

AUTOMOTIVE
DISRUPTION
RADAR
#4

China speeds ahead

September 2018

China speeds ahead

The top specs: Report summary

China is pulling away from the competition when it comes to new “disruptive” mobility services such as autonomous driving and car sharing. That’s the key finding of the fourth edition of the Automotive Disruption Radar (ADR).

It shows that China, the world’s largest car market, has extended its lead over its rivals to 5 points, with a total score of 75 out of 130 points (58%). Six months ago, it led by only 1 point.

Scores, calculated using 26 industry indices, give an indication as to which country will be first to introduce autonomous mobility. China surged ahead thanks to its leading market position in electric vehicles, accounting for more than half of the 700,000 EVs sold worldwide. It also benefited from a more open regulatory environment.

The study also shows that no one mobility brand yet dominates the global market, with none known to a majority of people. Uber rates highest, known to 46% of ADR4 survey respondents, followed by blablacar at 20%.

So the battle to be the “Coca-Cola” of mobility services – that is, a brand known to everyone – is yet to be won.

Everything is still to play for. ADR4 shows that the use of so-called demand-driven modes of transport, for example car sharing, taxis and ride hailing, is still low. Across the 14 countries, the use of one’s own or a friend’s car is still the dominant transportation type, with demand-driven modes having only an 8% share.

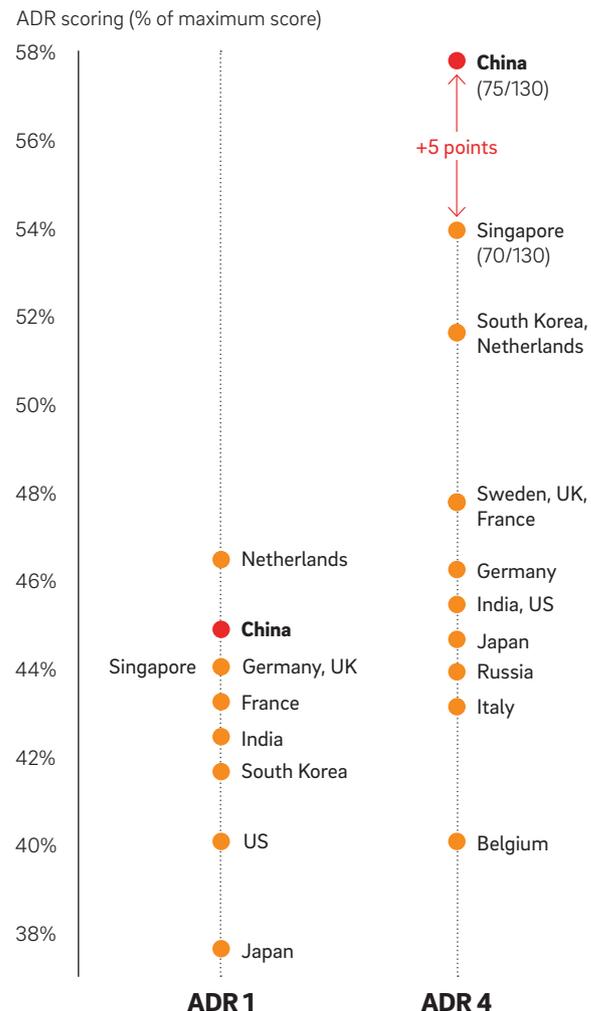
While there is little evidence of progress towards the launch of fully autonomous vehicles in terms of fleet size, ADR indicators measuring technological developments show major growth. Venture capital investment in mobility services and artificial intelligence jumped by nearly 50% to USD 25 billion in the past year, and patent numbers saw a solid increase. There was also a sharp rise in the number of researchers working in mobility sectors (27% in the past year) and a spike in announced activities by manufacturers, including on the introduction of highly automated cars (Level 4).

WHAT DO THE ADR FINDINGS MEAN FOR THE INDUSTRY?

- Develop or deepen partnerships both inside and outside the automotive industry, including collaboration with other manufacturers
- Manage the transformation from automaker to mobility provider – become more like a software company
- Offer software platforms for connected functions that are accessible to third parties

Country scoring in ADR first and last edition

China has extended its lead over the other countries in the last 18 months



Source: Roland Berger

Under the hood: Detailed report findings

ADR4 builds on the three previous editions, in which 10 to 13 countries were surveyed. ADR2 found that Asian countries were taking a lead in autonomous driving while mature markets were distracted by the dieselgate scandal. ADR3 noted a rapid shift towards new mobility services since ADR1 in March 2017.

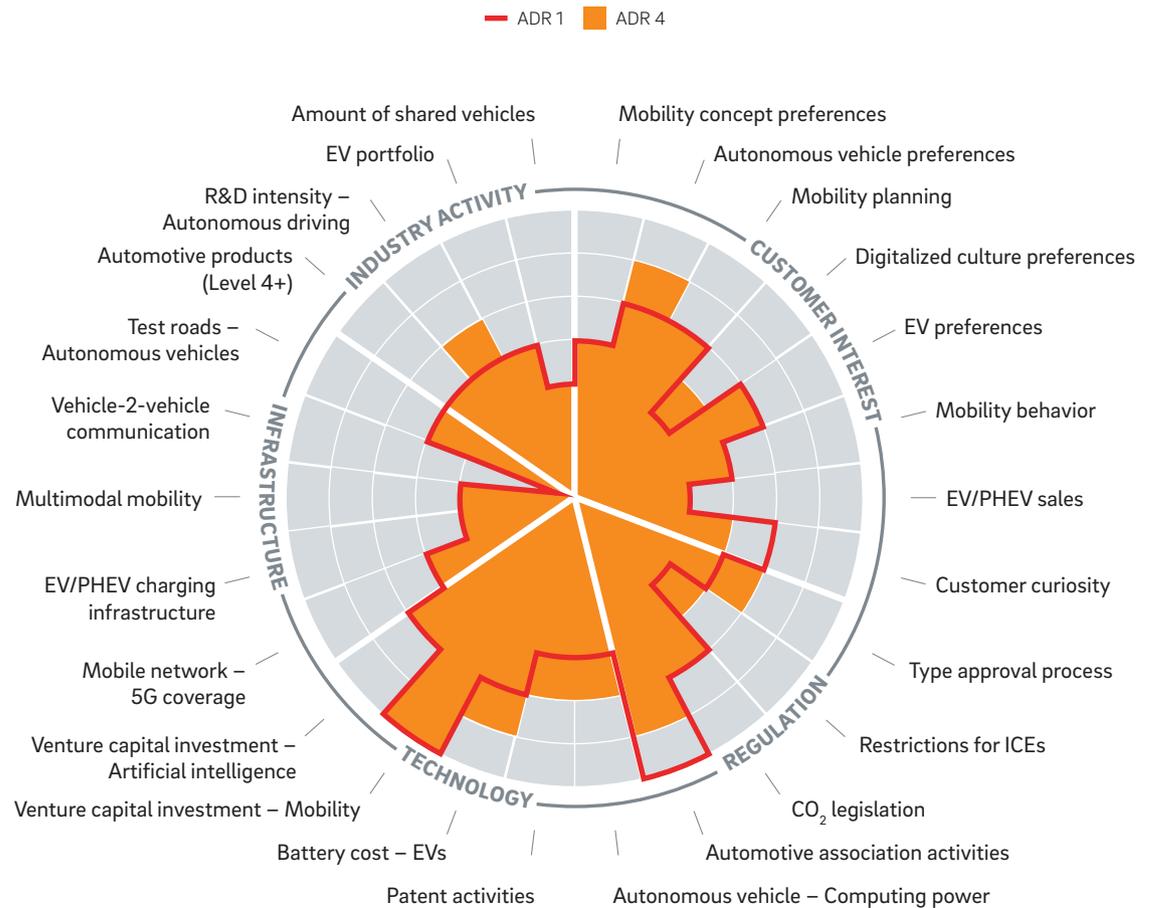
The latest edition is scored according to 26 industry indicators covering five dimensions. Below is a summary of the main findings under the most significant dimensions. Final country rankings are shown on page 8.

CUSTOMER INTEREST

Unsurprisingly bearing in mind its size and fast-developing market, China led the way in this area. Some 75% of Chinese survey respondents used an app at least once a week to plan a journey; 65% said they were interested in buying an electric vehicle; and the country sold by far the most EVs in the first half of 2018, with 390,000 vehicles representing 3% of total car sales in China compared to the US in second place with 120,000. But not even the Chinese could help shift some of the more stubborn mobility indicators. Overall, traveling in one's own or a friend's car remained the preferred mode of transport at 55%, with public transport next and demand-driven modes stagnating at about 8%.

AUTOMOTIVE DISRUPTION RADAR – ISSUE #4

GLOBAL SCORE PER INDICATOR (from 0 to 5)



Source: Roland Berger

One reason for this could be that almost half of all respondents said they never or rarely had a choice between different modes. The lowest rates in this field, suggesting the highest degree of choice, were found in India (20%), China (25%) and Russia (30%).

Nevertheless, interest in so-called robocabs, or automated taxis, further increased in the past six months. Half of all respondents said they would not buy a car again if robocabs were cheaper, a rise of 5 percentage points. Drivers in Japan and the Netherlands were especially interested (approx. 60% each), while the highest rating (75%) was found among the over-70s in Singapore, the country with the highest number of test fleets per inhabitant.

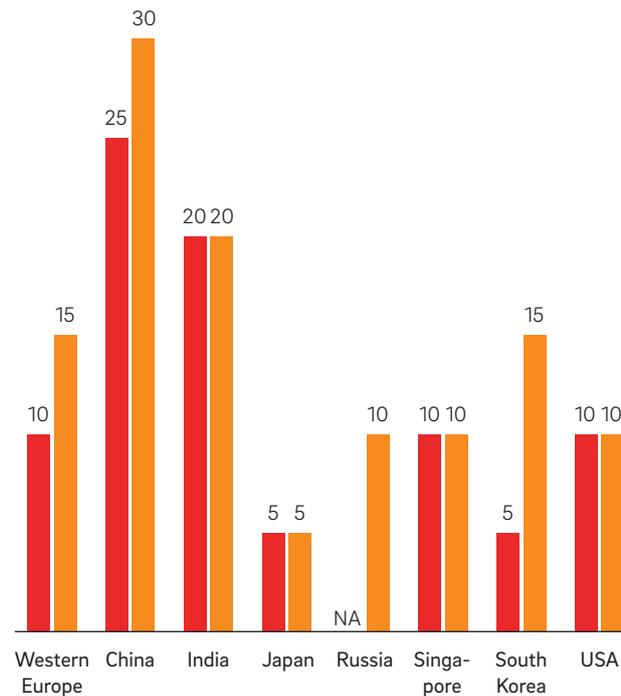
But while interest in autonomous driving is on the up since ADR3, the same can't be said of EVs. A similar overall rate of 35% of people said they would consider buying an EV as their next vehicle, with still low levels of interest in the West (Germany 25%, France 30%, UK 25%) counterbalancing growing interest in Asia (India and China both 65%). As in previous editions, price is globally the most commonly quoted reason for not buying an EV, closely followed by poor infrastructure. It will be interesting to see whether/how fast this changes in Germany once the installation of the announced fast-charging network on highways becomes visible.

Interestingly, however, this has not affected sales figures, with 700,000 EVs sold worldwide in the first half of 2018 – a 75% increase on the same period in 2017.

Share of people willing to buy their car online

General increase over the last 12 months in interest in buying cars online

"During your vehicle purchasing journey, will you use the internet to buy a car?"



■ Yes, ADR 1 (%) ■ Yes, ADR 4 (%)

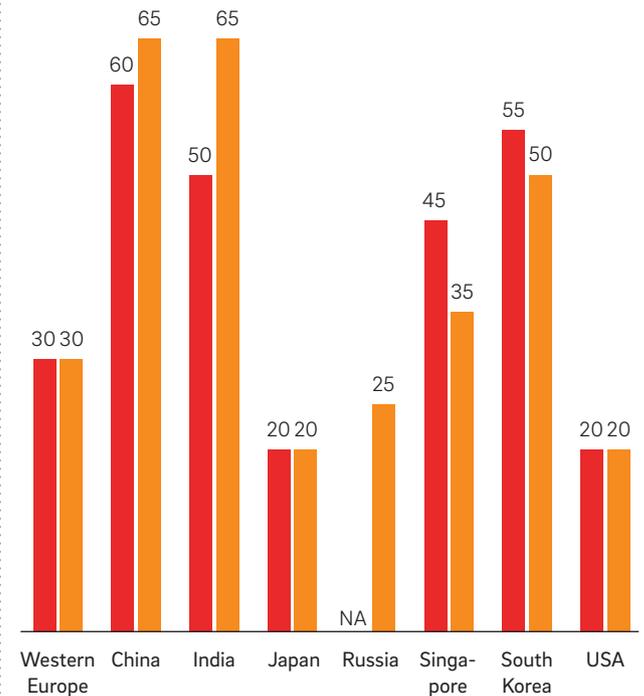
1 Electric vehicle

Source: ADR survey, Roland Berger

Share of potential EV¹ buyers

Clearly growing interest in buying an EV globally, albeit to differing degrees – top reasons for not considering EV remain high price and insufficient infrastructure

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



REGULATION

While more difficult to gauge in hard numbers, ADR4's indicators in the regulation dimension provided equally interesting findings. They showed that China is now open for autonomous vehicle (AV) business, another factor that helped it grow its lead over ADR rivals. The country's standardized guidelines and openness to trials of self-driving cars mean it is becoming a test bed and important potential market for large foreign manufacturers: Daimler and BMW both recently gained permits to trial autonomous vehicles on the streets of Beijing and Shanghai respectively. In addition, China is following an infrastructure-based approach and leveraging vehicle-2-everything (V2X¹) communication. The government says it wants to be a leader in the technology to compete with the likes of Tesla and Alphabet's Waymo in the US.

Elsewhere, other countries are also moving ahead on regulation. The biggest single step regarding type approval was taken by the UK, where the Automated and Electric Vehicles Act became law in June 2018. A key element of the Act was its rules on insuring automated vehicles, and it made the UK a leading nation in terms of AV legislation, alongside the US, Singapore and the Netherlands.

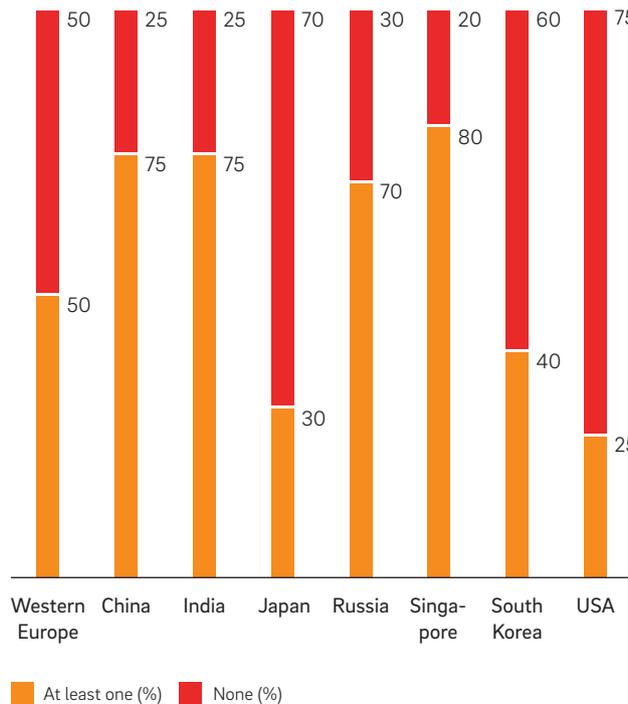
But many governments are finding that legislation is often not enough. Growing mistrust of large tech firms and fears that new technologies will hit jobs

¹ Vehicle-to-everything (V2X) communication is the connection and passing of information from a vehicle to its environment (infrastructure, other vehicle, mobile, grid, human, etc.)

Share of people knowing at least one person who gave up on cars

Singapore, China and India show most interest in other mobility concepts

"How many people do you know who did not and don't want to buy a car because they exclusively use other mobility concepts (e.g. car sharing, public transport, taxi, etc.)?"

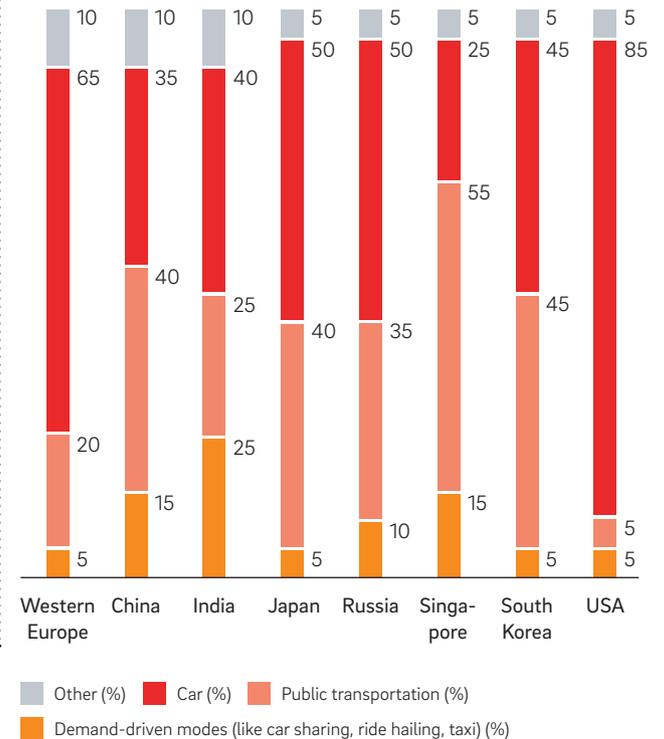


Source: ADR survey, Roland Berger

Share of car driving vs. other modes

US mobility is dominated by car driving – Asian countries distinctly below Western regions

"Thinking about the last couple of weeks, what % of distance (miles or kilometers) driven did you use which modes of transport for?"



mean that autonomous driving poses a growing political risk. Its future success may depend as much on overcoming opposition in society as it does on smart regulation of innovations. But while several countries are trying to regulate with an eye on the future and attempting to enable new mobility concepts, others are still catching up, solving problems from the old automotive world.

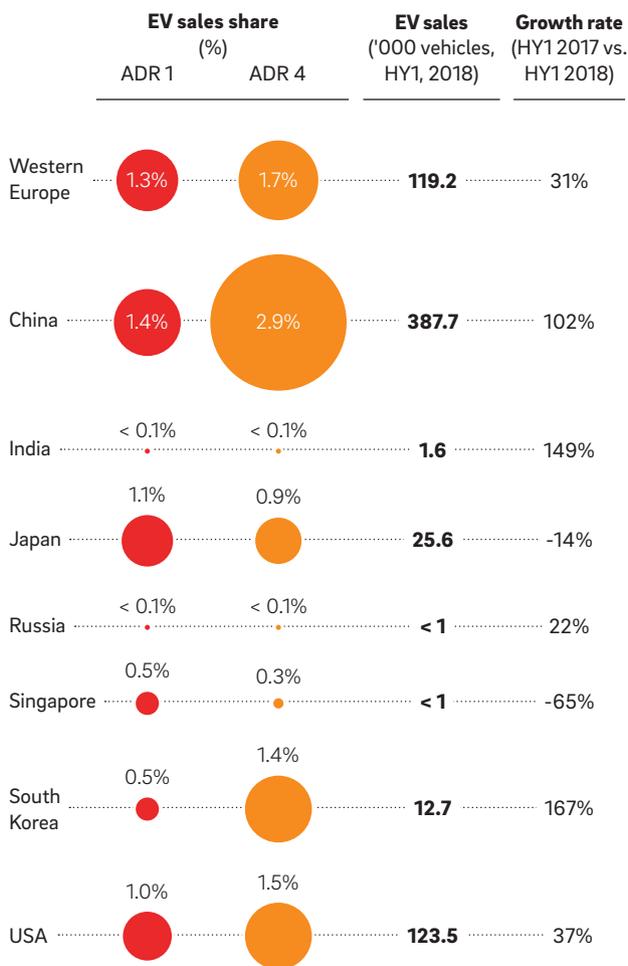
An interesting aside in this section is that Russia, taking part in the ADR study for the first time, has almost no regulations in place to control AV testing. The country's roads are essentially good to go.

TECHNOLOGY AND INDUSTRY ACTIVITIES

Indicators for these two dimensions were particularly healthy in ADR4, with China again performing strongly. In particular, big players in the country's automotive and technology sectors were partnership targets for foreign firms. Several tie-ups were recently agreed or strengthened, including BMW taking a seat on the board of tech giant Baidu's autonomous driving platform; Audi and Chinese tech giant Huawei signing a MoU for a strategic cooperation on autonomous and connected technologies; Daimler announcing the deepening of its partnership with Baidu and incorporating Baidu's connected services in its infotainment system MBUX; and Honda being the first Japanese OEM to join Baidu's consortium, "Apollo Plan", an autonomous driving alliance already incorporating Ford, Daimler, Nvidia and Intel among its 100 or so members.

EV¹ sales evolution in last 12 months

EV sales figures have kept increasing globally over the last 12 months

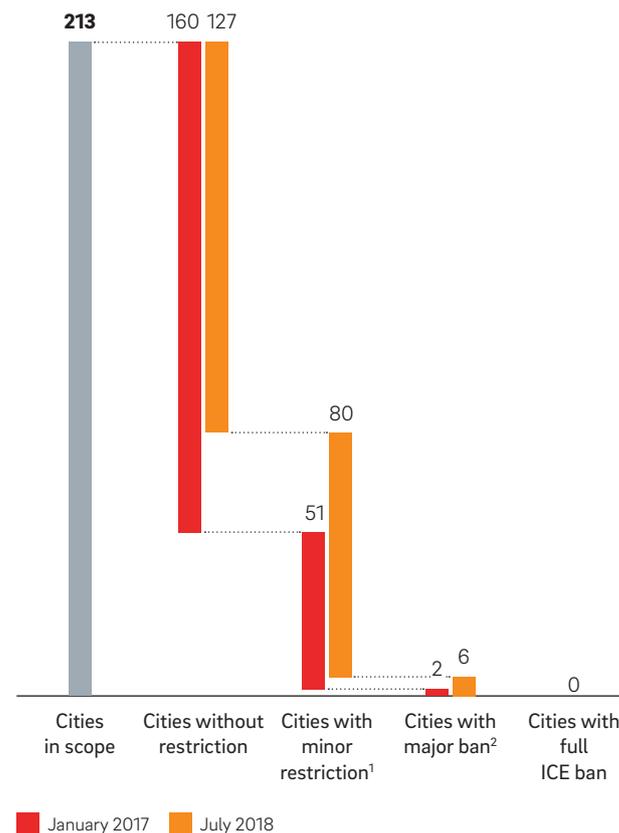


1 Electric vehicle

Source: ADR survey, Roland Berger

Regulatory evolution for Internal Combustion Engines (ICE) in urban areas

Slow but sure trend in cities developing various forms of ICE restrictions in the last 18 months



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

The last twelve months have also been a busy year for investors (July 2017-June 2018), with venture capital firms injecting more than USD 25 billion into mobility services and artificial intelligence, a key technology in AVs. The figure the year before was USD 14 billion.

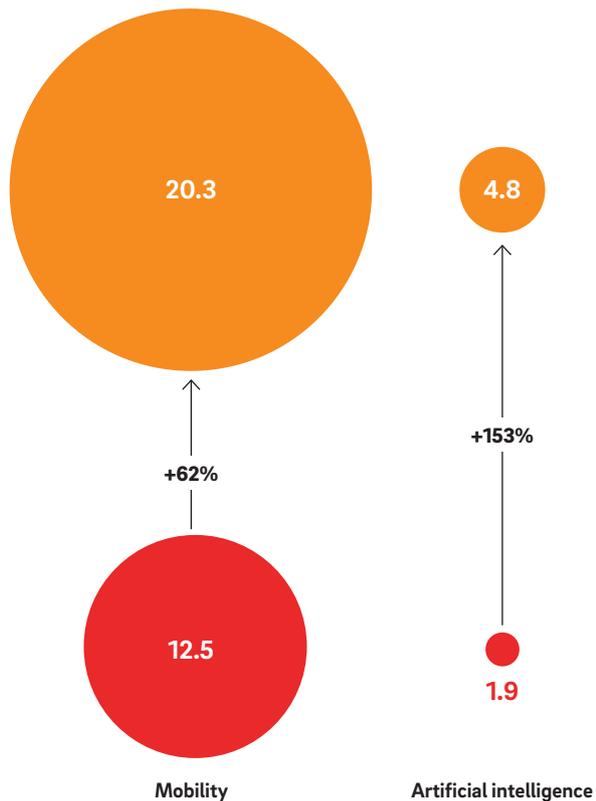
AI firms were the major beneficiaries, receiving almost USD 5 billion – a more than 150% increase on the previous period. Chinese deep-learning specialist SenseTime raising a record USD 600 million in a funding round led by online retailer Alibaba was the standout deal, but others were also significant. Silicon Valley-based Nauto, which retrofits vehicles with safety and networking systems, raised USD 159 million in a series B round led by Japan’s SoftBank. The firm’s systems have huge potential for gathering data for the development of self-driving cars.

It’s not only capital that’s being boosted. The number of full time R&D staff registered on LinkedIn and working in mobility services and autonomous driving hit an all-time high of 57,000 employees, a 27% increase in the past year. Patent approvals also shot up, with the share of patents relating to autonomous vehicles rising from 2.2% in 2017 to 3.9% in the first half of 2018.

Finally, several automakers unveiled big plans in the mobility field. Most notable among these was Ford’s announcement that it would consolidate its self-driving operations and invest USD 4 billion in autonomous vehicles by 2023, including USD 1 billion in transport specialist Argo AI.

**Investment in mobility and artificial intelligence¹
(in USD bn)**

Venture capital invested in disruptive technologies has almost doubled in one year



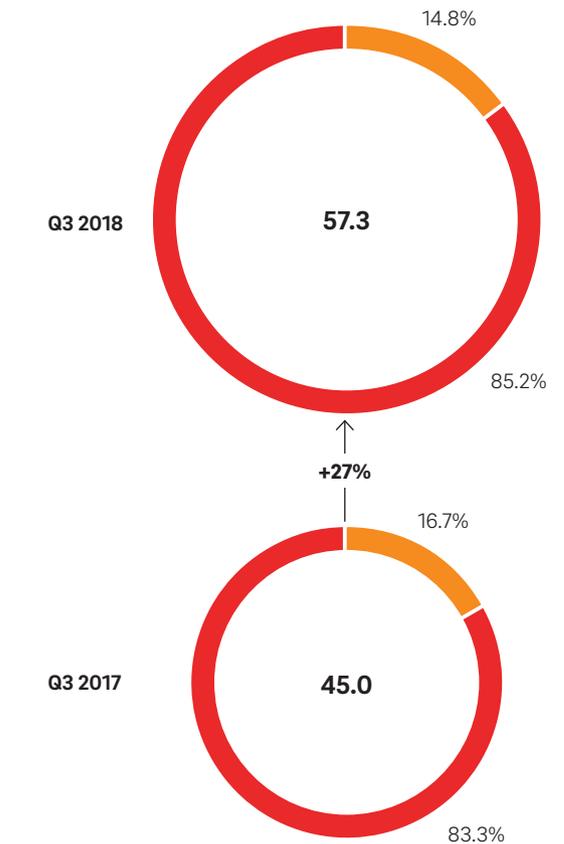
■ Jul 2016 – June 2017 ■ Jul 2017 – June 2018

¹ Including investments in smart cars, AI in transportation and autonomous vehicles technologies, and AI infrastructures (natural language processing, computer vision, etc.)

Source: Tracxn, Roland Berger

Number of employees listed on LinkedIn ('000)

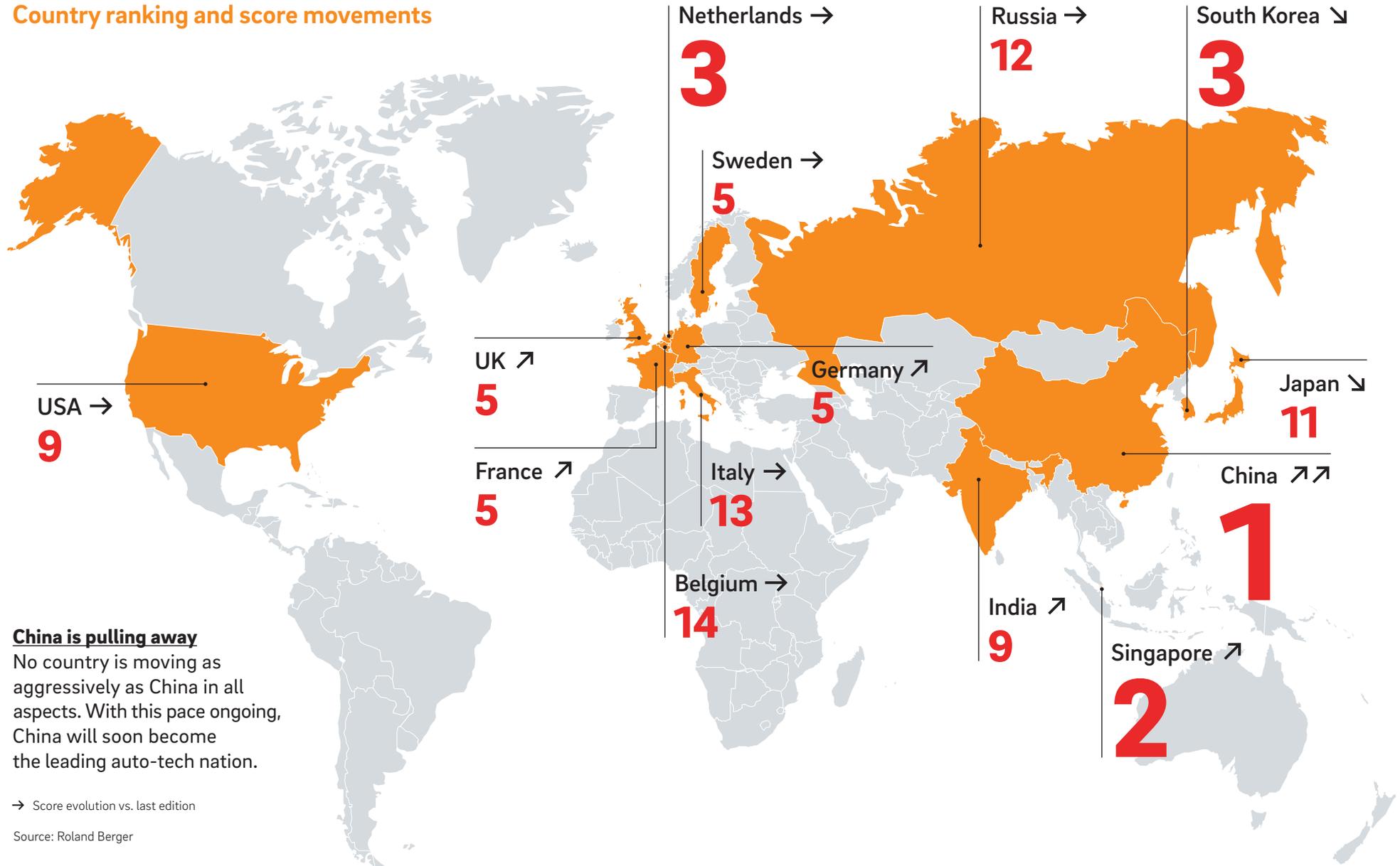
Continuous increase of R&D resources working on mobility services and autonomous driving



■ "Autonomous" job related ■ "Mobility" job related

Source: LinkedIn, Roland Berger

Country ranking and score movements



China is pulling away
No country is moving as aggressively as China in all aspects. With this pace ongoing, China will soon become the leading auto-tech nation.

→ Score evolution vs. last edition

Source: Roland Berger

Spot facts by country

CHINA #1 (75)

- Despite having a huge road network, China doubled its charging infrastructure in the past year, from 2.5 charging stations per 100 km of roadway to 5.7
- Chinese customers have the most faith in EVs – 39% would buy one to replace their trips on public transport

SINGAPORE #2 (70)

- 80% of Singapore respondents, 30% above the average, know at least one person who doesn't want to buy a car because they exclusively use other mobility services
- Singapore has by far the highest proportion of shared vehicles on its streets, at 16%

NETHERLANDS #3 (67)

- After topping the ranking in ADR2, the Netherlands stagnated in ADR4 and has been overtaken by several Asian countries
- Sales of electric and hybrid vehicles in the Netherlands rose to 3.3% of total vehicle sales even though EV subsidies fell

SOUTH KOREA #3 (67)

- South Korea leads in the provision of public test roads and test tracks for autonomous vehicles
- A majority of South Koreans, 55%, would prefer to use robocabs rather than owning a car

FRANCE #5 (62)

- French people like to drive: 70% of their total journey mileage is undertaken in a car, second only to the US (85%)
- The testing phase of France's 5G network, a critical component of autonomous driving, started in July 2018 and will last two years. It is one of the first trials

SWEDEN #5 (62)

- 45% of Swedes are open to robocab business models, yet currently only 25% use an app more than once a week to plan a trip
- Almost 6% of all vehicles sold in Sweden were all-electric or hybrid models, the highest proportion of all countries

UK #5 (62)

- The UK was the only European country in which sales of all-electric or hybrid models stagnated over the past six months, still representing just 1.6% of total vehicle sales
- People in the UK are yet to be convinced about EVs: only 25% say they are considering buying one

GERMANY #8 (60)

- Nitrogen oxide emissions continue to dog Germany's automotive industry – Hamburg initiated the first diesel ban on selected roads in the inner city
- Germany offers the highest number of EV models, yet only increased its EV sales rate to 1.8% of total car sales compared to 1.6% in ADR3

INDIA #9 (59)

- Despite approx. 65% of Indian respondents saying they would consider buying an EV as their next vehicle, only about 1,600 all-electric vehicles were sold in India in the first half of 2018
- Indians are not overly interested in autonomous mobility services: 70% would still buy a car even if robocabs were cheaper

Spot facts by country



USA #9 (59)

- It's not just US carmakers and tech firms that are interested in AVs, other industries are too. For example, retailer Walmart announced a deal with Waymo to test a grocery pickup service
- The US is the first country to run commercial tests of autonomous vehicle services



JAPAN #11 (58)

- Only 30% of Japanese respondents know at least one person who doesn't want to buy a car because they exclusively use other mobility services. The average is 50%
- Despite a high level of activity in autonomous driving, Japan shows no sign of introducing pollution restrictions on normal cars



RUSSIA #12 (57)

- Russians are the most spoiled for choice when it comes to choosing a transportation mode – 60% have a choice of mode for more than 40% of trips
- But the country has plenty of room for improvement in e-mobility: It finished bottom on the number of EVs sold, share of EV models available and charging infrastructure



ITALY #13 (56)

- Italy has the worst public charging infrastructure for EVs in Europe, at 0.4 charging stations per 100 km of road
- Investment development plans for 5G network experimentation have been approved in 5 cities (Milan, Prato, L'Aquila, Bari and Matera)



BELGIUM #14 (52)

- Belgians are the most price sensitive when it comes to electric vehicles – approx. 60% of drivers gave high cost as the reason for not buying an EV
- Belgium is one of only two ADR countries with no public test tracks for autonomous vehicles

What is the Automotive Disruption Radar?

The ADR is a biannual analysis of market trends related to disruption in the global automotive industry. Its latest findings are based, among other sources, on a survey of 14,000 car users in 14 countries (Belgium, China, France, Germany, India, Italy, Japan, Netherlands, Russia, Singapore, South Korea, Sweden, UK, USA). Each is scored along 26 indicators, grouped into five dimensions:

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

The ADR aims to answer key questions such as: which factors are driving change in automotive ecosystems; how are these evolving; and what can decision makers do to manage disruption?

List of all indicators and measures



○ Indicators ○ Measures

Authors

Dr. Wolfgang Bernhart

Senior Partner

+49 711 3275-7421

Wolfgang.Bernhart@rolandberger.com

Stefan Riederle

Senior Project Manager

+49 89 9230-8169

Stefan.Riederle@rolandberger.com

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PUBLISHER

ROLAND BERGER GMBH

Sederanger 1

80538 Munich

Germany

+49 89 9230-0

www.rolandberger.com



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.