So close yet so far.
The bumpy road to autonomous driving.

Automotive Disruption Radar #10

Roland Berger

Roland Berger's Automotive Disruption Radar is 10! Now covering 23 markets, this latest edition marks a major milestone in our twice-yearly tracking of 26 disruption indicators, and highlights what a valuable tool the ADR has become.

The new results show just how far the industry has shifted since ADR1 in January 2017, particularly around electrification. For example, the share of electric/plug-in hybrid vehicles sold as a percentage of total global vehicle sales has jumped from 1.5% in 2017 to 6.9% in HY1 2021; the number of charging stations per 100 km has more than quintupled to 2.8; and the number of cities with some form of restrictions on ICE vehicles has leapt from 88 to 155. Overall, the global average country score has soared by 25%.

But some things never change. The Netherlands again tops the ranking, as it has on several occasions, with a highest-ever score of 87. China comes next with 85, followed by Sweden and Singapore. All have often featured in the top 5. Meanwhile, Norway leads the way among ADR10's five new additions, going straight into the top 5. We look in detail at the new entrants' results.

More generally, ADR10 reveals that the Covid-19 pandemic, while damaging to the industry, continues to have a positive impact on disruptive technologies. It also shows that the electric revolution and developments in autonomous driving continue to evolve, albeit at a slower pace. We assess the latest developments in both.

Cover photo Thomas Winz/Getty Images

Under the hood: How the new entrants performed

The ADR started in 2017 with 10 countries in its scope, mostly key automotive markets such as the US, Germany and Japan.

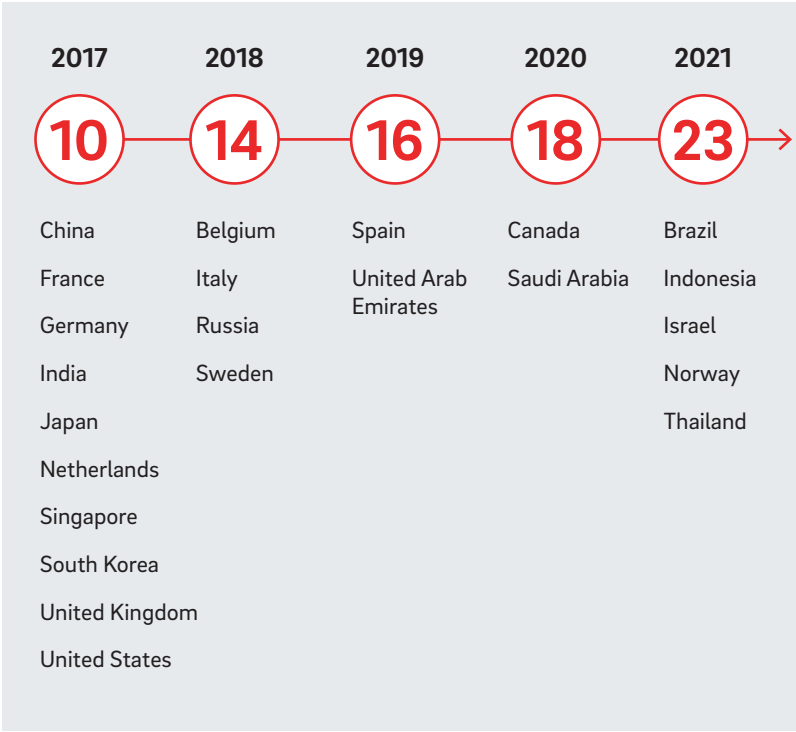
New additions followed in almost every subsequent report, culminating in ADR10's intake of five new entrants. This gives a new total global scope of 23 countries. With two perennial ADR performers (the Netherlands and China) again taking the top spots in ADR10, in this edition we focus instead on the performance of the new entrants – Norway, Israel, Brazil, Thailand and Indonesia.

No change at the top: The Netherlands again tops the rankings, with a now familiar pack following closely behind

Overall score as percentage of maximum score

Source: Roland Berger

Growing all the time: The original 10 ADR countries have been joined by a further 13 nations since 2017



#5 NORWAY

Norway makes a great debut in the ADR. But its results highlight that while a strong performance in the transition to electric vehicles (EVs) is an important factor in achieving a high ADR score, it cannot be relied upon alone. The Nordic nation leads the way when it comes to EV/plug-in hybrid vehicle (PHEV) sales as a percentage of total vehicle sales, with a huge share of 79%. Only Sweden (39%) gets close to this, with third-placed Germany down at 19%. It also performs well in terms of share of EV/PHEVs models in the overall portfolio of models available, with a share of 48%, versus 44% in South Korea and 43% in the Netherlands. But Norway is sorely lacking in other areas. For example, its regulatory framework for autonomous vehicles (AVs) lags behind many countries, and it offers few test roads for new autonomous driving technologies. For this reason, Norway's debut ends in a 'fast follower' position.

Source: Roland Berger

#11 ISRAEL

Israel is a well known hub for startups and high-tech industries. However, as its technologies will be used globally, ADR does not fully reflect its strengths in this area. But the country still performs well in a handful of indicators. For example, the ADR customer survey reveals high usage of mobility apps, with 80% of respondents using one at least once a week compared to a global average of 55%.

In general, however, Israel is distinctly average in its indicator scoring, achieving middle-of-the-road scores in legislation for AVs, test road availability and interest in EVs/PHEVs, for example. That said, no one indicator significantly lags behind the average, giving the country a strong base to build on.

#19 BRAZIL

The addition of Brazil gives the ADR its first glimpse of the automotive situation in South America. The developing nation ranks in the bottom third of the ADR10 listing, which is of little surprise considering the special conditions required for electric autonomous driving. Even so, it is interesting to note that even in a country with almost no charging infrastructure (just a few hundred units), interest in EVs is at a global average level: Some 60% of potential buyers are considering purchasing an EV/PHEV as their next car.

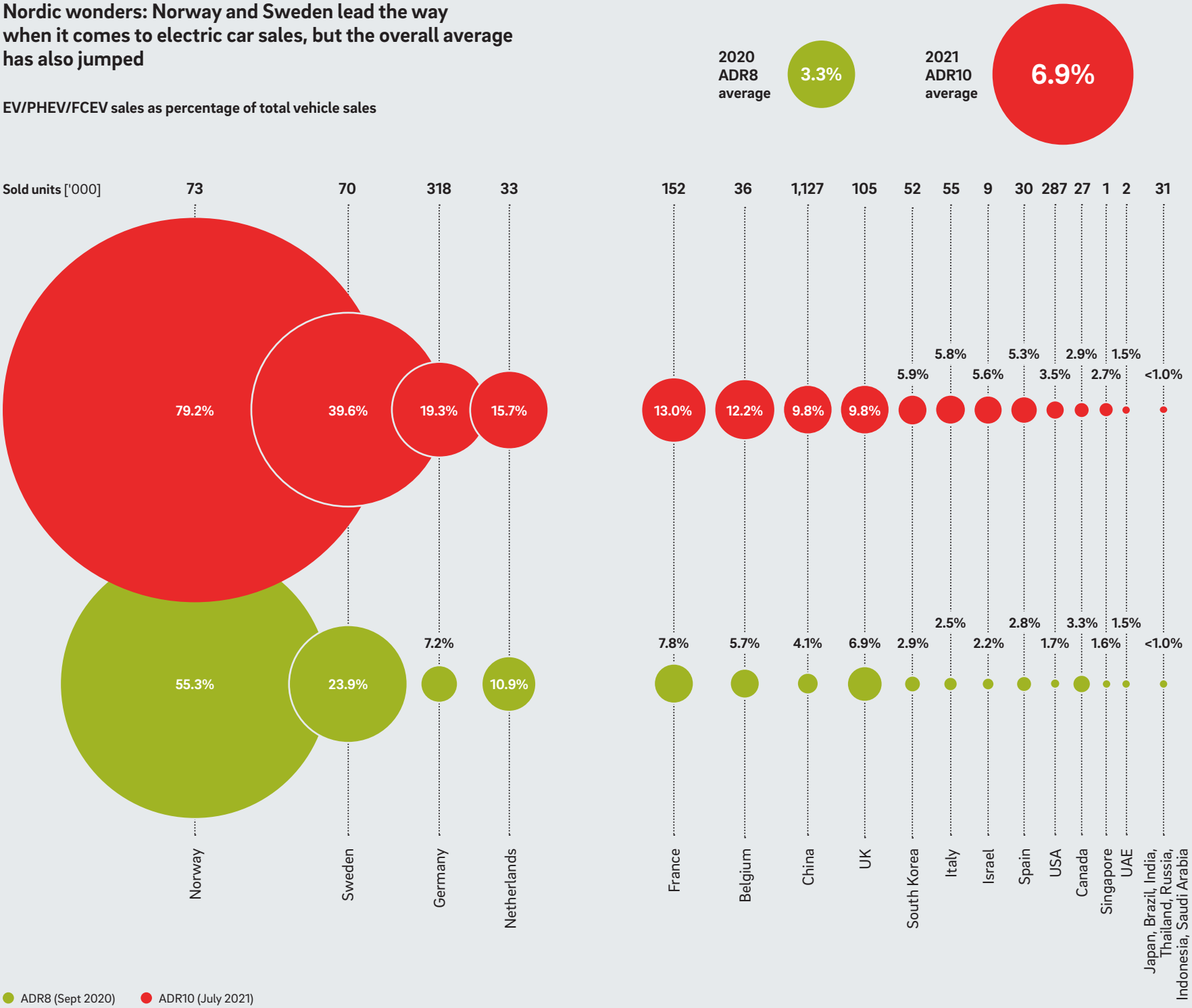
#22 THAILAND AND INDONESIA

The story in these two Southeast Asian nations is almost the same, with both positioning themselves as hubs in the EV ecosystem. Thailand is a step ahead, with investment steadily flowing in. For example, a PHEV factory was opened in 2019 and USD 50 million has been invested in charging infrastructure. Most recently, the Taiwanese electronics firm Foxconn announced plans to produce up to 200,000 EVs a year in the country in a joint venture with the Thai oil and gas company PTT, beginning in 2023/4. In addition, the country plans to ban ICE sales from 2035 and to reach an EV sales share of 50% by the end of this decade.

In Indonesia, meanwhile, Hyundai Motor and LG Energy Solutions plan to build a battery cell manufacturing site with 10 GWh capacity in Karawang. This will require an investment of around USD 1 billion. The plant is due to open in the first half of 2024 and aims to leverage Indonesia's significant raw material resources, especially of nickel. While these developments are a clear indication of intention, they are relatively modest. This is reflected in the low rankings of the two countries.

Nordic wonders: Norway and Sweden lead the way when it comes to electric car sales, but the overall average has also jumped

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

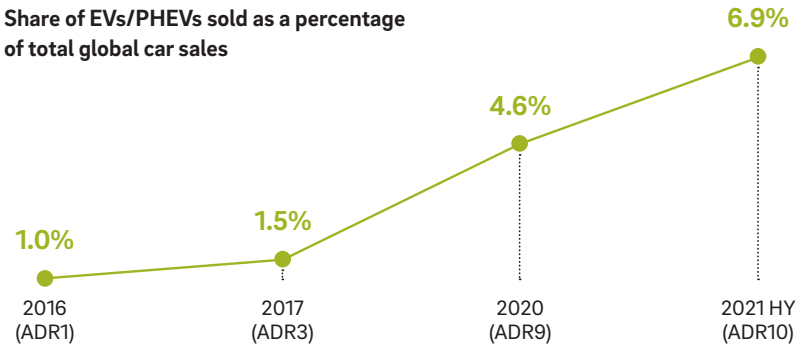


Source: EV volumes, IHS, Roland Berger

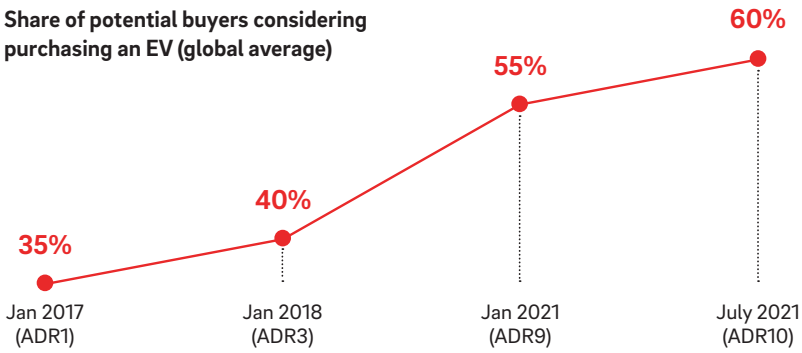
Electric vehicles – The battle between startups and OEMs hots up

ADR9 highlighted the breakthrough made by electric vehicles in 2020, with all electrification indicators showing a significant jump in progress. This trend has continued in 2021, as shown by the results in ADR10. We noted some key figures above, and the following help to underline the rapid shift:

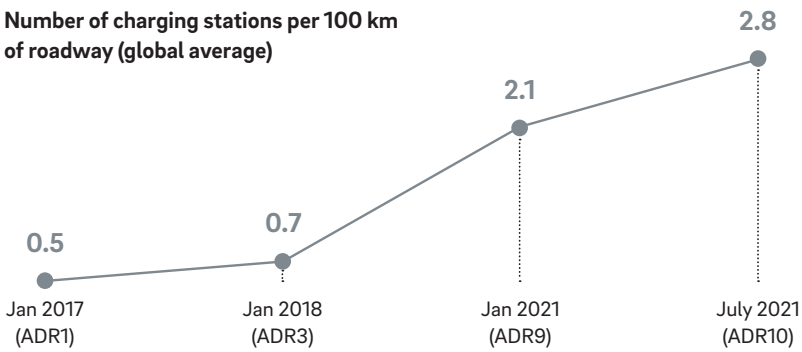
Share of EVs/PHEVs sold as a percentage of total global car sales



Share of potential buyers considering purchasing an EV (global average)



Number of charging stations per 100 km of roadway (global average)



Source: Roland Berger

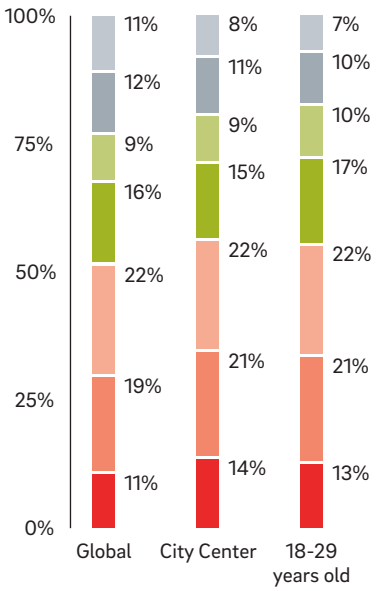
OEMS GO FOR BROKE

There are several reasons for the pickup in the pace of electrification. As well as the Covid-19 pandemic, the emergence of all-electric market newcomers (such as Tesla) and pressure to reduce emissions are driving the transition from ICE vehicles to EVs. Many traditional OEMs have announced EV quota and/or carbon-reduction targets. The Volkswagen Group, for example, wants 50% of its new cars to be battery electric by 2030, as does BMW (in Europe). Volvo is aiming to be fully electric by the same date. Volkswagen also wants to achieve carbon neutrality by 2050.

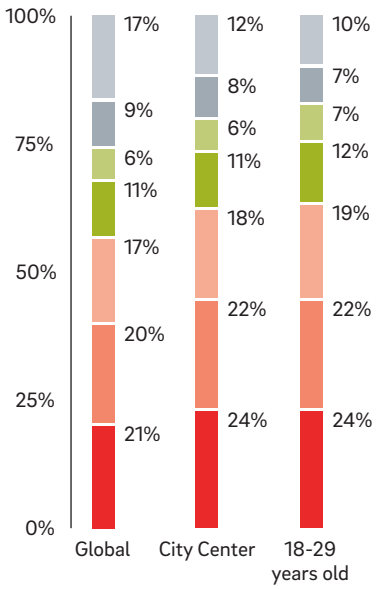
The moves by the big OEMs are in line with the results from the ADR10 customer survey. More than 40% or our respondents would like to see sales of ICE vehicle stopped by 2030. Tellingly, however, just 30% think this will actually happen.

The end of ICE: The majority of our survey respondents want to see an end to ICE vehicle sales by 2035

When do you think *that no new internal combustion engine vehicles will be sold in your country?*



When would you like *to have no new internal combustion engine vehicles sold in your country?*

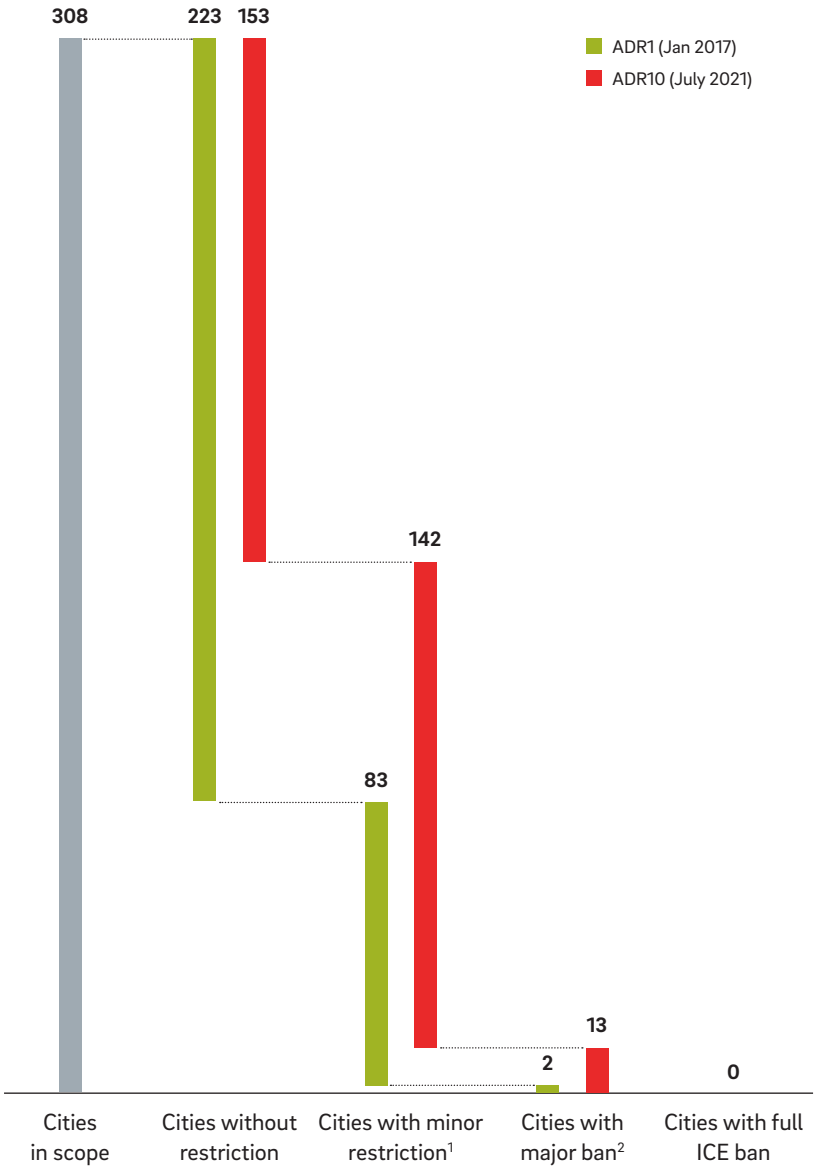


2025 2030 2035 2045 2055 Later Never

Source: RB online survey July 2021: 23,691 participants – Participants by country: Belgium (1,008); Brazil (1,010); Canada (1,020); China (1,014); France (1,014); Germany (1,005); India (1,003); Indonesia (1,016); Israel (1,381); Italy (1,015); Japan (1,018); Netherlands (1,011); Norway (1,053); Russia (1,005); Saudi Arabia (1,008); Singapore (1,018); South Korea (1,012); Spain (1,012); Sweden (1,017); Thailand (1,025); UAE (1,013); UK (1,000); USA (1,013)

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



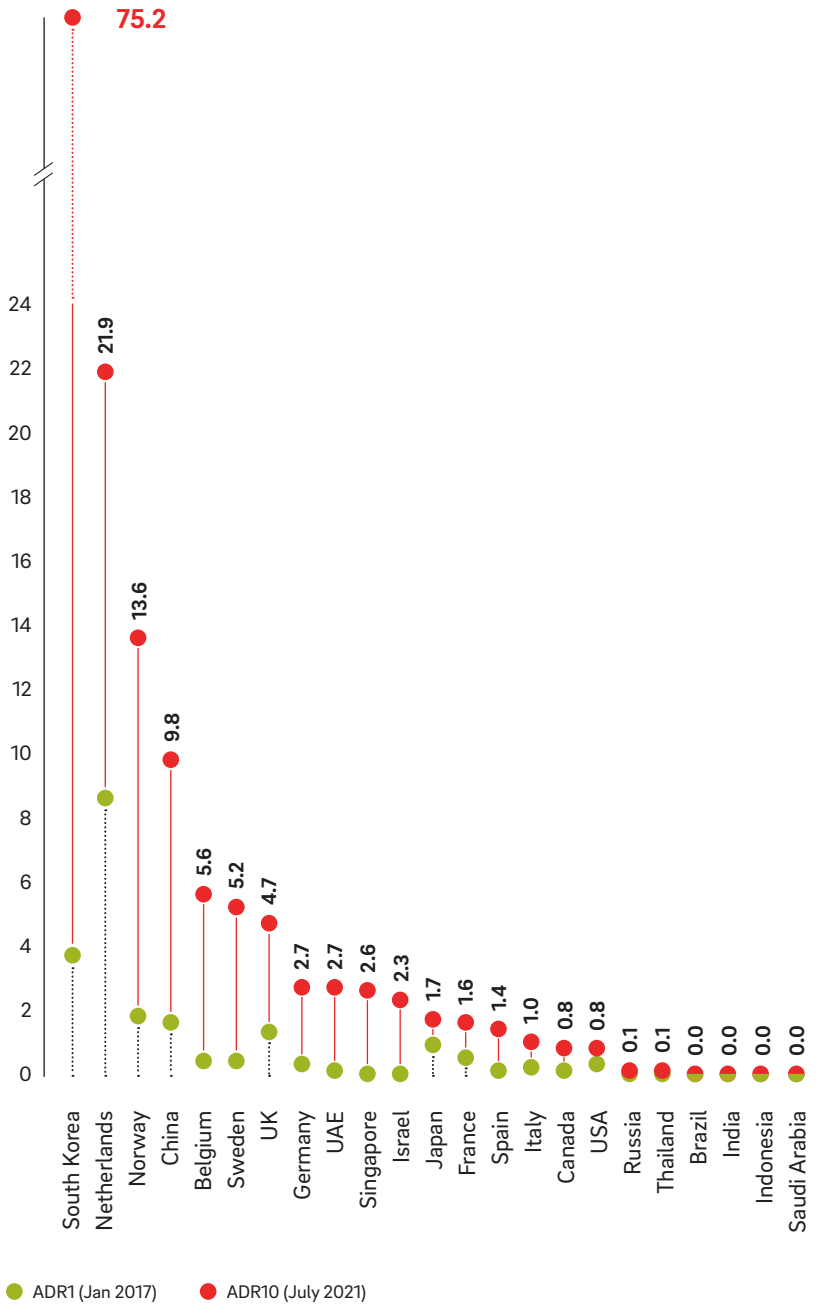
1 Ban on vehicles not meeting the latest emission standards (e.g. green badge) or selective actions (e.g. car-free days)

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

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, desk research, Roland Berger

NEWCOMERS STILL FINDING THEIR FEET

EV newcomers, meanwhile, are experiencing mixed fortunes, with many still looking for their place in the market. The most prominent, Tesla, has built a reputation around its user-friendly technologies and design solutions. But its vehicle innovation leadership is now being challenged by the OEMs, whose latest flagship EVs are seen as more cutting edge and high tech (for example, reviews of the Mercedes EQS). Investors know, however, that Tesla's real strength lies in its software architecture and artificial intelligence, which continue to lead the industry. They value Tesla as a tech company rather than an EV OEM.

This spells trouble for newcomers that are clearly positioned as EV OEMs. Companies such as Rivian, Fisker, Faraday Future and Lucid face an uphill battle to offer products that are superior to the latest offerings of OEMs and more advanced EV producers. Investors are also increasingly scrutinizing their business models looking for weaknesses. A few former high-flyers that used a special purpose acquisition company (a SPAC, or blank check company – see ADR9) to gain a rapid stock listing are now facing a "spactastrophy" as investors uncover problems and pull their money out. For example, shares in Hyzon Motors, Canoo, Lordstown Motors Group, Faraday Future and Nikola are trading at the same level, or even significantly below, their initial listing price.

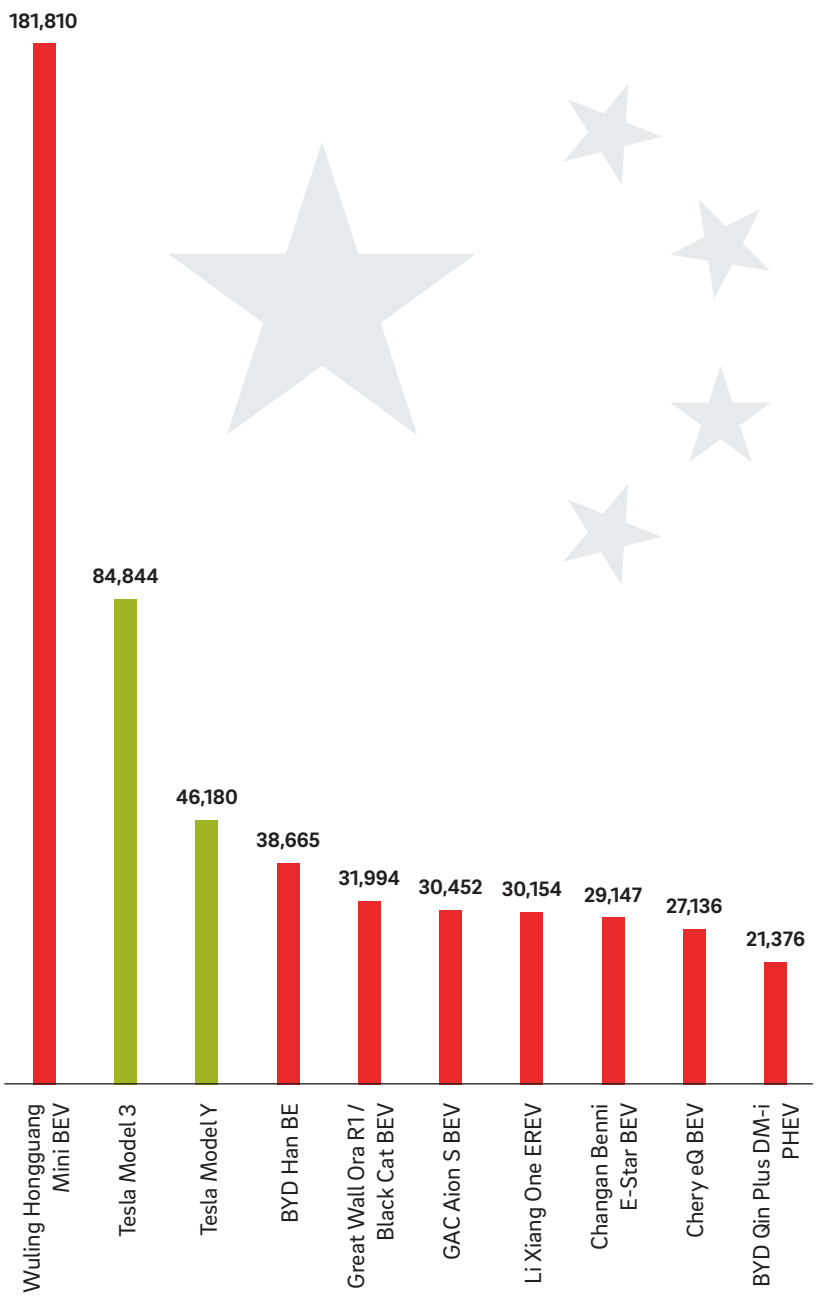
In fact, the only major market where new OEMs are positioned strongly in comparison to traditional OEMs is China. Chinese OEMs and new EV players dominate EV sales in the country. Even Volkswagen, the ICE market leader, is facing significant challenges in selling its new EV models there. Local rivals offer vehicles with similar or better electric powertrains along with market-leading connectivity and infotainment solutions, with attractive designs. Such progress highlights that in the new world of EVs, the race between traditional and new OEMs is wide open.

CHINA'S TOP SELLER

Not many people outside of China or the auto industry have heard of the Wuling Hongguang Mini EV. In the country, however, the three-door microcar achieved cult status and shot to the top of the bestseller list just a year after its launch in 2020. Seating four people and with a range of up to 170 km from the 13.8 kWh battery version, it is produced by SAIC-GM-Wuling, a joint venture between Chinese carmakers SAIC and Wuling, and General Motors. Cost has been a big factor in its success, with the base 9.2 kWh model selling for around USD 4,200. This compares with the USD 39,000 starting cost of a Tesla Model 3 in the country. The ability to personalize the car has meant that it has particularly appealed to a younger market, with around 70% of buyers born after 1990, according to Wuling.

Homegrown market: Almost all of the 10 top-selling EV models sold in China in the first half of 2021 were produced by Chinese carmakers

Top 10 selling EVs in China in 2021 HY1



Source: Roland Berger

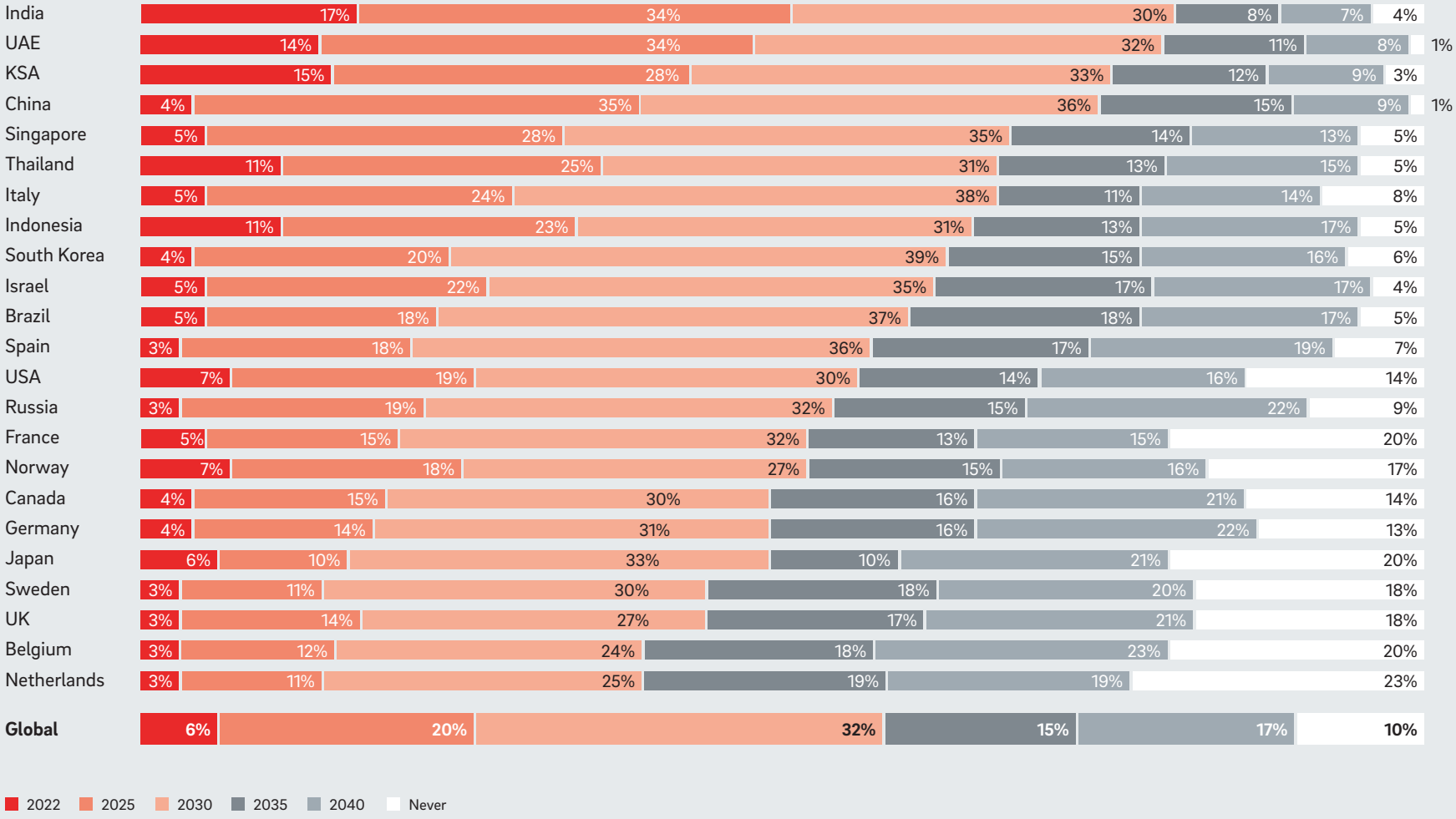
Autonomous driving – The bumpy road to reality

After peak hype over autonomous driving was reached in 2018 and following the launch of the first commercial service in the US state of Arizona in late 2020, developments have slowed.

The technological hurdles are still very high and currently the bulk of investment money is being channeled into EVs to launch the new generation of fully electric vehicles. Even so, the majority (60%) of our survey respondents expect that fully autonomous commercial mobility services will be operational by 2030.

The dawn of autonomy: People in Asian nations are far more confident that fully autonomous vehicles will be operational by 2030 than their Western counterparts

When do you believe we will have level 4/5 autonomous vehicles, i.e. fully autonomous vehicles without drivers, commercially operational (not for testing) on the roads?



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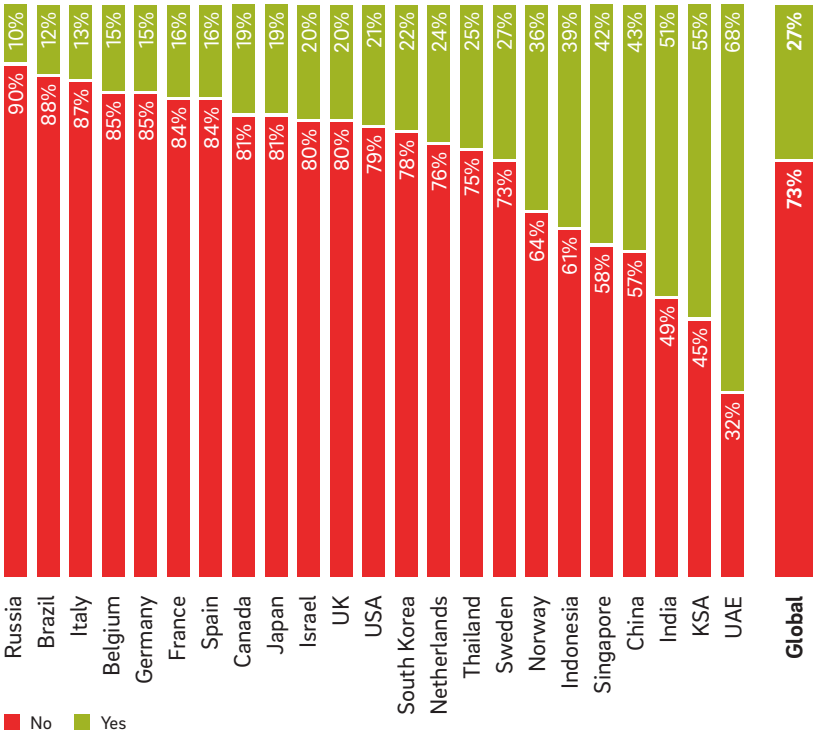
At the same time, more than 70% of respondents feel that governments are not supportive enough of the technology. Infrastructure, in particular, is thought to be lacking, followed by regulation, tests and investment levels.

Ready or not? Respondents believe that a lack of infrastructure remains the key stumbling block to the rollout of autonomous driving

Do you think your country is preparing well enough for autonomous driving (regulatory framework, testing, infrastructure, R&D investment, etc.)?



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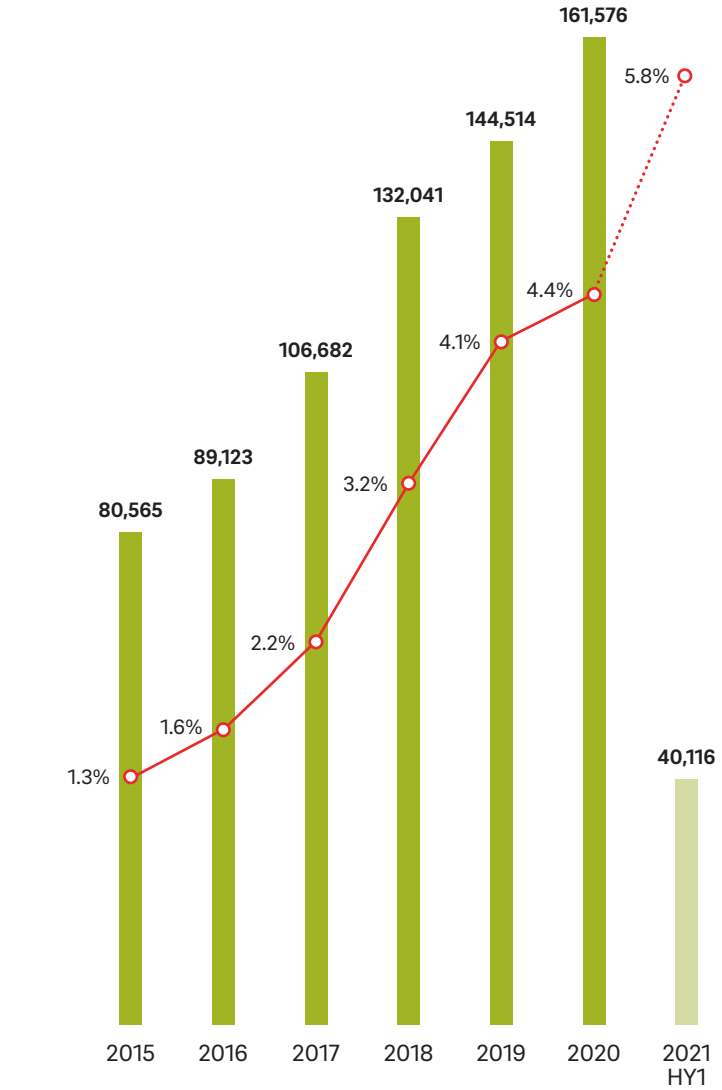
But a look at industry activities so far in 2021 suggests the timeframe of fully autonomous commercial services by 2030 is realistic. Below we give a few examples of the latest happenings.

Constant innovation: The number of patents related to autonomous driving has kept on rising since 2015

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



Source: Patentinspiration, Roland Berger

New normal: 5G mobile internet services are beginning to overtake and replace 4G services in some countries

Evolution of 5G rollout roadmaps

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

Cars

Argo AI, the AV technology startup backed by Ford and Volkswagen, was granted a Drivered AV permit as part of California's Autonomous Vehicle Passenger Service (AVPS) pilot in July 2021. It allows Argo to provide free rides (participants in the pilot cannot charge) in its self-driving vehicles on public roads. The move puts Argo in the small but growing group of companies seeking to expand beyond traditional AV testing — a signal that some companies are preparing for commercial operations. Aurora, AutoX, Cruise, Deeproute, Pony.ai, Voyage, Zoox and Waymo have all received VPS Drivered permits, which require a human safety operator. So far, only Cruise has secured a driverless permit, allowing it to shuttle passengers in test vehicles. Also in California, Motional, a USD 4 billion joint venture between Irish automotive parts supplier Aptiv and South Korean carmaker Hyundai, opened a road test center in Los Angeles. The move is part of Motional's plans to launch fully driverless robotaxis in U.S. cities in 2023, via the Lyft ride-hailing network. Services will use Hyundai's IONIQ 5 car, which offers Level 4 autonomous driving capabilities, meaning it can handle all driving operations in certain conditions and environments.

Vans

EV startup Arrival announced that its electric van has completed a driverless demonstration at a fully functioning parcel depot, paving the way for road testing. The company, based in London, ultimately plans to develop a scalable commercial Automated Driving System that relies on computer vision rather than expensive sensing technologies.

Minibuses

In August, Chinese tech giant Baidu announced the launch of Apolong II, a multi-purpose autonomous minibus. The firm, which is initially rolling out the AV on roads in Guangzhou, believes the customizable vehicle can be used for public transport, policing, healthcare and commercial applications. The Apolong II uses much of the autonomous driving technology behind Baidu's Apollo Robotaxi, but with upgraded computing power and sensors that allow it to "see" up to 250 meters away.

The next steps towards autonomous driving

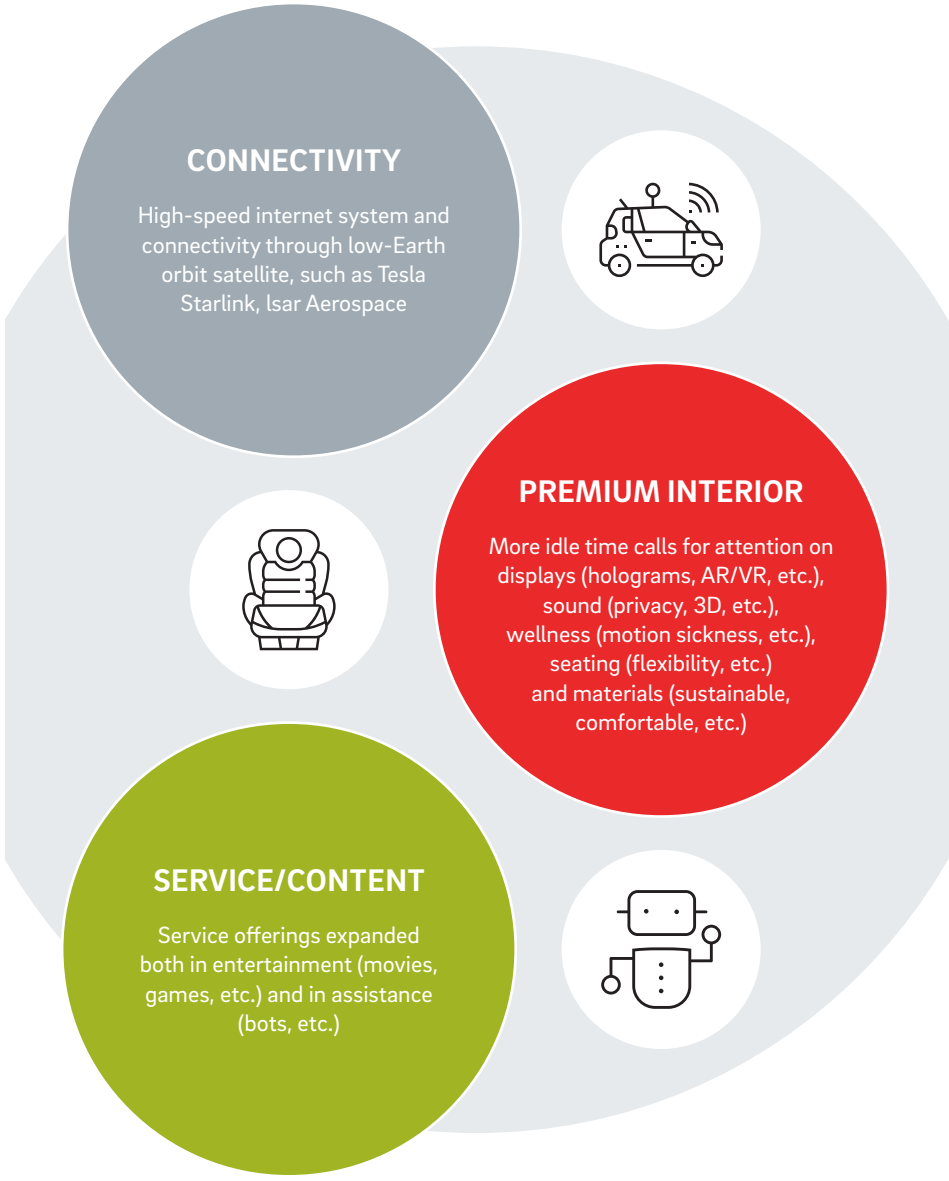
It is clear that commercial AV testing is progressing. Yet the key question of how to earn money from AV services in a sustainable manner remains unanswered. Viable and long-term business cases are still being worked out, and no OEM has developed a sustainable model.

In our opinion, there are three key enablers for OEMs: Offer the best connectivity; leverage a premium interior; and provide direct services and content. OEMs will need to research which of the three best fits their customer base – it might even be the case that different OEMs need different approaches. No matter which course they choose, the Automotive Disruption Radar will remain an essential tool in tracking progress, identifying trends and helping OEMs to better plan their business strategies.

To further 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.

The three key enablers: Connectivity, interior design and infotainment will become the key success factors of autonomous driving

Key enablers for service and content usage



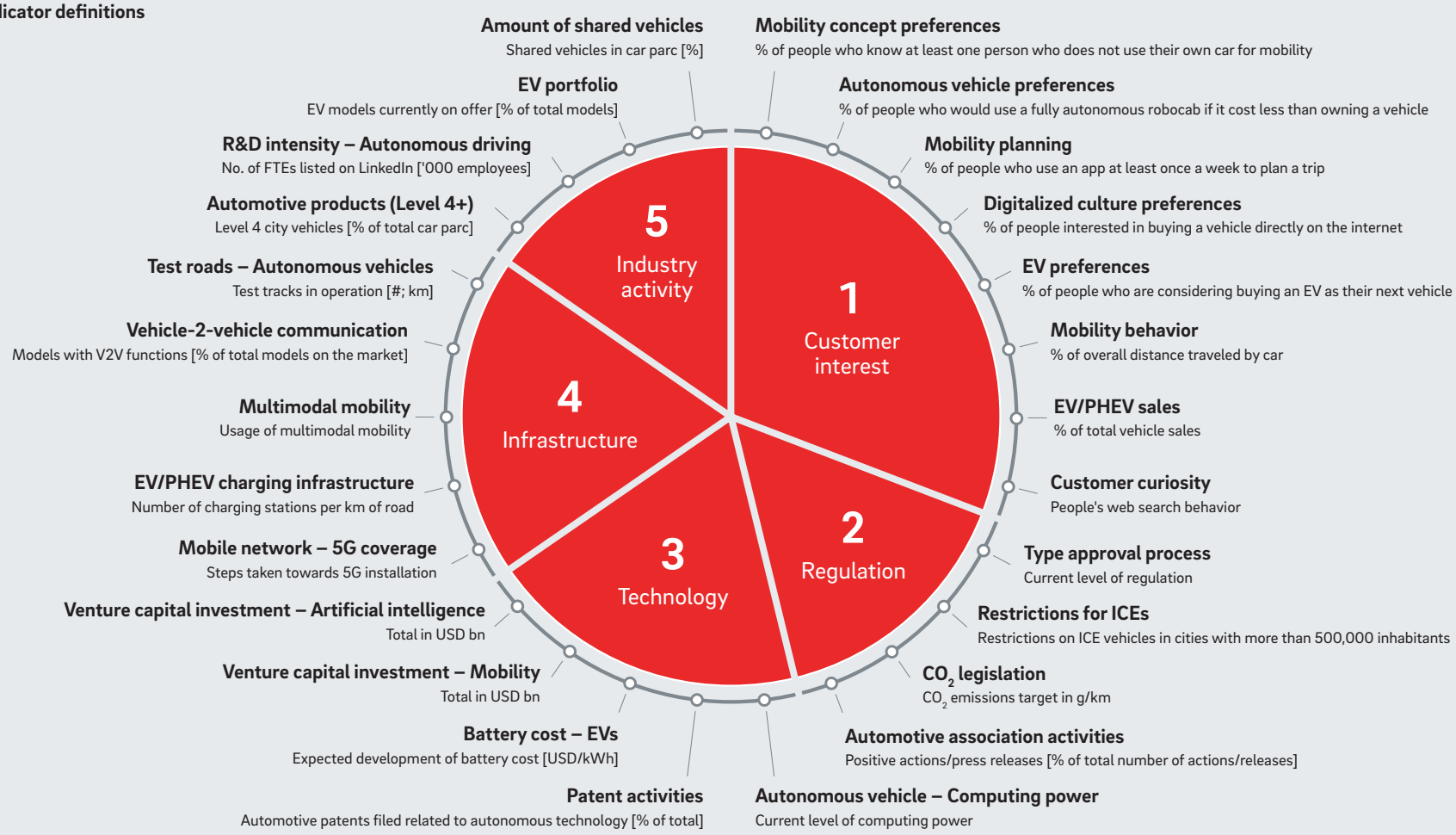
What is the Automotive Disruption Radar?

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 23,000+ car users across 23 markets (Belgium, Brazil, Canada, China, France, Germany, India, Indonesia, Israel, Italy, Japan, the Netherlands, Norway, Russia, Saudi Arabia, Singapore, South Korea, Spain, Sweden, Thailand, 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



Source: Roland Berger

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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

Photos Roland Berger GmbH

All Icons from Noun Project

The ADR community gathers insights from recognized experts in the disruption fields – beyond Roland Berger, it currently includes:

Automotive World is a leading B2B publication for the mobility sector

Carbometrix mission is to make companies' carbon performance data accessible and comparable

Charging Radar is the leading data analytics platform for public EV charging infrastructure

CoMotion is a global platform where lleaders and policymakers meet to share ideas, do business and plan the new mobility future

Fka is a research partner to the automotive industry, a position they have held since 1981

Springer Fachmedien is part of the Professional Group within Springer Nature – one of the world's leading science and professional publishers

→ **Read more about our community:** About – Automotive Disruption Radar (automotive-disruption-radar.com)

ADR Members can navigate through the ADR data, customize and download relevant charts, read expert insights... free of charge

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