

# The electric breakthrough. The EV market finally comes of age.

Automotive  
Disruption Radar #9

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The electric vehicle (EV) market finally took off in 2020, with sales, market share and other industry indicators all hitting record highs. EV penetration more than tripled between 2017 and 2020 to reach 4.7% of total vehicle sales, according to the latest Automotive Disruption Radar (ADR), a twice-yearly report that tracks 26 automotive indicators across 18 countries. The ADR also found clear signs that it's not just trailblazers like Tesla that are pushing the shift towards EVs – traditional automakers are now also making potentially game-changing advances and investments.

Overall, the ninth edition of the ADR recorded the highest average country score to date. It rose from 55% of the maximum achievable score in ADR8 to 56%, likely propelled by the Covid-19 pandemic's positive effect on disruptive technologies. The Netherlands again topped the rankings, followed by China and, jointly, South Korea and Singapore.

As well as analyzing the top country results and overall trends, this report looks in detail at the recent breakthrough of EVs. It also assesses automaker valuations. Huge valuations are currently being achieved by new automotive players, often driven by so-called SPAC IPOs. And, after years in the doldrums, the market capitalizations of traditional OEMs are now on the march thanks to new initiatives such as Volkswagen's ambitious gigafactory plans. OEMs should be encouraged to keep up the good work.

# Under the hood: ADR9's top performers

The top four countries in ADR9 were identical to those of ADR8 (September 2020), but the order has been shaken up, with China closing in on the Netherlands in top spot. Further down the order, the majority of European countries placed in mid-table, grouped around the global average score. Japan, Saudi Arabia and Belgium all scored poorly, but it was left to Canada to bring up the rear.

## Leading the pack: The Netherlands, China, South Korea and Singapore have ranked highly in all the ADR editions

Overall score as percentage of maximum score



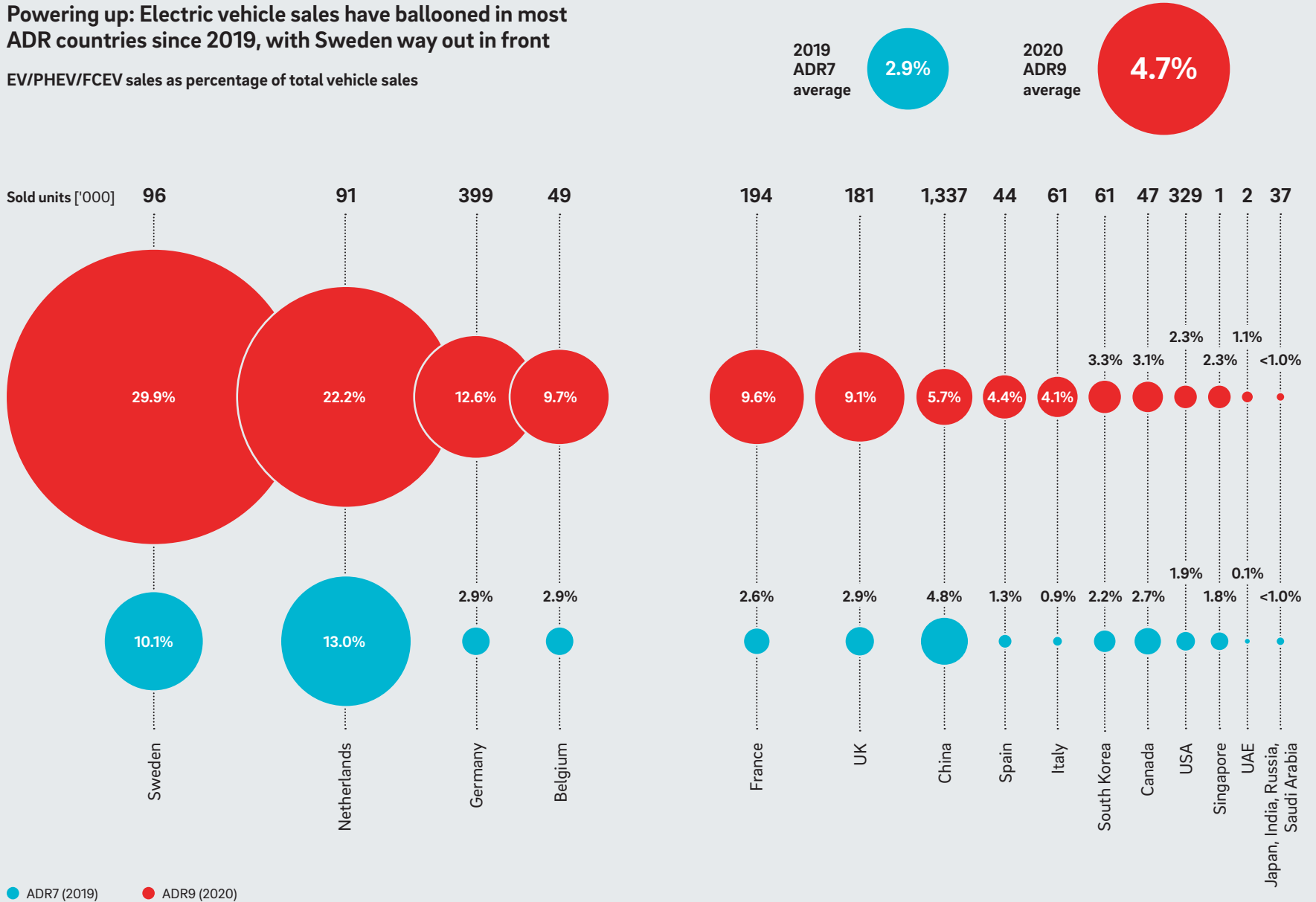
# #1 THE NETHERLANDS

For the second time running, the Netherlands (83 out of 130 points) secured the top spot, thanks largely to its position as a leader in electrification. Its share of EV sales vs. total vehicle sales hit ~22% in 2020, far above the ADR9 average of 4.7% and behind only Sweden (~30%),

The country also offers the best selection of EV models, with almost 40% of available models now electric. And the charging structure is second only to South Korea, with 15.8 charging stations per 100 km of road (ADR9 average = 2.2). The Netherlands also scores well on autonomous driving, with all roadways open to testing. However, it still needs to develop regulations for commercializing autonomous vehicles (AVs).

## Powering up: Electric vehicle sales have ballooned in most ADR countries since 2019, with Sweden way out in front

EV/PHEV/FCEV sales as percentage of total vehicle sales



Source: EV volumes, IHS, Roland Berger



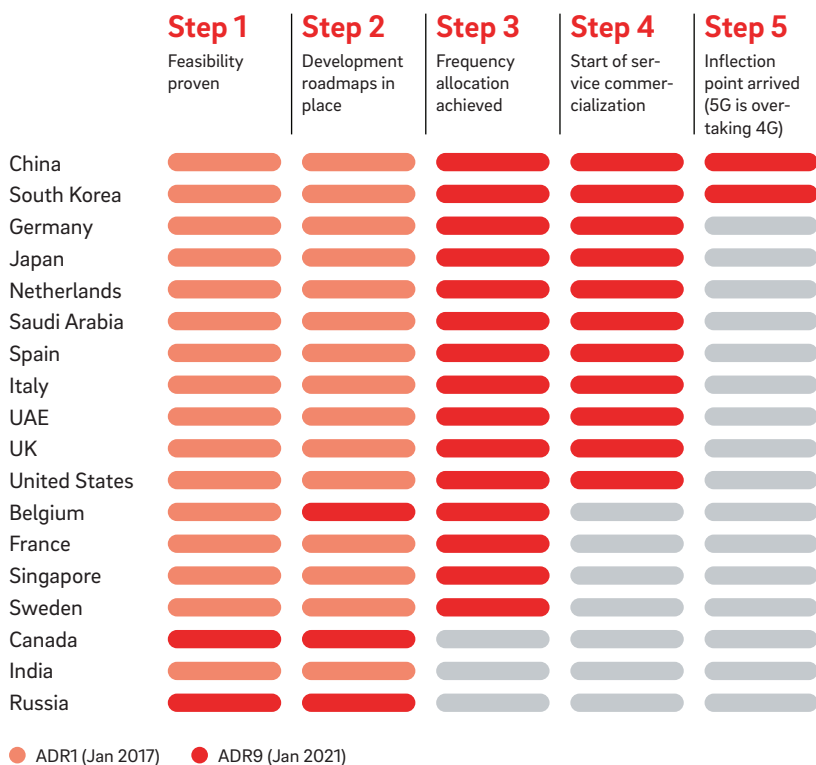
## #2 CHINA

After losing its crown and ranking fourth in ADR8, China has regrouped to take second spot in ADR9. Its resurgence was fueled by a strong desire for EVs. A total of 90% of Chinese are now considering buying an EV (ADR9 average = 55%), against 60% in 2017. EV sales also increased to an all-time high of more than 1.3 m units in 2020.

The country's push towards New Energy vehicles has no doubt been supported by the rollout of increasingly stringent regulations against vehicle emissions. Since 2017, the number of cities restricting access to vehicles with internal combustion engines (ICE) has leapt from nine to 27, or 93% of those in the sample. China also leads the ADR pack when it comes to mobile technology. More than 250 million people now have a 5G package, representing 15.6% of total smartphone users. In addition, 30% of Chinese are willing to buy a car online, against an ADR9 average of 15%. Unlike several other regions, China does not restrict online purchases.

### Data drive: More than half of the ADR countries now have commercial 5G services

#### Evolution of 5G rollout roadmaps



Source: Automotive Disruption Radar – data points from Edition 1 to 9

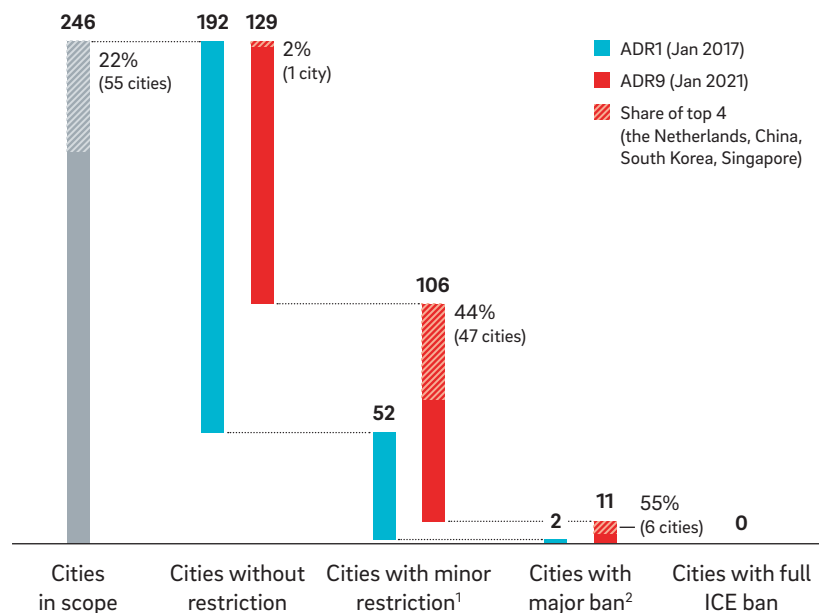
## #3 SOUTH KOREA

South Korea secured third place (jointly with Singapore) for the third time in a row. As with China and the Netherlands, strong electrification scores were key to its performance. A total of 75% of South Koreans are considering buying an EV, and the country is the clear leader in charging infrastructure, with 27.5 charging stations per 100 km. In addition, 100% of the 22 sampled cities in the country have implemented at least minor restrictions on ICE vehicles. EV sales, however, have some catching up to do, making up only 3.3% of total sales. This may be due to the relatively limited model offering (17.1% of available models are EVs).

South Korea also performed well on autonomous driving indicators. The entire country has been open to AV testing for more than four years, and it has reached an inflection point in 5G technology. Twelve million people, more than 20% of the population, now subscribe to 5G services, proportionally more than in China. In addition, 30% of South Koreans are ready to buy a car online.

### City limits: Cities in ADR countries are slowly but surely restricting the use of vehicles with internal combustion engines

#### Change in restrictions on ICE vehicles in urban areas



1 Ban on vehicles not meeting the latest emission standards (e.g. green badge) or selective actions (e.g. car-free days)

2 Clearing the roads of ICEs over a significant timeframe or low chance of being able to register an ICE vehicle

Source: Automotive Disruption Radar, Roland Berger

# #3 SINGAPORE

In ADR9, Singapore has cemented its place as a top four regular. But unlike the other high performers, this is not due to strong EV results but to a sound performance over a range of ADR indicators. For example, private cars are used for only 35% of journeys (pre-Covid 20%) against an ADR9 average of 60%, and 85% of people know at least one person who gave up their private car to use other types of mobility (ADR 9 average = 65%). Indeed, shared vehicles (rental cars, taxis, on-demand formats) make up 21.1% of the national parc, against an ADR9 average of 1.9%.

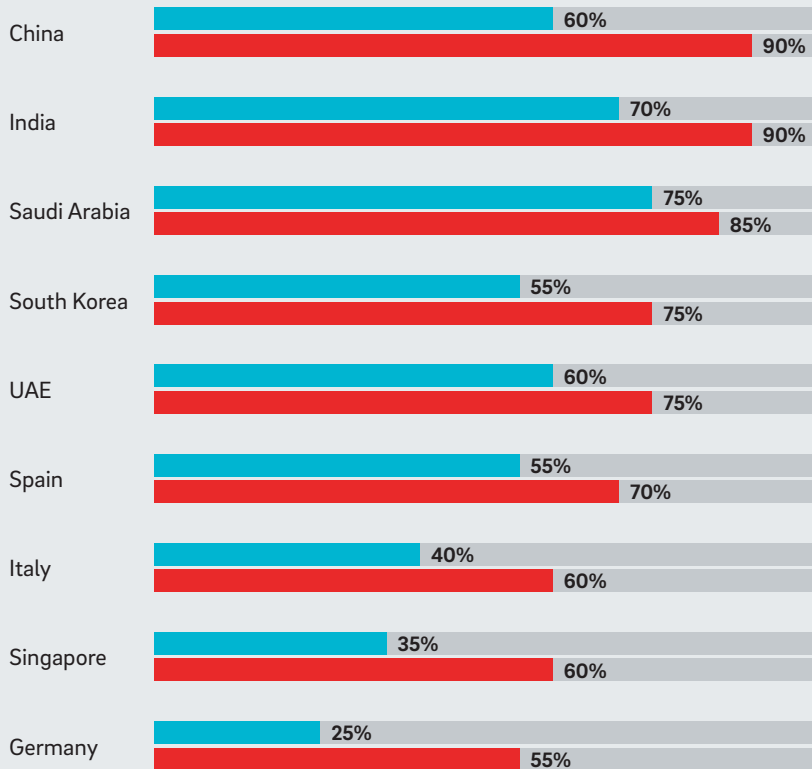
The choice of mobility modes is another high point, with 60% of respondents saying that they are able to choose their mode of transport for more than two in five of their journeys.

Singapore's autonomous driving and EV indicators are less impressive, but improving. The island state is developing AV regulation and has designated several large test zones, but there is no commercial 5G offer as yet. And while the number of people considering buying an EV has jumped to 60% from 35% a year ago, EV sales are low – they rose slightly to 2.3% of total sales, well below the ADR9 average of 4.7%. Charging infrastructure is also limited.

## Growing demand: Interest in buying an electric vehicle rose markedly in all but one ADR country during 2020

### Percentage of potential car buyers

"Are you considering buying a battery electric vehicle as your next car?"

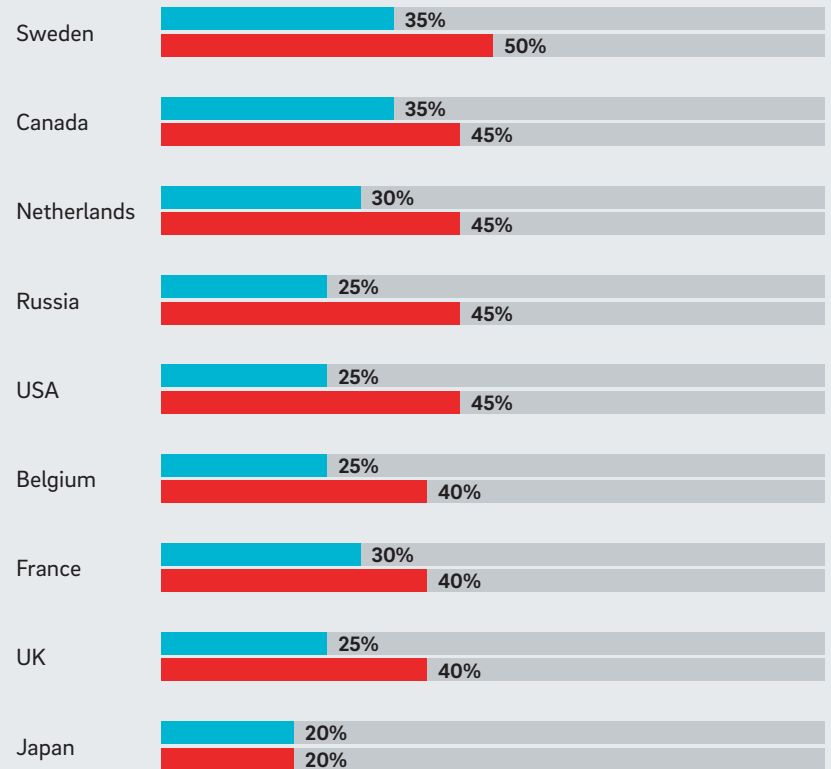


■ ADR7 (Jan 2020) ■ ADR9 (Jan 2021)

ADR7 average  
(Jan 2020)



ADR9 average  
(Jan 2021)

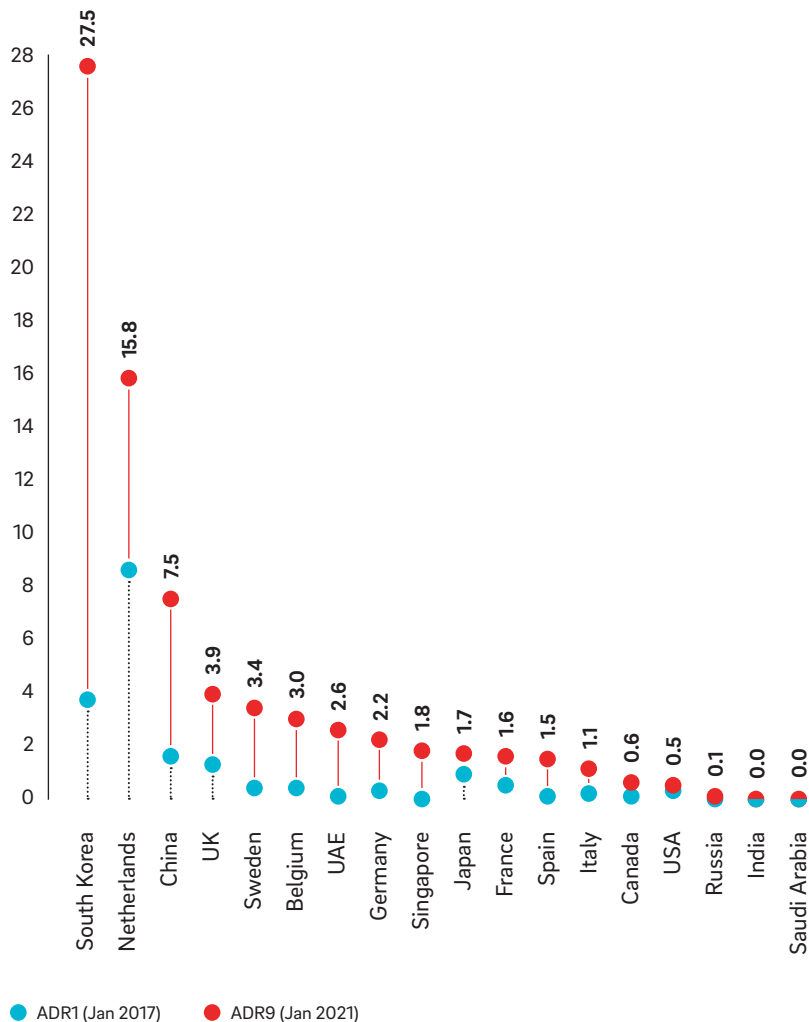


# Charging ahead: The shift to electrification

In the first of our detailed analyses, we look at the ADR trends that suggest EVs have now come of age. It's clear that the overall market, industry and technology indicators for electric powertrains are at an all-time high in ADR9 (survey completed in January 2021).

## Charging ahead: South Korea and the Netherlands are now the clear leaders in charging infrastructure density

Number of charging locations per 100 km of roadway



Source: EV Volumes, Roland Berger

→ **People are more interested than before**  
55% are considering buying an EV as their next car, vs. 40% in January 2020 and 35% in 2017

→ **People are buying EVs**  
The vehicles have increased their share of total sales in the 18 ADR countries to 4.7%, vs. 2.9% in 2019 and 1.5% in 2017

→ **OEMs are making EVs**  
The number of EV models has increased – they now represent 34.2% of total models on offer, vs. 26.4% in January 2020 and 13.3% in January 2017. A broad range is associated with higher sales – countries with a limited or no model offer have EV sales below 2%

→ **Funds are investing in EVs**  
Some 57% of the top 15 deals in the transport technology sector in 2020 involved companies making electric cars and/or batteries, for example Tesla, Rivian, Nikola, Waymo and Gojek

→ **Roads are being prepared for EVs**  
Charging infrastructure has now reached an average of 2.2 stations per 100 km of roadway. This represents a more than 300% increase in the total number of stations since 2017

→ **EV technology costs are falling faster than expected**  
Battery costs were above USD 300 per kilowatt hour in 2015, but are now around USD 110 / kWh. They are expected to further decrease to USD 60-70 / kWh by 2030, but projected raw material shortages make hard figures difficult to predict.

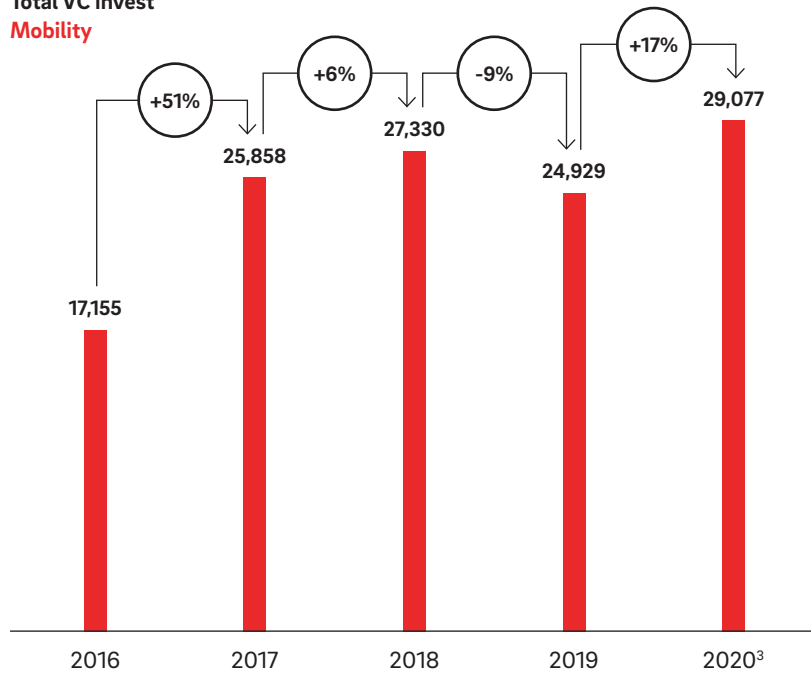


## Big deals: Venture capital investments in mobility companies shot up in the year to June 2020, with several multi-billion dollar deals

Investment in venture capital<sup>1</sup> [USD m]

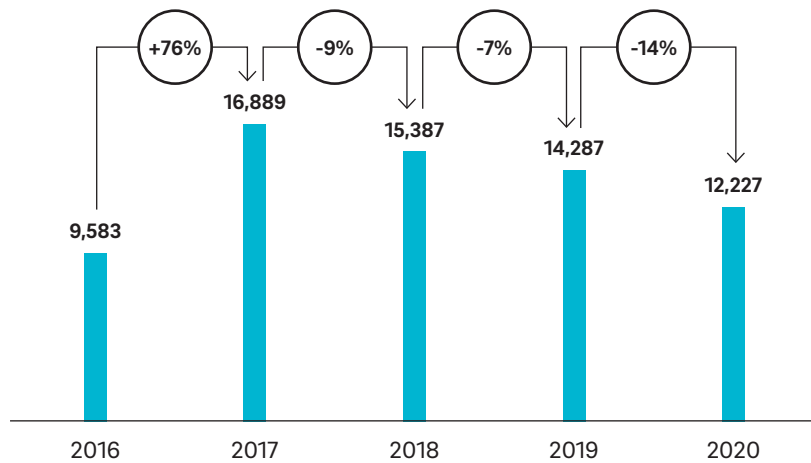
Total VC invest

Mobility



Total VC invest

Artificial Intelligence<sup>2</sup>



1 Analysis on disclosed amounts

2 Including investments in smart cars, AI in transportation and autonomous vehicles technologies, and AI infrastructures (natural language processing, computer vision, etc.)

3 Including Tesla, Rivian, Nikola, Waymo and Gojek

Source: Tracxn, Roland Berger












It should be noted that many of these developments were driven by Covid-19 stimulus programs, as well as electric vehicle subsidies. For example, China, Japan, South Korea and Germany all currently offer direct subsidies to buyers of battery and hybrid electric vehicles (up to EUR

9,000 in Germany). EV developments are unlikely to be sustained without these. Several countries (e.g. France, the UK) have also recently pledged to phase out ICE vehicles.

## Tax and spend: Several ADR countries offer subsidies or tax breaks to electric vehicle buyers, although most are time or budget limited

Purchase and tax incentives with trends (selected countries)

	China	USA	Germany	France	UK	Japan	South Korea
<b>Subsidies</b>	Subsidies of up to EUR 2,500 for BEVs and EUR 2,700 for PHEVs	Subsidies for first 200,000 electric cars an automaker sells	xEVs are subsidized at EUR 9,000 and PHEVs at EUR 6,750	Bonus/malus system with a subsidy of up to EUR 6,000	Subsidy of up to EUR 3,000 for BEV  Budget is limited to about EUR 470 m and grant is valid until 2023	Subsidy of up to EUR 6,340 for BEV and EUR 3,200 for PHEV	Subsidy of up to EUR 6,000 for BEV with a price below EUR 45,000. Lower subsidy for more expensive cars
<b>Taxes</b>	No vehicle purchase tax on new-energy vehicles, effective in 2021 and 2022	EUR 6,400 consumer tax break	EVs are totally exempt from the annual vehicle tax for 10 years  Taxation of private use of PHEV company cars is reduced	Possible exemption from registration tax for alternative fueled vehicles; BEVs are exempt from company tax	BEV and PHEV are exempt from the annual vehicle tax  BEVs are exempt from company car tax	Tax breaks on low-emission cars	
<b>Trend</b>	Subsidies were reduced compared to 2020, tax exemption valid until 2023  	Subsidies limited to a very small number of vehicles. No change to previous years  	The tax exemption is valid until 2021 but budget was increased for 2021  	The budget for the car scrap-page scheme is limited to EUR 395 m, similar budget as year before  	Incentives are limited to specific years or a budget  	Incentives are limited to specific years or a budget  	Incentives are limited to specific years and are lower than previous year  

# The old guard strikes back

In further evidence suggesting EVs are now becoming mainstream, there has been a recent strong shift towards, and commitment to, electrification by traditional industry players. There are several examples. In November 2020, General Motors announced its strategy for an all-electric future, committing to 30 new EV models by 2025. The US company plans to invest more than USD 27 billion in EV and autonomous vehicle product development between 2020 and 2025 to make this happen. This is more than its planned spend on gasoline and diesel products. In March 2021, Volvo went one step further, becoming the first major premium car brand to commit to using hybrid or full-electric powertrains in all their models. It aims to achieve the target by 2030. Meanwhile, in Asia, Toyota said in September 2020 that its annual global sales of EVs could hit 5.5 million in 2025, five years earlier than planned. The Japanese company has already said it aims to launch more than 10 battery EV models in the early 2020s.

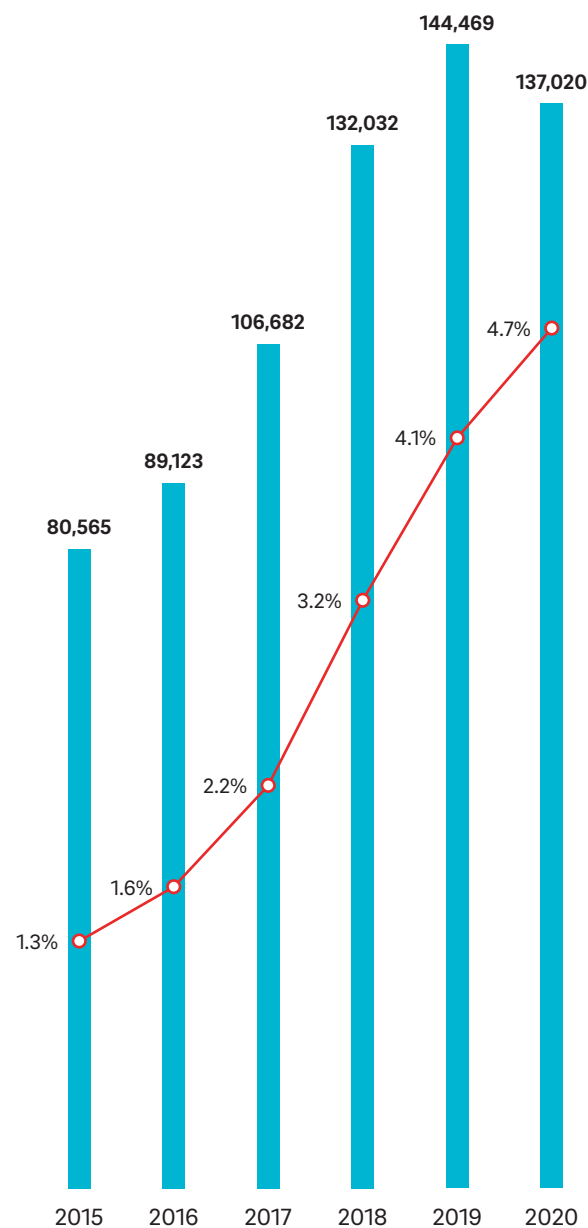
But perhaps the most remarkable announcement came from Volkswagen on its "Power Day" launch in March 2021. It unveiled big plans to catch up with Tesla's battery technology by opening six gigafactories with a total capacity of 240 GWh before 2030. Production of a unified cell architecture will see the cost of entry-level models fall by up to 50%, making EVs price-competitive with ICE vehicles.

At the event, Volkswagen also presented its new life-cycle strategy. This is designed to ensure the sustainability of the company's batteries and reduce the price of future cells. It also plans to recycle 95% of the raw materials in batteries through hydro-metallurgy processes. In other sustainable technology moves, future Volkswagen EVs will have bidirectional charging to allow electricity providers to use the vehicles as mobile power banks, while so-called second life options will mean former EV batteries can be used in combination for the large-scale storage of electricity from renewable sources.

It will be interesting to see if the traditional OEMs catch up in the race with Tesla and other newcomers. Undoubtedly, competitive intensity for all the startups and even Tesla will increase as OEMs ratchet up their game, likely resulting in ever-better products. Having now committed to electrification, OEMs should take comfort from their progress so far and be motivated to continue.

## Constant innovation: The number of patents related to autonomous driving has been steadily rising since 2015

Autonomous vehicle/function patents as a share of all driving technology patents



■ Total patents in scope ○ Share of patents with keywords

Source: Patentinspiration, Roland Berger

# SPACs and market caps: Company valuations are soaring

The second of our detailed analyses looks at company finances and, in particular, valuations. A comparison of the top five publicly listed EV players with the top five traditional OEMs is revealing. For instance, Tesla, the number one EV player, has a valuation higher than the top five OEMs combined. Looking down the whole list, it is clear that the market highly values EV players irrespective of their revenues, profitability or even whether they have produced a product.

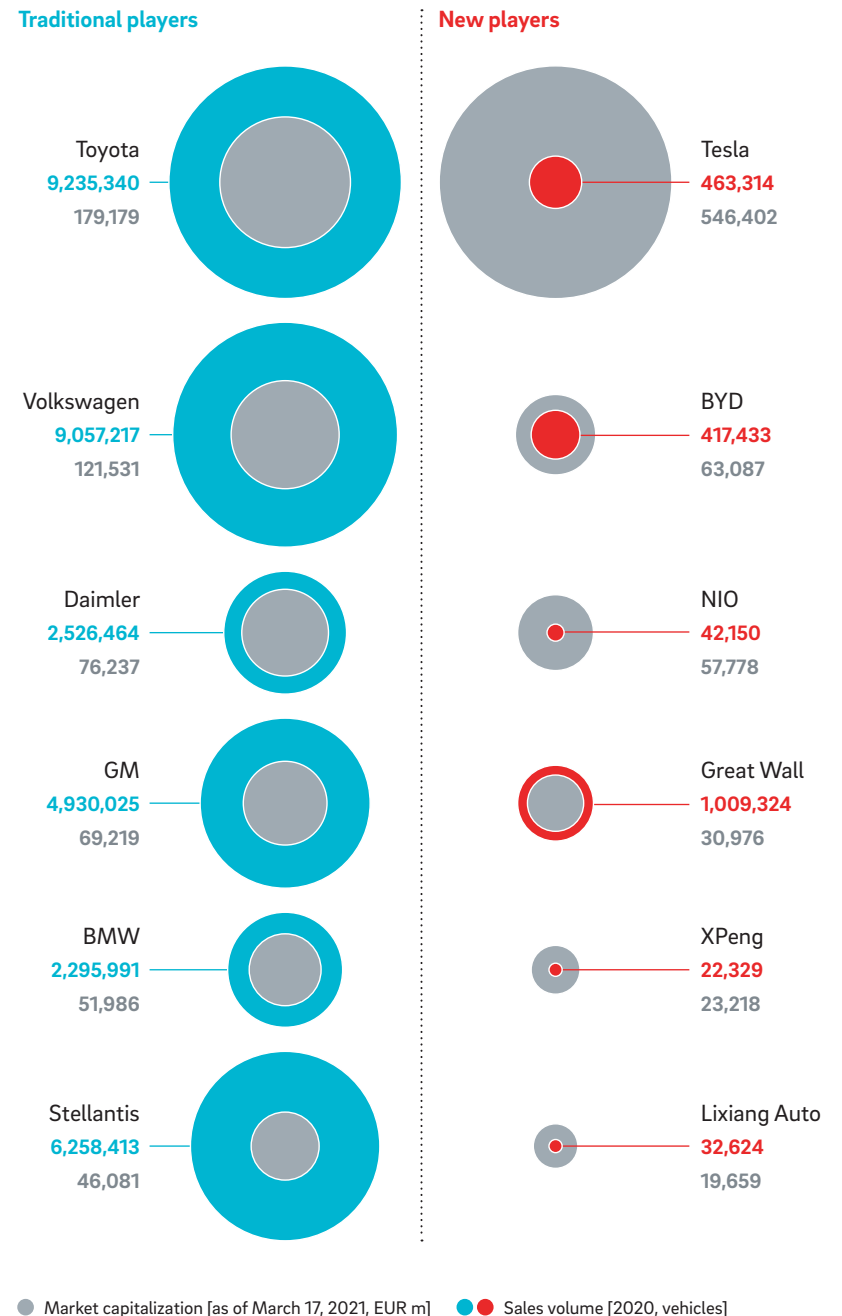
But OEMs have recently been fighting to claw back some of the market capitalization they have lost to the newcomers. In February 2021, for example, Daimler announced it was splitting its business into segments under a holding company in a bid to make the group more transparent and valuable. Within three days, its share price jumped 13% from USD 59 to USD 67, taking its market capitalization to USD 86 billion. Similarly, three trading days after Volkswagen's Power Day in March 2021, its share price had leaped by 21% to USD 230. In the same period, the company's market capitalization rose by 29% to USD 165 billion.

Higher valuations are important to companies as they make it easier to finance innovations. This applies to new players as much as traditional OEMs. With money sloshing around the markets at the moment due to low interest rates, this has helped to fuel the rise of so-called Special Purpose Acquisition Companies (SPACs). These shell companies are set up solely to raise funds via an IPO, with investors promised a future reverse merger with a named company that wants to go public. SPAC plays have several advantages over a traditional IPO: They are faster, cheaper and don't require the disclosure of business models.

A recent high-profile example is the e-car maker Lucid's deal with Churchill Capital Corp IV, a SPAC. In February 2021, Churchill Capital Corp IV's stock price implied Lucid had a valuation of USD 56 billion – an enormous valuation for a company with no revenue. Many other new technology firms have agreed SPAC deals recently in a bid to achieve high valuations, including EV battery firm QuantumScape, which does not even have a product on the market. As a result, the number and valuations of SPAC deals has rocketed in the past 18 months. However, many analysts have warned that the SPAC bubble may soon burst.

## Value for money? Despite traditional players selling many more cars, new players are achieving similar or higher market valuations

Market valuations [EUR m] and 2020 sales volumes of traditional and new players

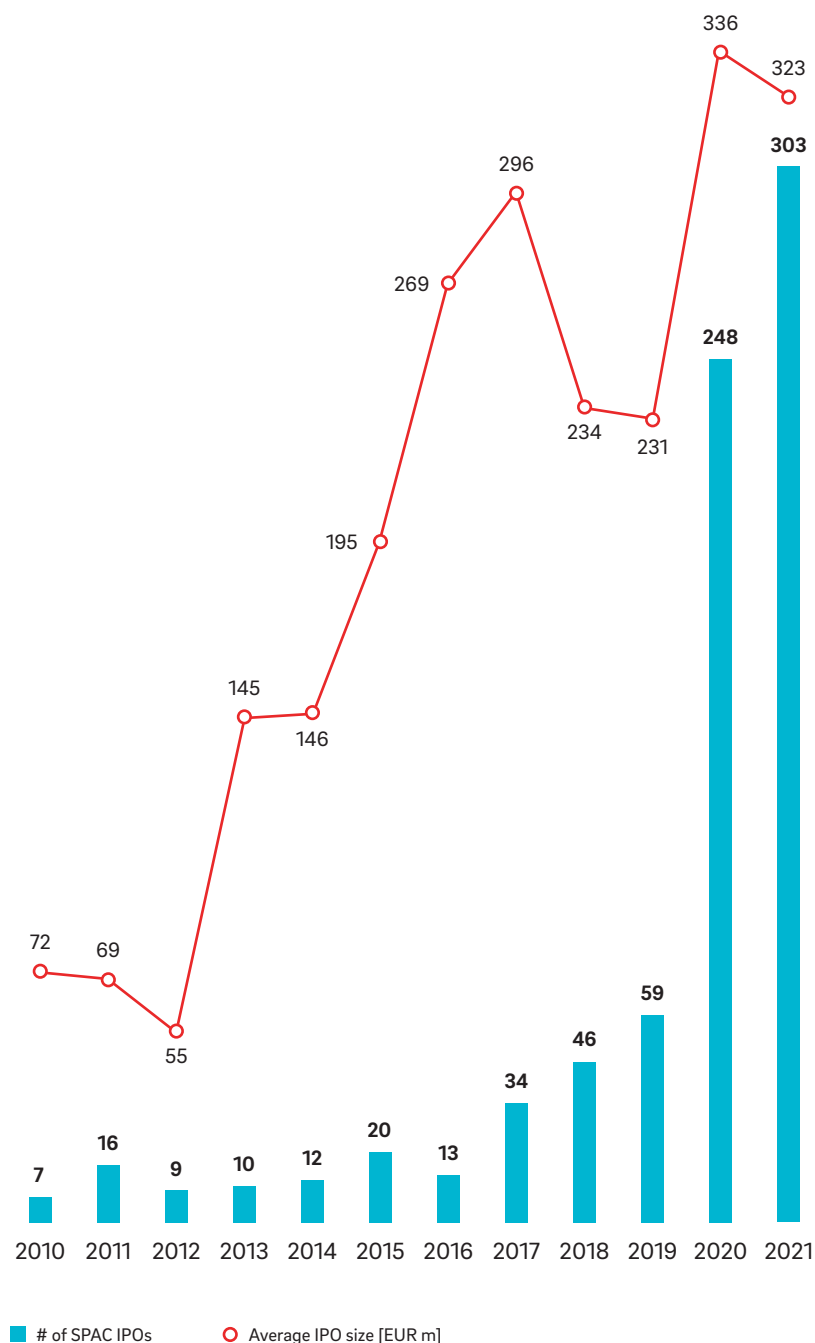


Source: Capital IQ, IHS, Roland Berger



## The rise of SPACs: The number and size of SPAC IPOs have increased dramatically since 2010

Number of SPAC IPOs and average IPO size [EUR m]



Source: SPACdata, Roland Berger

## Time for OEMs to impress

Despite concerns about SPACs, the chances of new players achieving a high market valuation today are very good. This is because markets assess their future potential rather than the state of today's automotive market. This explains why even the most innovative traditional OEMs currently have a relatively low valuation, making it harder for them to invest.

To better manage this challenge and compete with disruptive players, it may become necessary for traditional OEMs to more publicly highlight their strength to markets and investors. The recent success of Daimler and Volkswagen in this respect shows that the markets take notice of such demonstrations of strength. Without them, it may become harder to make investments in their business, EVs and new technologies such as autonomous driving. In short, they should be proud of their successes to date and flaunt them.

To help companies adjust to the new normal in the automotive industry, including post-Covid strategies, disruptor threats and maintaining a competitive advantage, Roland Berger has developed its Automotive Triple Transformation framework. It aims to help senior automotive executives bring order to the complexity and equip their businesses for the challenges of the coming decade.

# What is the Automotive Disruption Radar?

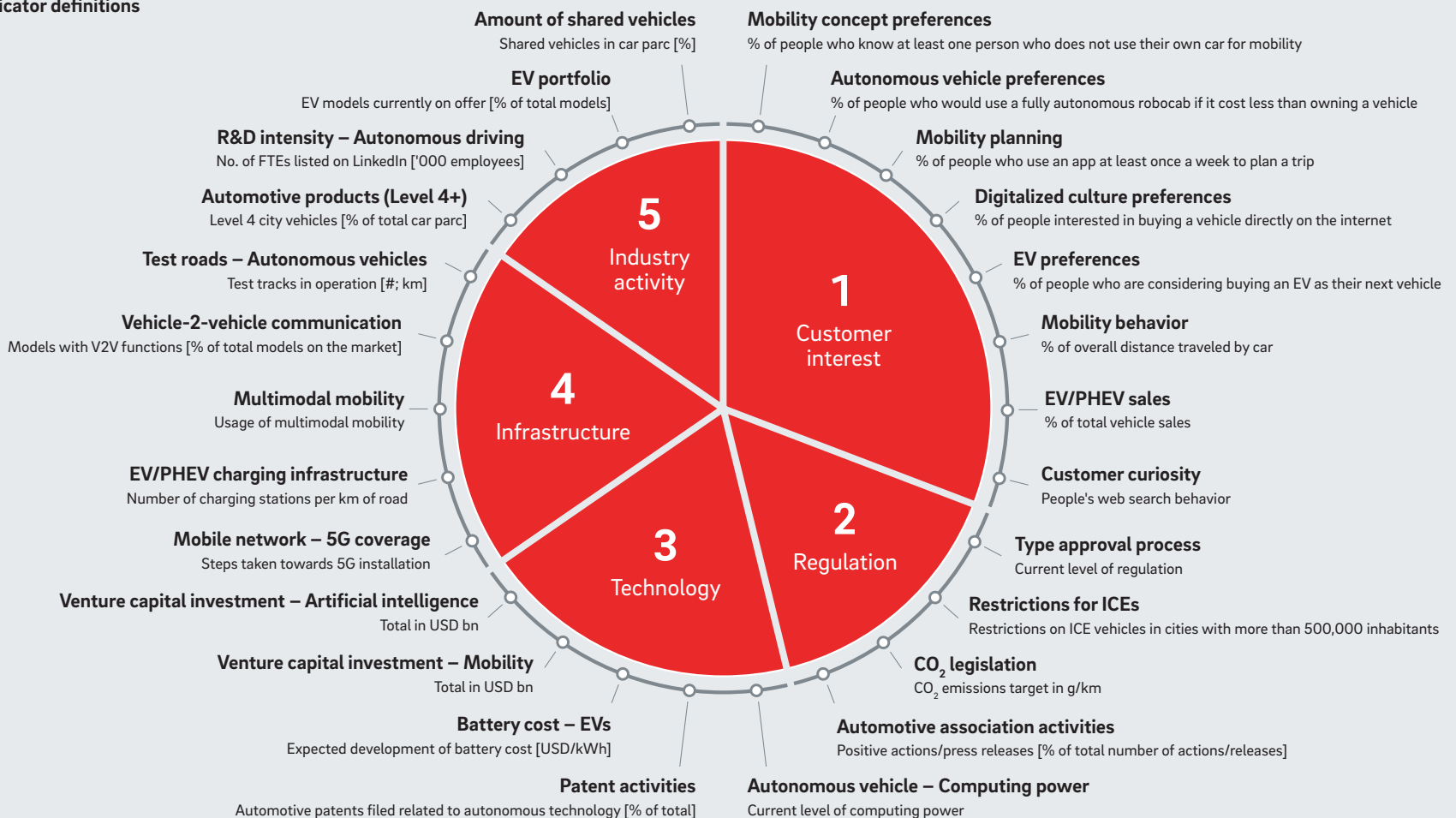
The Automotive Disruption Radar is a biannual analysis of market trends related to disruption in the global automotive industry, first undertaken in January 2017. Its latest findings are based on field research and a survey of 18,000+ car users across 18 markets (Belgium, Canada, China, France, Germany, India, Italy, Japan, the Netherlands, Russia, Saudi Arabia,

Singapore, South Korea, Spain, Sweden, UAE, UK, USA). Information is also drawn from external sources such as leading mobility experts and major industry reports. Each nation is scored along 26 indicators, grouped into five dimensions.

The ADR aims to answer key questions such as: which factors are driving change in automotive ecosystems; how do these factors evolve over time; and what can decision makers do to best manage disruption? Ultimately, the ADR is a go-to decision-making tool for senior executives in the mobility sector.

## 360-degree coverage: The Automotive Disruption Radar is based on the permanent screening of 26 indicators along five dimensions

### Indicator definitions



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## What is the Automotive Disruption Radar Community?

Roland Berger's Automotive Disruption Radar (ADR) website is a one-stop shop for automotive industry data and analyses. It offers free access to data from the **Roland Berger Automotive Disruption Radar**. Via the platform, users can navigate past and current data, customize and download charts and even configure their own radar. In addition, the ADR website features curated thought-leadership articles by third-party contributors, often presenting alternative views, different angles and fresh insights. Visitors to the site can also access links to publications and videos produced by Roland Berger investigating a wide range of current topics in the automotive industry.

→ Visit <http://automotive-disruption-radar.com>



**Roland Berger** is the only management consultancy of European heritage with a strong international footprint. As an independent firm, solely owned by our Partners, we operate 50 offices in all major markets. Our 2400 employees offer a unique combination of an analytical approach and an empathic attitude. Driven by our values of entrepreneurship, excellence and empathy, we at Roland Berger are convinced that the world needs a new sustainable paradigm that takes the entire value cycle into account. Working in cross-competence teams across all relevant industries and business functions, we provide the best expertise to meet the profound challenges of today and tomorrow.



## Automotive Disruption MADE by RB

We believe that the combination of 4 dimensions (Mobility, Autonomous driving, Digitalization and Electrification) is likely to trigger a major disruption in the automotive industry over the next 15 years. Since 2016, we have been bringing together our experts from all around the world to try to make this new future and its implications more concrete, and to best support the key decision makers of the automotive industry.



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