Challenges abound

Ongoing crises call for a proactive approach

NEWS

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AUTOMOTIVE DISRUPTION RADAR #7

April 2020

Roland Berger

A call to action

The top specs:
Report summary

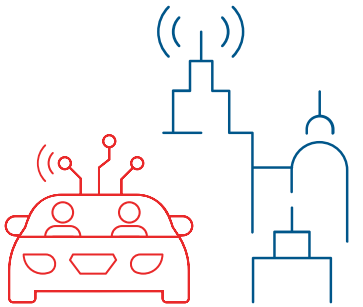
With major governments pushing ahead with plans to turn climate-neutral and the possibility of further trade wars, not only between the United States and China, but also between the United States and Europe, sales volumes in the automotive industry were already very likely to decline before COVID-19. The current crisis may now become a catalyst of this development, or even a game changer for the complete automotive industry. Widescale shutdowns of assembly plants, supply chains and sales activities affect the financial situation of the industry tremendously. Moreover, it is unclear by when and how the market will recover. Our forecasts indicate a plunge of the automotive volumes up to 40% and the pace of a recovery is unknown.

In these highly uncertain times, OEMs and suppliers need to ensure their short term liquidity in order to survive. Whatever the length of the COVID crisis, the Automotive world will look different afterwards. Today's high CAPEX demand is not affordable anymore and OEMs are struggling to finance their e-mobility products. Cost-cutting activities are therefore expected to proceed at much higher speed. But the necessary structural transformations materialize in time. At the same time, most traditional industry players are instinctively trying to defend their home turf – a strategy that may prevent them from building the new competencies that are so urgently required for their future new mobility landscape like autonomous driving.

Business models based on autonomous vehicles are now being tested on a large scale, especially in the United States. Retail giant Walmart, for example, has entered several partnerships and carried out repeated testing of vehicles. In December 2019 the firm announced further cooperation with Nuro, an American robotics company known for its work in the area of autonomous delivery vehicles. Walmart has also licensed its vehicle technology to self-driving truck startup Ike and is allowing the startup Udelv to test autonomous grocery deliveries in Arizona and Gatik AI to trial deliveries from its main warehouse in Bentonville, Arkansas. The trend towards driverless commercial services as a sustainable business model is not limited to the United States, either: French flag carrier Air France is currently partnering with Toulouse-Blagnac Airport and Charlatte Autonom to test an autonomous shuttle for luggage transportation.

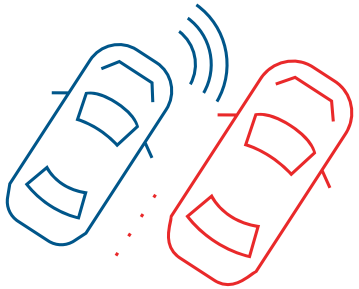
Technology roadmaps and paths are becoming clearer. In ADR 6 we reported on new chip designs and intelligent algorithms, and work here is progressing. For example, Nvidia has presented a new chip, called Orin, that can handle over 200 GB/s of data – compared to around 2 GB/s in the Tesla Autopilot V2.5 computer, which used older generations of Nvidia chips. Other companies are also introducing innovations, such as artificial intelligence (AI) chips with significantly lower energy consumption, specifically designed to handle neural network computation. Israeli startup HAILO recently raised USD 60 million in its B-round financing, while Chinese startup Horizon Robotics has begun production of China's first automotive-grade processor. These chips, which may be much cheaper then normal GPUs or even CPUs, will redefine the role of intelligent sensors in vehicles.

Things are progressing on a larger scale, too. The automotive technology company Human Horizons is building smart-city infrastructure in the Zhangjiang Hi-Tech Park in Shanghai as part of its Vehicle-Road-City Integrated Smart City project. Their aim is to lay the groundwork for high-tech roads and autonomous vehicles in future smart cities. This initiative is part of the company's larger "3 Smart" strategic blueprint: smart vehicle, smart road, smart city. Clearly, the Chinese way of automating mobility will differ significantly from that of other regions, where renewing infrastructure will take much more time.



Over the past three years, our respondents have become increasingly at ease with digital tools and services. This augurs well for the adoption of autonomous mobility services. Thus, compared to 2017, the share of respondents who use an app at least once a week to plan a door-to-door trip grew from 30% to 45%. This increase is strongly driven by people in traditional automotive markets, such as Germany, the United Kingdom and the United States, where numbers of users have risen from 10% to 25%.

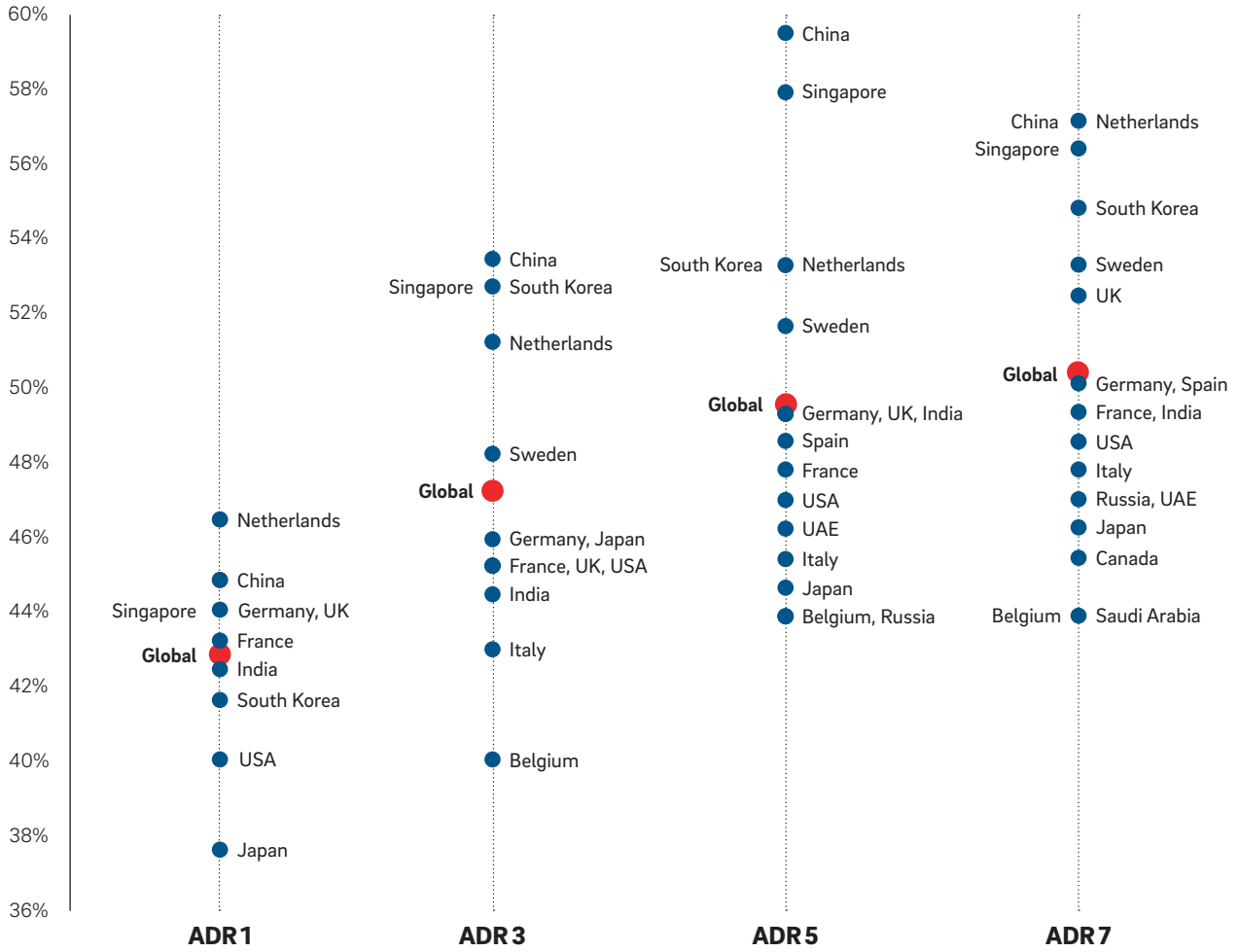
A question mark remains over whether the main players in the automotive industry, both OEMs and suppliers, will be able to meet market expectations. At the moment their approach appears to be rather passive. They are focusing on their core business, in so doing missing opportunities for partnerships and running the risk of seeing their share of value creation dwindle. This contrasts with the approach of new players, such as electric vehicle (EV) startup Rivian, which partners with Amazon, and Canoo, which partners with Hyundai. Both companies are rapidly capturing future profit pools.



Country scoring in selected ADR editions

Top three automotive nations remain unchanged, Netherlands rising fast

Overall score evolution through 7 editions (% of max. achievable score)



Source: Roland Berger

Under the hood:
Detailed report findings

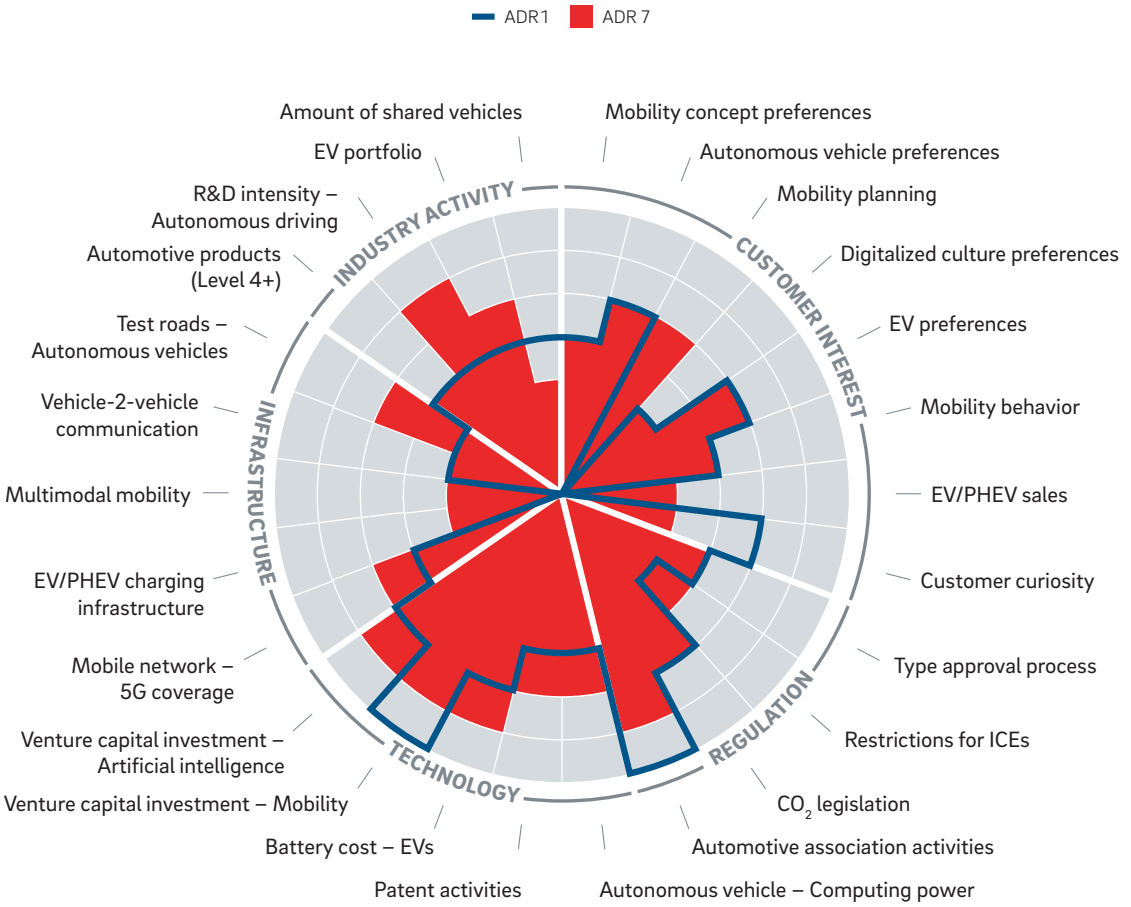
This seventh edition of our biannual ADR examines the automotive market in 18 countries, with Canada and Saudi Arabia included for the first time in this issue. The survey considers 26 different indicators for the industry and had a total of 17,232 respondents. The survey took place in January 2020 and therefore does not yet incorporate effects of the current COVID-19 crisis. Nonetheless the findings underline the existing trend which are now accelerated by the dynamics. The top three automotive nations remain unchanged compared to ADR 6: China and the Netherlands rank equal first, followed by Singapore. However, as we foresaw in ADR 6, indicators in smaller automotive markets, such as the Netherlands, are rising faster than ever, especially in the area of mobility planning usage and sales of EVs and PHEVs. For the overall country rankings, see page 3.

CUSTOMER INTEREST

ADR 6 found that interest in EVs and autonomous vehicles was holding up, despite the downturn in the industry. ADR 7 finds that, globally, this interest has remained at the same high level, with 55% of people prepared to use a robocab service and 40% thinking about buying an EV as their next vehicle.

AUTOMOTIVE DISRUPTION RADAR – ISSUE #7

GLOBAL SCORE PER INDICATOR
(from 0 to 5)



Source: Roland Berger

Sales growth for EVs and PHEVs is slowing down compared to the situation in ADR 6, with 2.1 million units sold in 2019 and 1.9 million units in 2018 in the 18 countries included in the survey, a growth rate of 8% a year. For comparison, in order to meet CO_2 goals, sales of vehicles with electrified powertrains need to show double-digit annual growth, despite stagnating global automotive sales. More than 340 models of EVs and PHEVs are now available in the 18 ADR countries, a significant increase on the 125 models available in 2016 (ADR 1).

REGULATION

The regulatory framework for autonomous vehicles continues to expand, a tendency already observed in ADR 6. Russia has drafted a concept for road safety involving autonomous driving, for example, to be finalized by September 2021. In ADR 6 we reported that South Korea was working on its roadmap for the approval of autonomous vehicles; since then, the Ministry of Land, Infrastructure and Transport has announced an unprecedented set of road safety rules for Level 3 autonomous cars, allowing automakers to manufacture and sell Level 3 cars from July 2020.

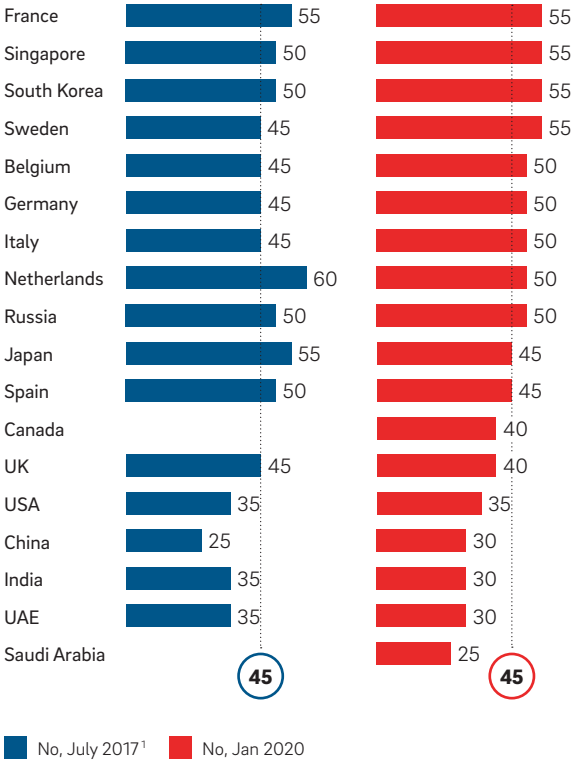
Testing is also becoming more widespread. Of the 18 countries analyzed, 15 have dedicated test areas for autonomous vehicles (only Saudi Arabia, UAE and India do not). Regulations in some countries go even further, allowing autonomous vehicles on public streets and in city centers. This is the case in Berlin in Germany and Xinhua in China, for example.

Customer preference - Evolution through time and region

No significant change in AV and EV acceptance – Local situations remain largely stable

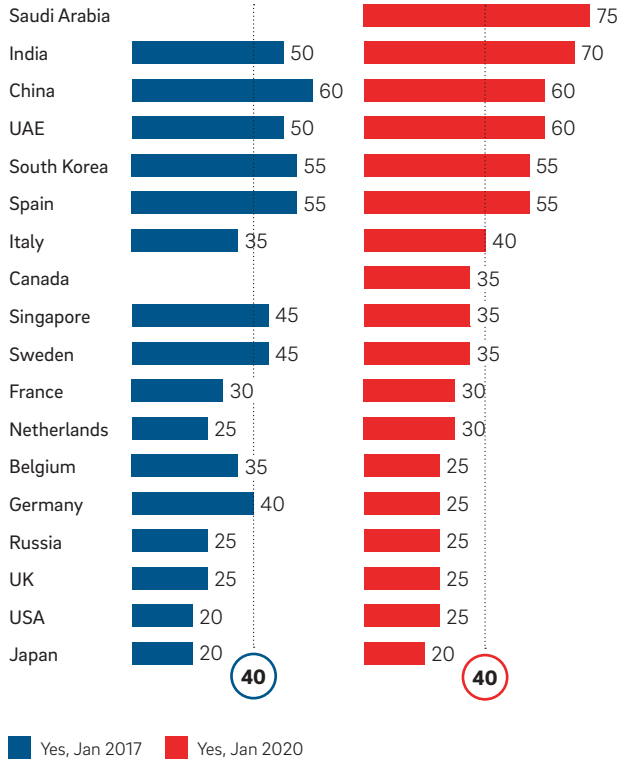
AUTONOMOUS

"Would you still buy a car again if fully autonomous robocabs could be used at lower cost per trip compared to your own car?" (% of those saying "no")



ELECTRIFIED

"Are you considering buying a battery electric vehicle as your next car?" (% of those saying "yes")



1 Value for Italy = July 2017, values for Belgium and Sweden = Jan 2018, values for Russia = July 2018, values for UAE and Spain = Jan 2019

Source: RB online survey January 2020: 16,808 participants – By country: Belgium 1,014; Canada 1,022; China 1,005; France 1,022; Germany 1,024; India 1,008; Italy 1,013; Japan 1,014; Netherlands 1,008; Russia 1,011; Saudi Arabia 506; Singapore 1,009; South Korea 1,008; Spain 1,014; Sweden 1,025; UAE 504; UK 1,006; USA 1,019

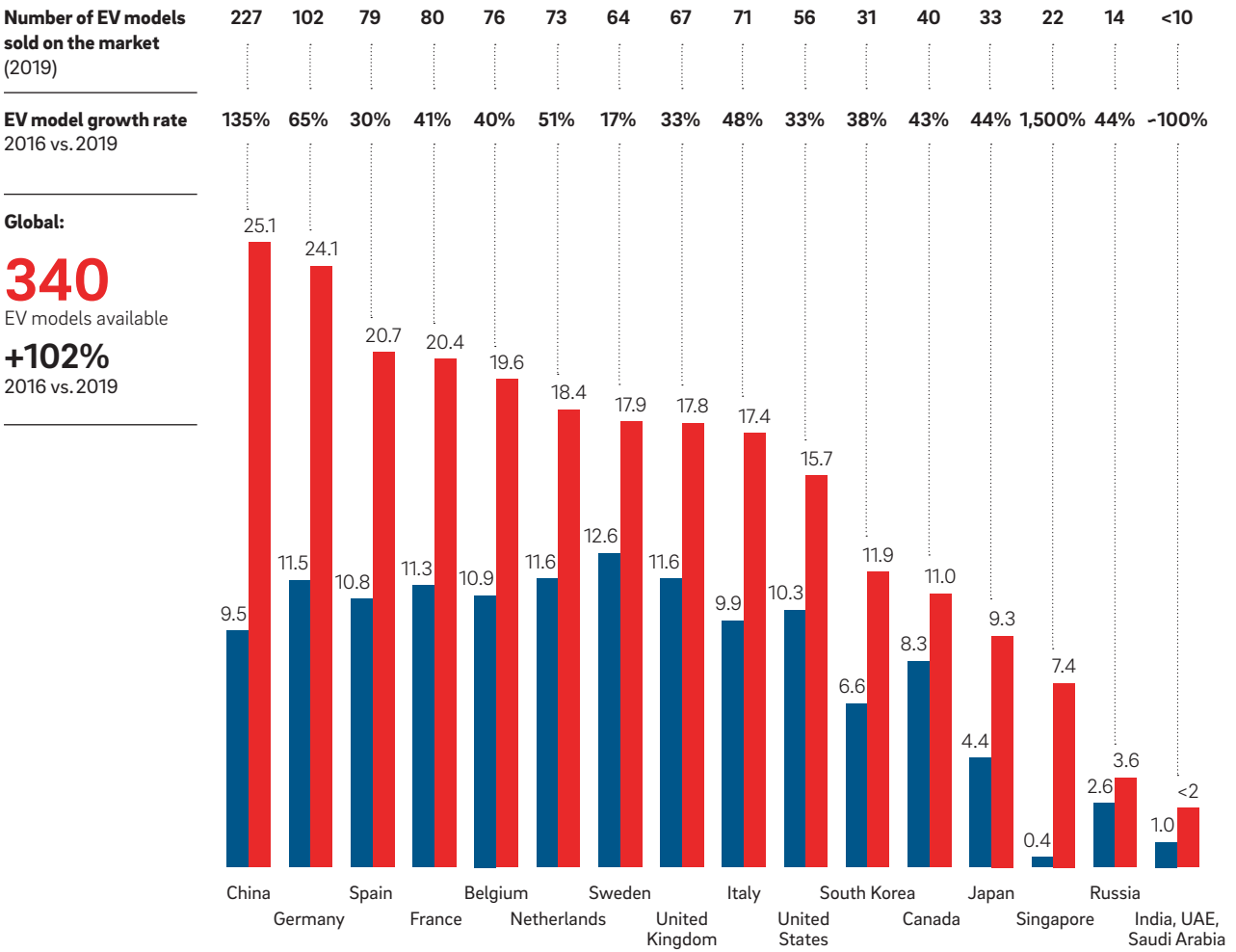
Restrictions on conventional gasoline and diesel powertrains in cities are increasing, further driving the adoption of EVs and PHEVs. Of the 245 cities analyzed, 145 cities have no specific restrictions (down from 191 in January 2017), 89 have minor restrictions (up from 52) and 11 have major restrictions (up from just two). None of the cities has a total ban yet. Going against the general trend, some Chinese cities (Wuhan, Foshan, Ningbo, Tangshan, Hefei) have relaxed or even lifted restrictions as pollution has decreased. It will be interesting to see whether restrictions will continue to be used as a short-term way to tackle local emissions or if in the future they will be used more as a long-term instrument for steering consumers towards less polluting vehicles, in other words EVs and PHEVs.

TECHNOLOGY

As stated in previous ADRs, venture capital investments in artificial intelligence (AI) are a crucial enabler for autonomous driving. Invested capital in this field grew from USD 5.8 billion in 2018 to USD 7.7 billion in 2019, an increase of more than 32%, and does not appear to have peaked yet. The year 2019 saw massive investments in the field, with USD 2.6 billion going to self-driving technology platform Argo AI, USD 1 billion invested in the non-profit AI research company Open AI, and a major investment in AI-focused independent R&D lab Megvi.

EV/PHEV/FCEV share of models in OEM portfolios

Growing share of EV offer for most of the countries – Highest shares in Europe and China



Source: ADR analysis, Roland Berger

Investments in mobility were less bullish. USD 9.27 billion was invested in 2019, a 32% decrease on 2018 and more than USD 10 billion less than the all-time high of 2017 (USD 21.4 billion). This may be due to the fact that, despite all the hype about new mobility concepts in recent years, few of these business models have actually generated profits. We may now be entering a phase in which investors are more cautious and expect concrete returns on their cash-intensive investments in new mobility concepts.

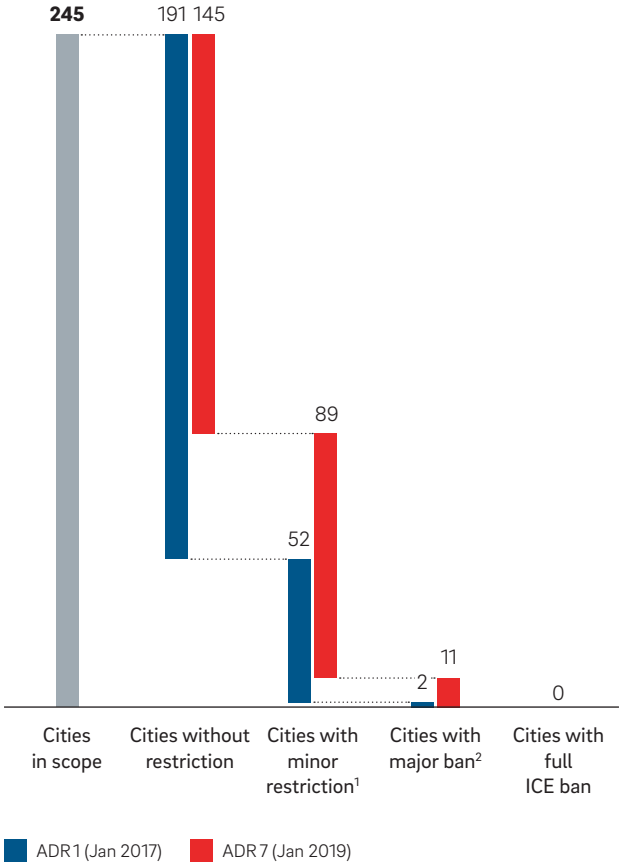
Patents and R&D capacity continue to grow, as in previous ADRs. More than 100,000 employees are now active in the field of mobility or autonomous driving, according to data gathered from LinkedIn. Moreover, the number of patents referring to autonomous driving rose once again in 2019, now representing 4.5% of all the patents we examined (compared to 2.3% in 2017).

INFRASTRUCTURE AND INDUSTRY ACTIVITY

In ADR 6 we drew attention to the lack of charging infrastructure worldwide. The situation has since improved: Today, charging infrastructure is one of the fastest-rising indicators examined in our study. With more than 1.7 charging stations per 100 kilometers at the end of 2019, the overall network is now three times as dense as it was in 2017. The Netherlands leads the way, while China and South Korea have made massive progress. Germany and other European countries are also improving. This overall trend is expected to continue.

Regulatory evolution for internal combustion engines (ICEs) in urban areas

Slow but sure trend of cities developing various formats of ICE limitations



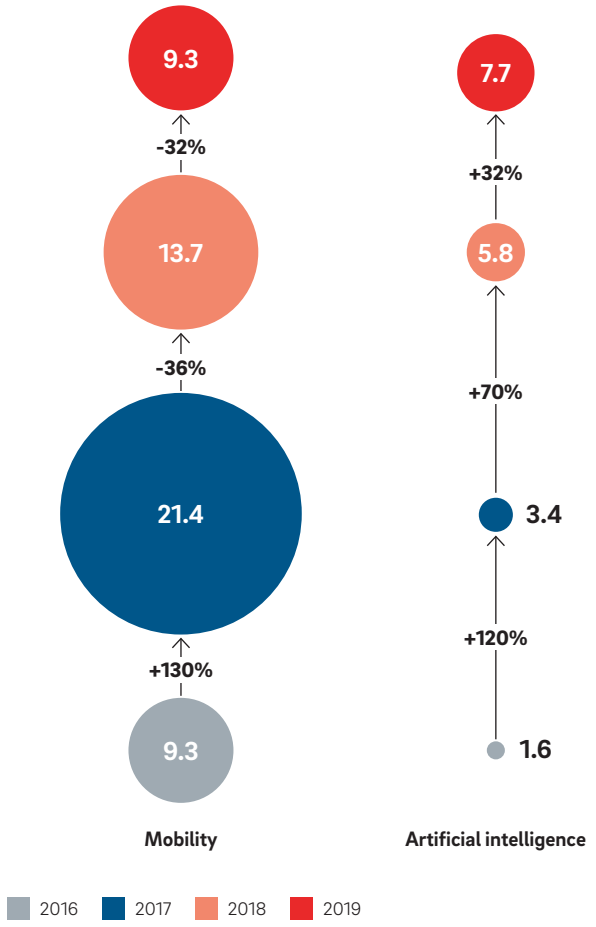
1 Ban on vehicles not meeting the latest emission standards (e.g. green badge) or selective actions (e.g. car-free days)

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

Source: Desk research, Roland Berger

Venture capital investment[1]: Mobility platforms and transport technology [USD bn, 2016-2019]

Continuous increase in AI investment, while mobility investment are falling back

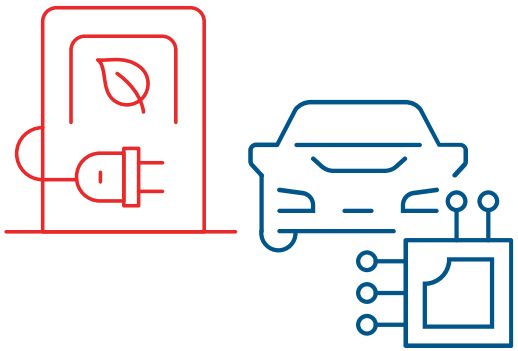


1 Analysis on disclosed amounts

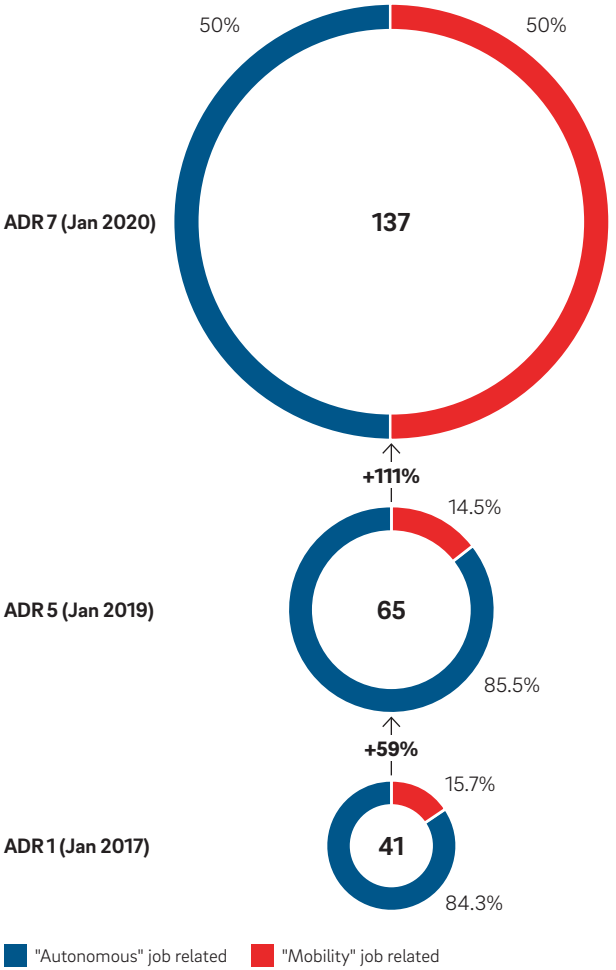
Source: Tracxn, Roland Berger Automotive Disruption Radar

Vehicle-to-vehicle (V2V) equipment also continues to spread. With Volvo and Mercedes having expanded into new geographical areas, this technology is now available in eight of the 18 countries considered in our study. As yet, Toyota's models are only sold in Japan. Volkswagen has launched a Golf with a vehicle-to-everything (V2X) function on the US market.

Technological progress in the industry continues. In December 2019, QIA and Volkswagen AG announced a pioneering autonomous driving and electric transportation initiative aimed at transforming urban mobility in Qatar. In January 2020, GM subsidiary Cruise gave a preview of its first driverless car without steering wheel or pedals. It remains to be seen whether OEMs will push on to commercialization or focus instead on their current core business.



Number of employees listed on LinkedIn ('000)
Huge increase in "mobility related" jobs



Source: LinkedIn, Roland Berger

Evolution of V2V vehicles' commercialization
Rise in V2V equipped vehicles launched in the market in last three years

SITUATION IN 2017

3 models equipped with V2V functions offered:

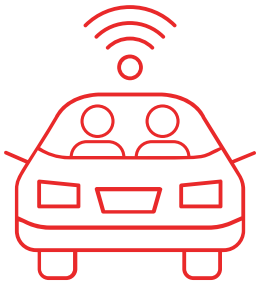
- → Cadillac CTS (now discontinued)
- → Mercedes-Benz E-Class
- → Toyota models (in Japan only)

In 3 countries:
USA, Canada, Japan

SITUATION IN 2020

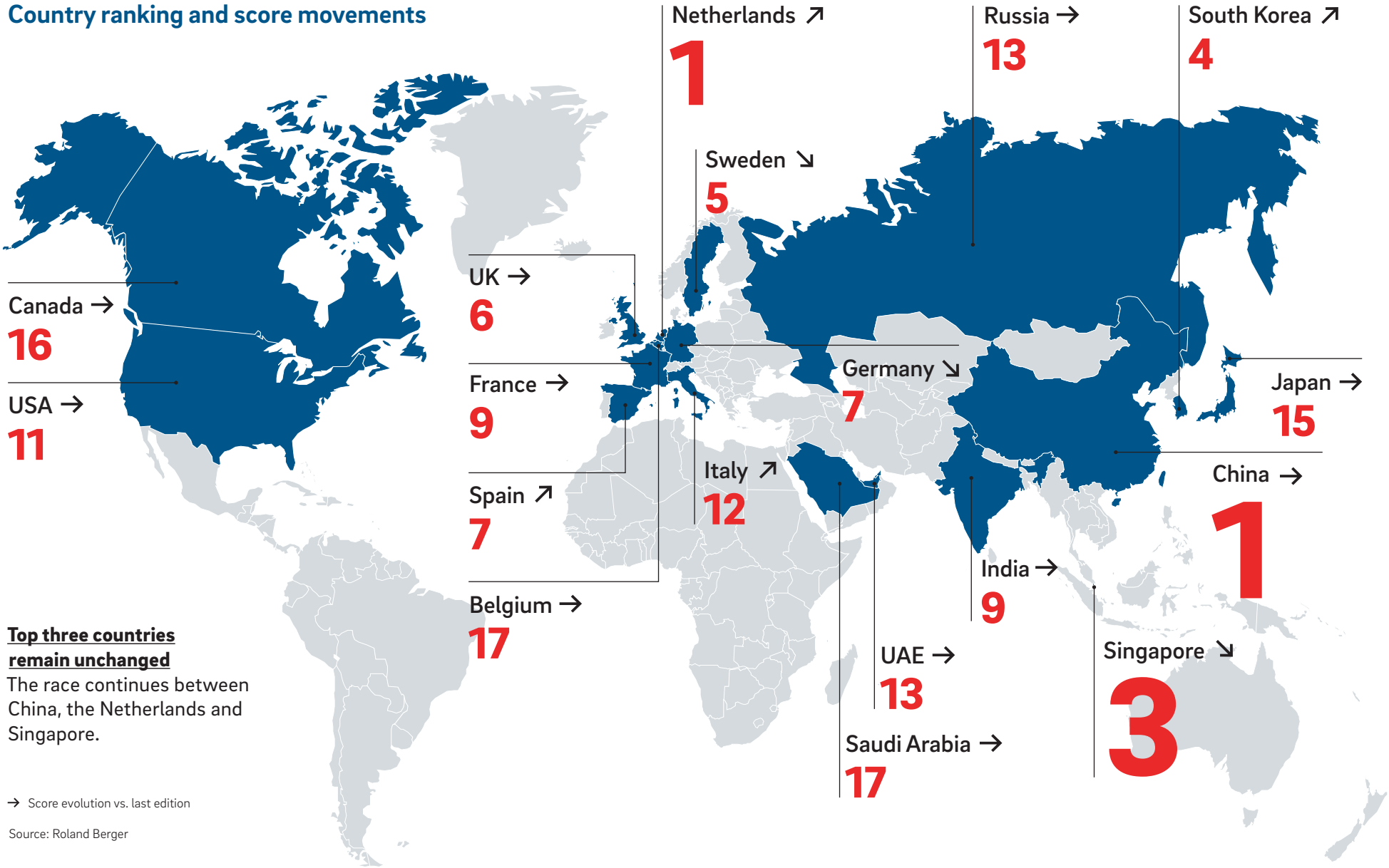
20 models equipped with V2V functions offered:

- → Mercedes-Benz E-Class, S-Class, A-Class, GLA, GLC
- → VW Golf
- → Toyota (Prius PHV, Prius, Crown, Alphard, Vellfire)
- → Volvo XC90, S90, S60, V60, V60 Cross Country, V90, V90 Cross Country, XC40, XC60, V40



In 8 countries:
Netherlands, Germany, Japan, Canada, Sweden, USA, Italy, France

Country ranking and score movements



Top three countries remain unchanged
The race continues between China, the Netherlands and Singapore.

→ Score evolution vs. last edition

Source: Roland Berger

Spot facts by country (score out of 130)

CHINA #1 (74)

- Sales of EVs are slowing in China, with just 4% growth in 2019 compared to 80% the previous year. However, the country has made progress on infrastructure
- China is fostering the development of autonomous driving, designating vast areas surrounding major cities such as Shanghai and Beijing for testing

NETHERLANDS #1 (74)

- The Netherlands are leading in the KPI of share of EV/PHEV sales
- Unsurprisingly, the Dutch charging network is also the most developed of all the countries in the study, with more than nine charging locations per 100 kilometers (compared to an avareage of 1.7)

SINGAPORE #3 (73)

- Singapore is trying to reduce the use of cars by cutting the amount of space dedicated to them and promoting shared vehicles
- Interest in EVs is low: Only 30% of respondents would consider buying one, they represent just 1.9% of all vehicles sold and only 22 models are available on the market

SOUTH KOREA #4 (71)

- South Koreans remain enthusiastic about EVs, with 55% of local respondents prepared to buy one, but EV represent only 2.3% of vehicles sold (2.9% on average)
- 60% of South Koreans regularly use navigation apps and 55% would not buy a car again if they could use robocab services

SWEDEN #5 (69)

- Sweden sells 10% of all EVs worldwide, making it second only to the Netherlands. This is despite having a relatively small charging network, at just 2.9 stations per 100 km
- Interest in autonomous vehicles is high, with 55% of respondents prepared to give up on owning a car if they could use robocabs. However, limited testing is currently taking place

UK #6 (68)

- Sales of EVs have been growing steadily since 2017, from 1.7% of all vehicles sold to 2.9% in 2019, though only 25% say they'd consider buying one as their next car
- This is supported by a charging network of above-average size, with 3.65 stations per 100 km

SPAIN #7 (65)

- Spain's EV charging network is small but rapidly growing, up 64% since January 2019 and 553% since January 2017.
- Customer enthusiasm is also high: 55% of local respondents would consider buying an EV, compared to 40% on average across all countries in the study

GERMANY #7 (65)

- Interest in autonomous vehicles is high in Germany, with 50% of people prepared to give up owning a car in favor of robocab services. Testing is fairly widespread, including in urban centers
- 5G has been commercialized, while regulations on autonomous vehicles are still under discussion

FRANCE #9 (64)

- Activity around autonomous vehicles is strong in France, with large testing areas and support from the general population. Thus, 55% of local respondents would give up owning a car if they could use robocabs
- The French are less enthusiastic about EVs, however, with only 30% of respondents considering buying one. More effort is also needed in the area of infrastructure

Spot facts by country (score out of 130)

 INDIA #9 (64)

- → India shows growing interest in EVs, with 70% of respondents prepared to buy one today compared with 50% in 2017. However, sales and charging infrastructure are practically non-existent
- → India is yet to start its journey with autonomous vehicles. No approval process for V2V is underway and 5G remains at the roadmap stage

 USA #11 (63)

- → Interest in EVs remains low, with just 25% of respondents considering buying one. Sales figures slowed from 80% growth in 2018 to 70% growth in 2019
- → Rural dwellers are more willing to adopt autonomous vehicles (35%) than urban dwellers (25%). The country remains a frontrunner in terms of the regulation and testing of autonomous vehicles

 ITALY #12 (62)

- → Limited progress is taking place in EVs and autonomous vehicles. EV sales volumes are below 1% and there is just one charging station per 100 km (up 43% since January 2019)
- → Italian cities are tightening restrictions on internal combustion engines (ICEs) and introducing stricter rules on green zones

 RUSSIA #13 (61)

- → Russia is drawing up a concept for road safety involving autonomous vehicles, to be finalized in September 2021
- → Car-sharing now makes up 0.1% of the total fleet, compared to just 0.03% one year ago. However, this is mainly in Moscow, which represents 85% of the car-sharing market

 UAE #13 (61)

- → UAE has seen a sharp increase in charging infrastructure, with now more than eight stations per 100 km
- → Interest in EVs is growing, with 60% of local respondents saying that they'd consider buying an EV as their next vehicle, compared to 50% a year earlier. However, sales are still practically non-existent

 JAPAN #15 (60)

- → Japan is traditional when it comes to mobility: New concepts are unpopular, shared vehicles account for just 0.8% of the total fleet (half the global average) and ride hailing is non-existent
- → The government is pushing autonomous vehicle initiatives in the run-up to the 2020 Summer Olympics in Tokyo. Vehicle testing and debates about regulation are high on the political agenda

 CANADA #16 (59)

- → As in the US, individually owned vehicles reign supreme in Canada. No restrictions on cars exist in cities and new mobility formats have had limited impact
- → Unlike in the US, however, EVs have a significant profile in Canada, with 35% of respondents considering buying one. EVs make up 2.6% of vehicle sales, compared to a global average of 2.9%

 BELGIUM #17 (56)

- → Belgium is progressing slowly in terms of autonomous vehicles, sales of EVs and infrastructure. However, interest in robocabs is growing
- → Individually owned vehicles remain the main form of mobility, accounting for 60% of trips, compared to 0.6% for shared vehicles

 SAUDI ARABIA #17 (57)

- → Saudi Arabia displays a mismatch between the level of interest in EVs (75% of respondents) and the reality on the ground, where sales of EVs are almost zero, fewer than ten models are available, infrastructure is practically non-existent and there are no restrictions on ICEs
- → Around 75% of people in Saudi Arabia use an app at least once a week; 38% would be prepared to buy a car from a non-brand dealership/third party

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. Its latest findings are based on field research and a survey of 17,000+ 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). ADR's 26 indicators are grouped into five dimensions:

- → **Customer interest:** Do people want autonomous vehicles and to what extent?
- → **Regulation:** What are the regulatory conditions?
- → **Technology:** How far advanced is the technology for autonomous driving?
- → **Infrastructure:** How developed is the infrastructure for autonomous vehicles?
- → **Industry activities:** Which solutions have been announced or already exist?

THE AUTOMOTIVE DISRUPTION RADAR PROVIDES GUIDANCE

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? Beyond the survey, information is also drawn from external sources such as leading mobility experts and major industry reports. Ultimately, the ADR is a go-to decision-making tool for senior executives in the mobility sector. Each nation is scored along the 26 indicators. This framework allows us to conduct a fact-based measurement to try to determine which nation is most likely to introduce autonomous mobility first.

SEVEN ADR ISSUES WITH FINDINGS FROM THE SURVEYS HAVE BEEN PUBLISHED SO FAR

ADR 1 (January 2017[1])
Tracking disruption signals in the automotive industry

ADR 2 (July 2017[1])
Asia ahead. Have major Western European markets already lost the race for future mobility?

ADR 3 (January 2018[1])
Mobility services move up a gear

ADR 4 (July 2018[1])
China speeds ahead

ADR 5 (January 2019[1])
Mobility's great leap forward. A world on the verge of autonomy

ADR 6 (July 2019[1])
Time to think smart. Uncertainties signal a need for new approaches to mobility

ADR 7
March 2020[1]

Challenges abound
Ongoing crises call for a proactive approach

1 Date of data collection

List of all indicators and measures

○ Indicators ○ **Measures**

Source: Roland Berger

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FOR MORE INSIGHTS INTO OUR ADR FIGURES AND ANALYSIS PLEASE DO NOT HESITATE TO CONTACT US!

About us

Roland Berger, founded in 1967, is the only leading global consultancy of German heritage and European origin. With 2,400 employees working from 35 countries, we have successful operations in all major international markets. Our 52 offices are located in the key global business hubs. The consultancy is an independent partnership owned exclusively by 250 Partners.

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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.