents in India expressed a desire to own a connected vehicle that receives over-the-air software updates to enhance and/or correct its functionality over time. About half of the respondents (48 percent) were even willing to pay a significant fee (up to INR 50,000) up front as part of the vehicle purchase price, while 36 percent respondents were willing to pay on a per-use basis to receive the benefits of various connected technologies.

Thus, both the demand and supply for connected car technology are primed up. Implementation by ecosystem players across their offerings will determine whether we are able to reap the benefits of connected car technology to the full potential.

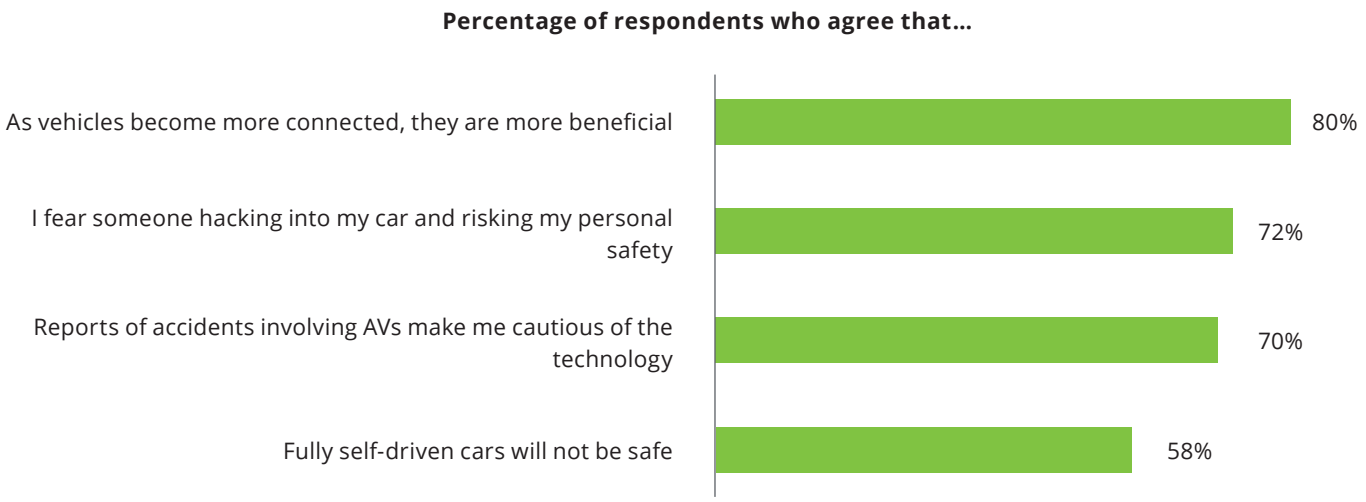
Autonomous vehicles

Apart from congestion, the other primary concern on Indian roads is the high rate of accidents and lives lost due to them. Despite having 1 percent of the world's cars, over 4.6 lakh road accidents (6 percent of the world) took place in India during 2018 leading to over 1.5 lakh deaths (11 percent of the world22). While, the Motor Vehicles (Amendment) Act, 2019 and the Bharat New Vehicle Safety Assessment programme were launched with the aim of increasing road safety, their effectiveness remains to be seen.

AVs have the potential to largely address India's road safety issues. However, the technology hasn't seen much traction in India, given the fear of job losses, weak traffic infrastructure, and low adherence to traffic rules (e.g., lane discipline, following traffic signals, jaywalking) that act as big hindrances to the smooth operations of AVs. Certain aspects of autonomous driving have been introduced in the Indian market with a lot of success—parking and navigation assistance, electronic stability programme, anti-lock braking system, etc., that automate specific parts of a user's driving experience. In the short term, full AVs may be limited to controlled pilots running in independent environments such as airport shuttles, bus rapid transit systems (BRTS), and city metros.

The customers have also expressed mixed emotions regarding their perception of AVs. While they agree that the technology is beneficial to the ecosystem, they are unsure about various safety aspects associated with EVs. The unfavourable experiences from globally publicised experiments and a low-track record of safety have shifted consumers' trust over AVs from existing tech companies to new specialised companies.

Figure 12. Consumer perception of Autonomous Vehicles



Source: 2020 Deloitte GACS (n=3,022)

A revolutionary future of mobility

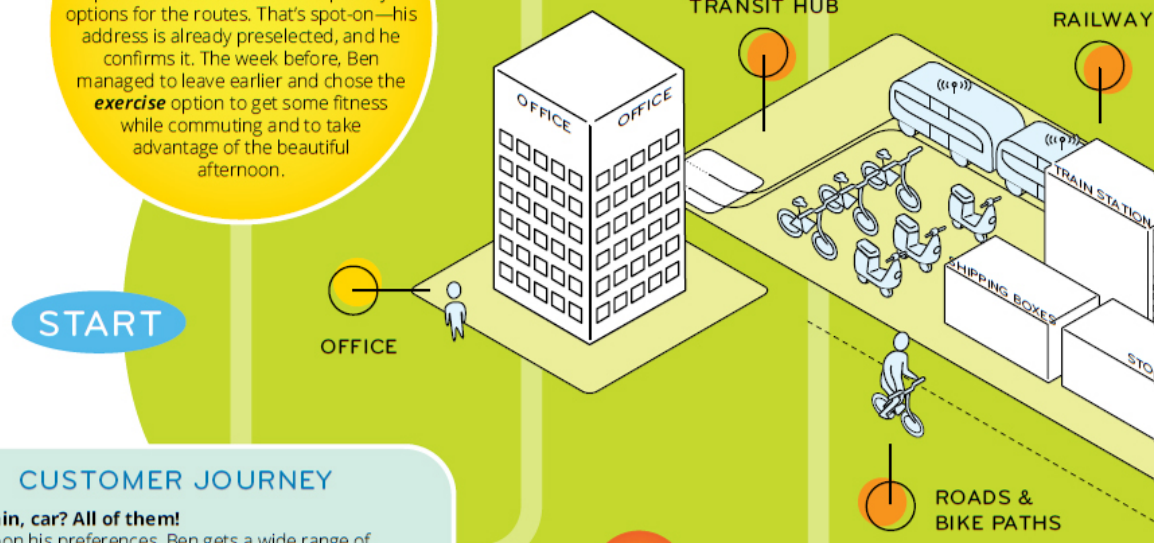
The report independently studies the affects of the four major disruptions in the mobility ecosystem—electrification, shared mobility, connected services, and AVs. It is also interesting to note how these four disruptions coalesce to revolutionise the future of mobility. Such a future promises a frictionless, automated, and personalised mobility on demand.

OK, I'm ready to go.

Ben is ready to go home. It's almost 8 p.m., a testament to his unpredictable workload: He leaves at a different time each day, facing a range of traffic conditions. Ben has a busy life, and it's important for him to make the best of his commute. As he heads to the elevator, he pulls up his smartphone and checks out his best route options.

Today, my commute should allow me to . . .

Ben's mobility app knows his usual preferences for late hours and preselects ***time*** and ***cost*** as priority options for the routes. That's spot-on—his address is already preselected, and he confirms it. The week before, Ben managed to leave earlier and chose the ***exercise*** option to get some fitness while commuting and to take advantage of the beautiful afternoon.



1 CUSTOMER JOURNEY

Bike, train, car? All of them!

Based upon his preferences, Ben gets a wide range of options and modes for the trip, along with suggestions for the top routes that best suit his needs—for instance, his app knows that when it's this late he will avoid walking. He picks the third-quickest option, since he can use the train stop to get a few grocery items for dinner—many stores now deliver to busy train stations—and can ride in an autonomous pod home for the last leg of the trip to help him carry them.

ECOSYSTEM SUPPORT

Mobility management services combine an individual's specific history and current circumstances with data from millions of others and information from different modes of travel across the city. Using advanced analytics, they offer users tailored, seamless options.

2 CUSTOMER JOURNEY

Within my budget and all in one fare!

Ben gets a single fare estimate for his entire selected trip, which includes details for each segment's costs. He uses a pay-per-mile system, which allows him to move seamlessly—and use multiple modes—through a single mobility platform. Immediately after committing to his route, Ben receives an electronic ticket on his cellphone for the entire itinerary.

ECOSYSTEM SUPPORT

Supporting ecosystems

Payment providers manage Ben's per-mile plan. Insurance companies work with mobility managers to incorporate customized per-trip insurance that accounts for the particular route and the types of travel he'll use.

3 CUSTOMER JOURNEY

Better than walking.

Right outside the building, Ben scans his phone to unlock one of the two available bicycles in the rack. Bikes are increasingly becoming the vehicle of choice in his city. He hops on, quickly merging into a dedicated bike lane, and heads toward the second leg of his trip: the train station.

ECOSYSTEM SUPPORT

Physical infrastructure

City planners work closely with the private sector to operate and maintain critical infrastructure, from bike racks to train platforms. Those physical assets are increasingly smart and connected, allowing constant, real-time monitoring.

Note: For illustrative purposes only.

4

CUSTOMER JOURNEY

Let me run some errands.
After a smooth ride, Ben parks at the station's bike rack near the entrance. His smartphone, sitting in his pocket, sends an electronic signal enabling him to access the platform and board the train. While en route, Ben shops for a few grocery items he needs for dinner. The in-app selection is a little restricted, a natural constraint of having fresh groceries available at the station upon his arrival.

ECOSYSTEM SUPPORT

Digital infrastructure providers offer ubiquitous, high-speed (5G) connectivity that enables smooth and secure online experiences. Horizontal operating systems and improved telecommunications are critical for supporting Ben's journey. Beyond entertainment, this critical infrastructure becomes an integral part of the journey from point A to B.

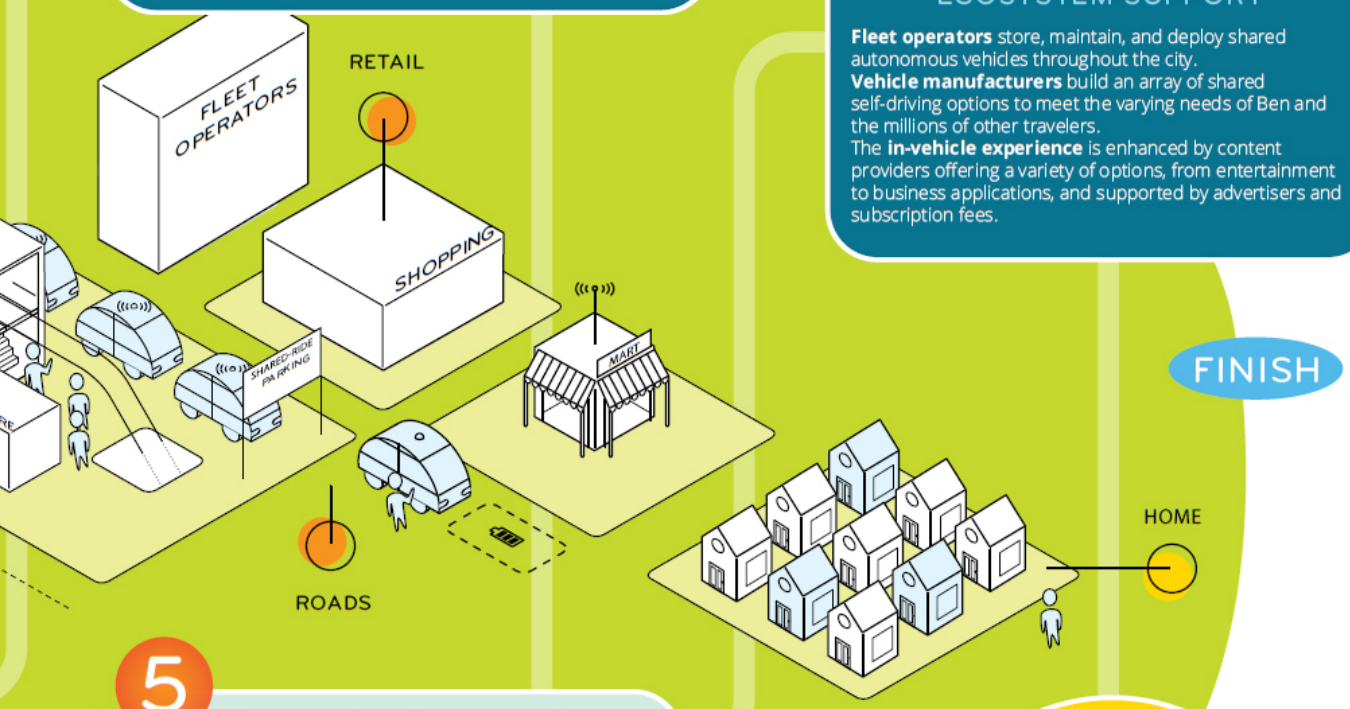
6

CUSTOMER JOURNEY

My ride awaits . . .
Toting shopping bags, Ben walks toward the rideshare pickup area outside of the train station, where his autonomous pod picks him up. His ride is short, but he is still able to catch the highlights of his favorite team's win on the car's screen.

ECOSYSTEM SUPPORT

Fleet operators store, maintain, and deploy shared autonomous vehicles throughout the city.
Vehicle manufacturers build an array of shared self-driving options to meet the varying needs of Ben and the millions of other travelers.
The **in-vehicle experience** is enhanced by content providers offering a variety of options, from entertainment to business applications, and supported by advertisers and subscription fees.



5

CUSTOMER JOURNEY

Where's the food? I'm hungry.
After a 30-minute ride, Ben disembarks and looks for the station's grocery-store lockers; a smartphone app unlocks a compartment where his items have been placed for him. He picks up the grocery bags, checks that his order is complete, and continues his trip.

ECOSYSTEM SUPPORT

Retailers and logistics providers have reconfigured operations to enable nearly on-demand provisioning of products to consumers.

This was an affordable five-star ride!
Finally, as soon as Ben's pod drops him off at his front door, his mobility app emails him a summary of the trip. He is able to see how much money the entire trip cost and track his spending pattern and accruals over the course of the month. He is able to rate his ride, and the trip overall, as well as provide feedback and report any issues back to the mobility system.

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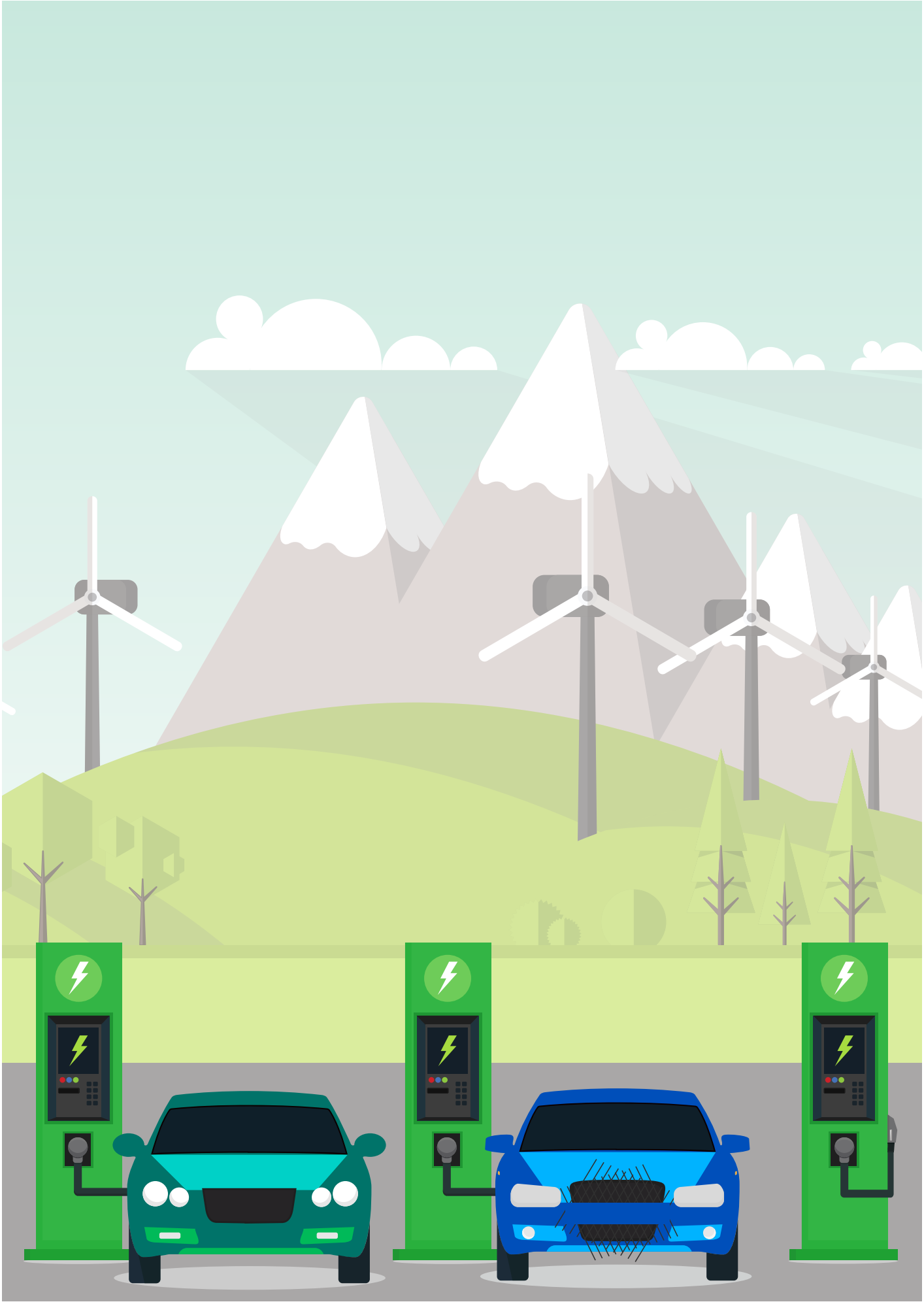

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