Automotive Insights from Clearwater International

clearthought

Autonomous vehicles

The development of autonomous driving, connectivity and smart mobility are raising pertinent questions for OEMs

Seismic shift

Autonomous driving will revolutionise the automotive industry. It will reduce road accidents and deaths, cut traffic congestion, help tackle pollution, and increase productivity as drivers let technology take the strain.

For producers the developments in autonomous driving are upending the business models of OEMs as new entrants from the technology sector pour billions into the automotive industry, creating a seismic and long-lasting shift in the market.

Backed by very strong balance sheets, these new entrants are prepared to invest heavily in R&D – and talent - as they introduce a whole raft of new applications in vehicles. This poses a huge challenge for existing OEMs, not just in terms of trying to compete on R&D spend, but also in terms of where exactly to invest in the mobility revolution.

How much investment should go on autonomous driving? How much on electrification? And how much on connectivity solutions and shared mobility?

Which business models, especially in terms of mobility concepts, will emerge for OEMs and other stakeholders in a connected, autonomous driving world - and to what extent they will threaten or substitute today's largely hardware-based revenue model of OEMs – is one of the key unanswered questions.

Integrated solution

Winners will be those players which are able to offer consumers - and successfully charge for it - maximum convenience in an integrated solution, combining low-to-zero emissions, autonomous driving, connectivity and smart mobility concepts.

The winners could be an element of both old and new companies, as new tech entrants strike up relationships with established players in their rush to acquire new technical skills, a trend we have seen in the M&A space lately.

As a recent report[1] noted, OEMs are now seeking solutions that integrate a "connected lifestyle with existing mobility solutions". But competitors from the digital world are defining the problem and solution from the opposite direction, wanting to "integrate mobility with an existing connected lifestyle" that consumers already enjoy.

As another report[2] notes, to deliver semi-autonomous and fully autonomous driving, the software used to determine a car's position and trajectory on the road will have to deliver a new level of capability compared to current ADAS (Advanced Driver Assistance Software). The development of new radar systems and laser-based LiDAR (Light Detection and Ranging) scanning devices will be critical.

Timescales

Many across the industry believe that despite the huge technological advances we are seeing, regulations will ultimately set the pace of autonomous vehicle (AV) growth.

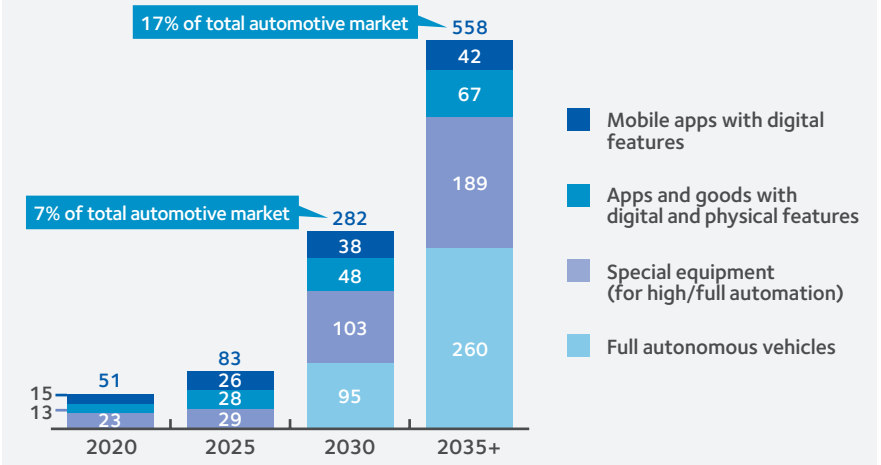
For instance, when a passenger is not controlling a vehicle a key question is what happens if there is an accident. Who is responsible - the manufacturer, the software provider, or the passenger? Aligned to these tough questions there is also public scepticism. As such, the prevailing view is that fully autonomous cars are likely to remain a small-volume market for some time yet.

For at least the next decade most consumers are more likely to buy vehicles that use technology only to assist drivers, such as automated emergency braking or assistive parking, rather than fully autonomous cars.

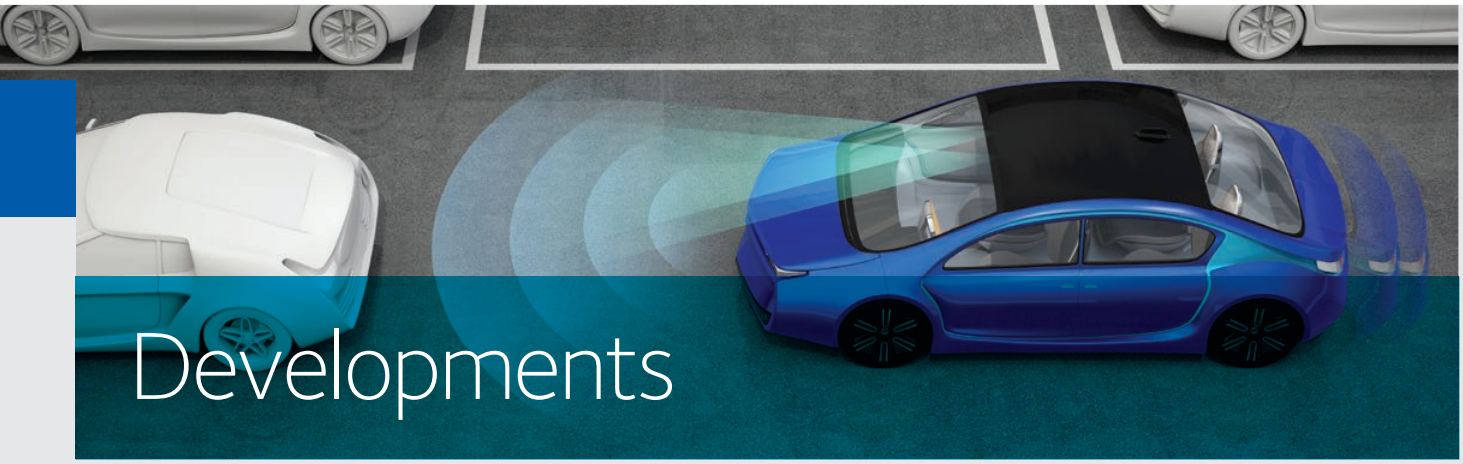
[1] A.T. Kearney – How automakers can survive the self-driving era

[2] Goldman Sachs - Monetising the rise of Autonomous Vehicles

Global market for automated and autonomous driving, including related services ($bn)



SOURCE: IHS Automotive, Berylis Connectivity, Compass 2014, Factiva, Just Auto; A.T. Kearney analysis



Developments

Market forecasts

As the chart on the previous page shows, the annual market for special equipment in AVs (on board control, guidance and communication systems) will reach $103bn (€83bn) by 2030, while the market for AVs will reach $95bn (€76bn) by that date[1]. The overall value of the market is expected to double to almost $560bn (€450bn) between 2030 and 2035.

IHS Automotive[2] also recently revised its forecasts for AV sales upwards, forecasting nearly 76 million vehicles with some level of autonomy sold by 2035. It predicts particularly strong growth between 2025 and 2035, with sales of all AVs growing from just under 1 million units in 2026 to 21 million units in 2035.

Levels of autonomy

The gradual move towards AV is represented by many different levels of autonomy in a vehicle (see table below).

These range from scenarios where the driver is in complete control and there is no automation, through to one where the driver is not expected to be available for control at any time during the trip.

Assessing the speed at which the industry moves up to higher levels will be crucial for leading players as they set out their strategies over the coming decades.

Regulation

A few years ago a report from Goldman Sachs[3] said the current regulatory framework was not set up to contemplate the legalities and liabilities associated with vehicles that drive themselves.

Fast forward to 2018 and the regulatory environment remains just as unclear and complex with the absence of a clear regime for liability of an autonomous vehicle.

The US, which has been at the forefront of the AV revolution, has been grappling with the issue for many years and in the absence of a federal lead individual states such as California, Nevada and Arizona have been writing their own rules. However, last year the US Senate did finally publish principles outlining what legislation around AVs might look like.

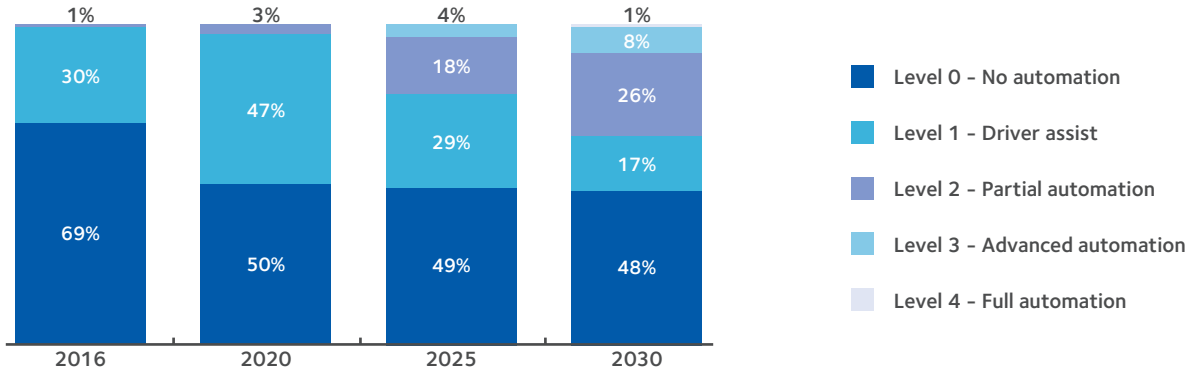
In Europe the UK has published a Modern Transport Bill setting out what needs to be done to support the introduction of driverless cars. The Bill lists a number of proposals regarding how self-driving cars should be insured, and lays out instances where the owner will be at fault, even after engaging autonomous mode.

In Germany new ethical guidelines state that the software that controls AVs must be programmed to avoid injury or death at all cost. Germany has also passed legislation under which a driver must be sitting behind a wheel at all times ready to take back control if prompted to do so by an AV. Meanwhile China is developing national regulations for testing of AVs on public roads.

However social acceptance of self-driving remains one of the biggest barriers to AVs with significant scepticism among consumers. Concerns about the safety of the technology are paramount, but there are security concerns too as vehicles become more automated and prone to hacking.

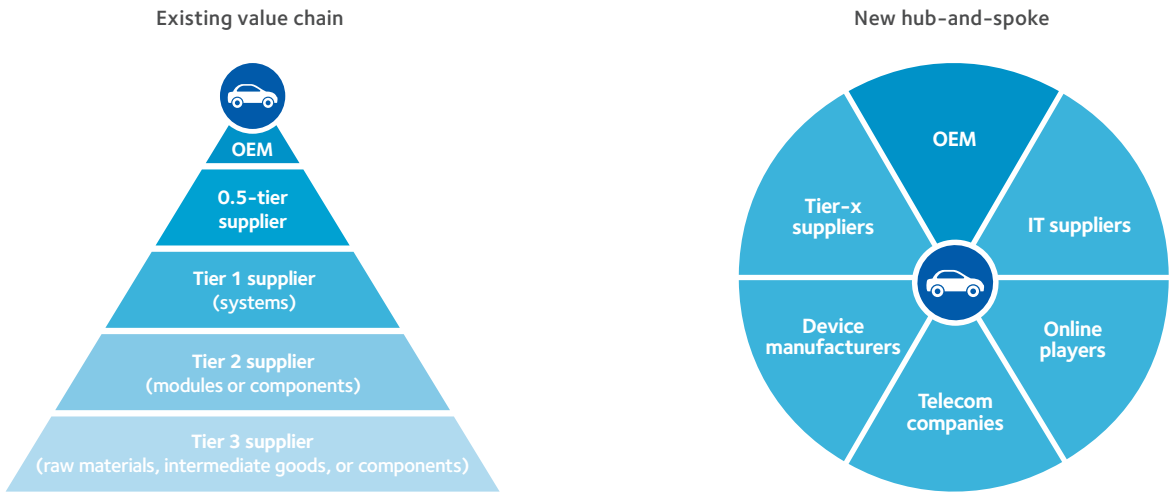
Existing transport infrastructure also poses difficulties. For instance Baidu, a leader in driverless car technology in China, recently said that chaotic roads in China, where cars compete with scooters and pedestrians, was a "serious obstacle" to staying competitive in autonomous driving.

Increasing share of automation in the mid-term



SOURCE: Clearwater International research

Autonomous driving will disrupt the automotive industry



SOURCE: A.T. Kearney

OEM strategies

Announcing plans to launch a public ride-sharing service in several cities that use fully self-driving cars by 2019, General Motors recently described self-driving cars as "the biggest thing since the internet".

For OEMs such claims are fully justified. Precisely how they match consumer needs with autonomous driving solutions, while overcoming public scepticism about relinquishing control of vehicles, remains a key question. Which business models will win in this new landscape?

A.T. Kearney[1] predicts that although it will take up to 20 years for fully autonomous driving to emerge, not all OEMs will get a piece of the market and it is dangerous to assume that the sheer size of the market will guarantee that everyone is a winner.

In particular it thinks that the existing 'pyramid' value chain in the automotive industry will be replaced by more of a hub-and-spoke arrangement (see above). Compounding the challenge is that nearly all participants in the other spokes are multi-billion dollar companies with strong research and development teams, regional or global market leading positions, and have "an appetite for large, game-changing growth opportunities".

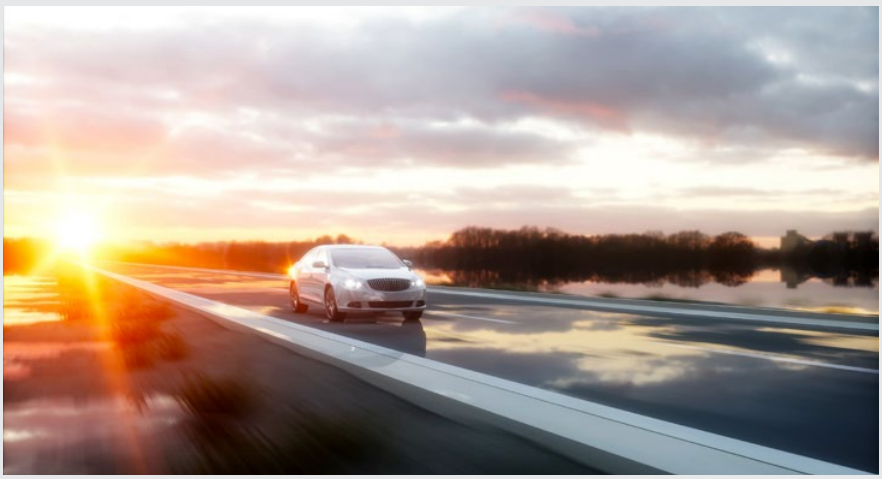
Against this backdrop OEMs are having to think hard about which players they should be partnering with. As the chart on the right shows, they are in a scramble to secure tie-ups with the partners that they think they will need to gain market share.

A good example of a deal earlier this year saw chipmaker Nvidia partner with Uber, VW and China's Baidu. Uber will use Nvidia's chips for its artificial intelligence (AI) computing system in its fleet of self-driving cars, while VW will use the Nvidia Drive IX platform to help develop its next set of cars.

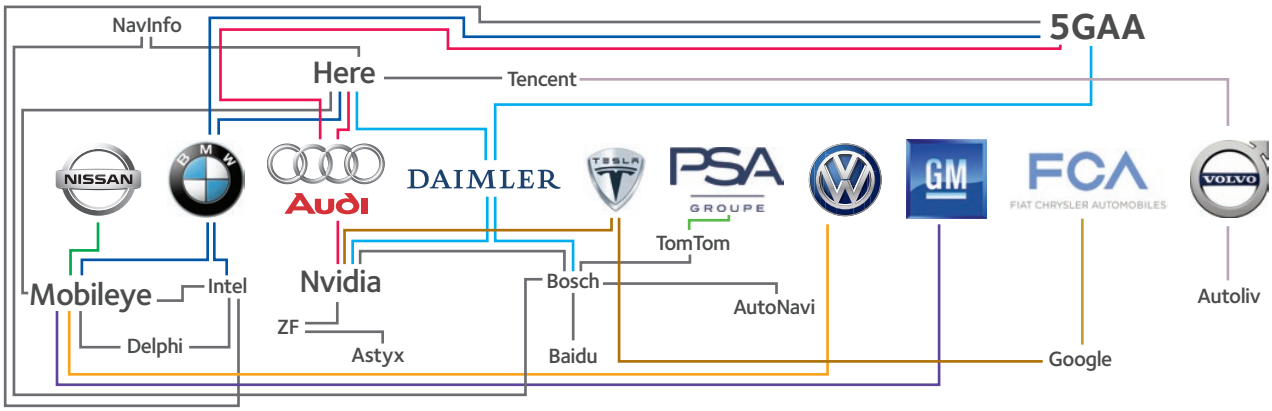
OEMs also need to take on board the impact that AVs and changing consumer habits will have on their bottom line. For instance, one of the reasons why there has been so much corporate activity around the 'robo-taxi' market is that observers think this could be one of the first areas to really see the impact of AVs as more consumers seek connected and shared driving options.

When we spoke to leading AV expert Professor Dr Hans Christian Reuss, from the Research Institute of Automotive Engineering and Vehicle Engines in Stuttgart, he said AV is a very complex subject for OEMs because it cannot be considered separately from the topics of electrification of the drives and networking of the vehicle's functions.

He adds: "A particular challenge is safety as for vehicles with automation levels 3 and 4 billions of kilometres of testing are required, and this protection can only be fulfilled with virtual test procedures such as 'Virtual Integration and Test' or 'Hardware-in-the-Loop' testing of automation functions and driving simulation. Due to the enormous importance and the interdisciplinary nature of autonomous driving there will be great demands on the education and training of engineers."



A selection of international manufacturing supplier cooperation in autonomous driving



SOURCE: Automobilwoche

Supply chain impact

Tier 1 suppliers also face a huge range of options and challenges in this new landscape. To become leaders in assistive and autonomous technology, Bain[4] says suppliers will need to develop new capabilities, especially in certain aspects of software engineering, such as raw data fusion and machine learning which enable vehicle systems to analyse data from multiple sensors and make correct decisions in the absence of a human driver.

Suppliers will also need to embark on M&A as well as strategic partnerships and alliances to ensure they have access to important technologies and skills. Above all, it says they will have to change the way they operate, becoming more agile and maintain a flexible approach to strategy while strengthening their own technological culture.

As the chart below shows, this race to gain the technology and IP needed to be leaders in the AV field is gathering pace among both Tier 1 suppliers and OEMs.

What is also striking is that it appears they have - for the time being at least - stolen a march on the tech giants, with only Google just scraping into the top 10.

[1] A.T. Kearney – How automakers can survive the self-driving era

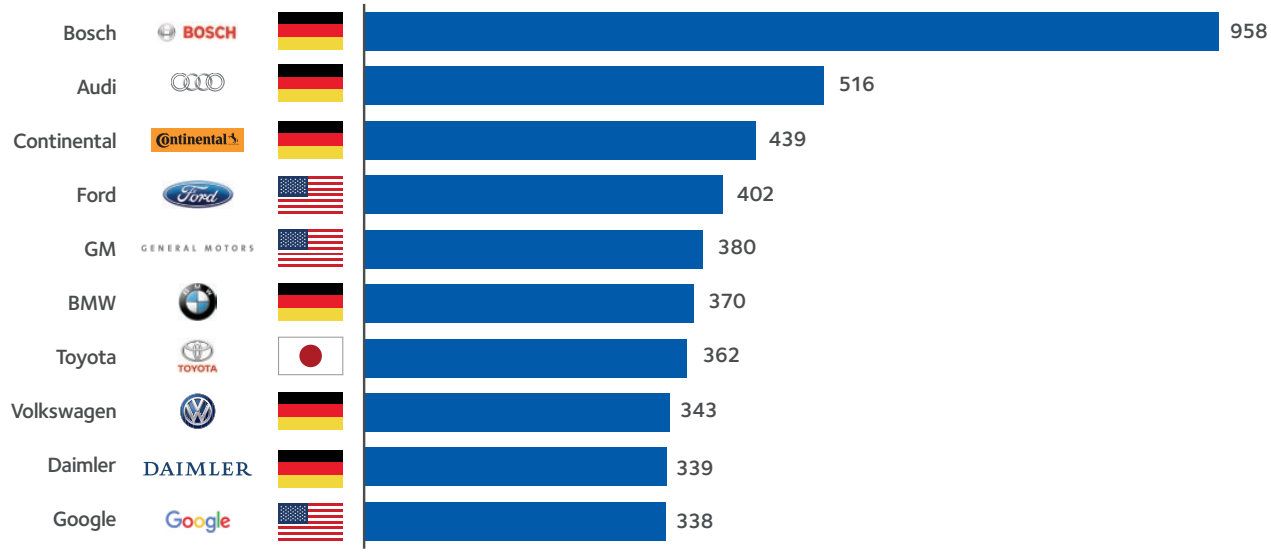
[2] IHS Automotive – Forecast October 2017

[3] Goldman Sachs – Monetising the rise of Autonomous Vehicles

[4] Bain – An Autonomous Car Roadmap for Suppliers

Who leads the autonomous driving patent race?

Number of worldwide patent filings related to autonomous driving (Jan 2010 - Jul 2017)



SOURCE: Cologne Institute for Economic Research, WIPO

M&A activity

The fact that the Silicon Valley tech giants are entering the automotive supply chain is nothing short of a revolution for the automotive industry.

Furthermore, leading internet groups from elsewhere in the world are also joining the party. For instance China's leading internet groups Baidu, Alibaba and Tencent are all building intelligent and connected vehicles.

Where the two camps meet will be critical. Parties on both sides are striking up non-exclusive relationships and collaborations, and over the past year we have seen a wave of announcements.

For instance Ford is collaborating with Lyft to develop self-driving taxis available for commercial use by 2021, while General Motors has also invested heavily in Lyft and is testing hundreds of electric self-driving taxis on public roads. Lyft's other partners include Jaguar Land Rover and Waymo, the self-driving unit of Google's parent Alphabet. Meanwhile Uber has struck a deal to buy up to 24,000 self-driving cars from Volvo.

Notable recent deals:

General Motors acquired **Strobe**, the US-based developer of laser-imaging technology geared toward enhancing the development of AVs. Strobe will join Cruise Automation, a subsidiary of GM. The acquisition enables GM to accelerate its efforts to build and test electric cars with self-driving capabilities.

Autoliv, a Sweden-based manufacturer of automotive safety systems, acquired the LiDAR and Time of Flight brands from **Fotonic i Norden AB**, a Sweden-based camera specialist. LiDAR and Time of Flight cameras are important sensors to make autonomous driving a reality.

Innoviz Technologies, a leading provider of LiDAR sensing solutions, raised $65m (€52m) in a recent fundraise. Delphi Automotive PLC and Magna International participated in the round, along with additional new investors including 360 Capital Partners, Glory Ventures and Naver.

LeddarTech, a Canadian developer of Leddar, a LiDAR sensing technology, secured $101m (€81m) in a round of financing. Investors included Gillingham, Delphi, Lombardy, Magneti Marelli, Integrated Device Technology and Fonds de solidarité.

Continental Aktiengesellschaft, a German manufacturer of automotive components, acquired a minority stake in **EasyMile**, a France-based provider of shared driverless transportation. The acquisition enables Continental to develop cutting-edge technologies for autonomous driving in cities. Continental has also acquired Israel's **Argus Cyber Security**, a specialist in guarding connected cars against hacking.

ams AG, the Austrian designer and manufacturer of high performance analogue and mixed signal solutions, acquired **Princeton Optronics**, the US-based company that develops high-power Vertical Cavity Surface Emitting Lasers (VCSELs).

TomTom, the Dutch provider of navigation solutions, acquired **AutoNOMOS Labs**, a German developer of autonomous and driver-assistance systems to prevent road collisions. The acquisition strengthens TomTom's position in autonomous driving.

Intel Corporation acquired a minority stake in **HERE**, the US-based provider of digital maps and location-based services. The acquisition will enable Intel and HERE to collaborate on the research and development of a proof-of-concept architecture that supports real-time updates of high definition maps for fully automated driving.

Autoliv and **Volvo** set up a joint venture to develop software for autonomous driving and driver assistance systems. The transaction is in line with Volvo and Autoliv's strategy to use the latest ADAS/AD know-how to create robust and flexible solutions that are at the technological forefront.

Delphi Automotive acquired self-driving car startup **nuTonomy**, a US software company. nuTonomy was founded by Karl Iagnemma, head of MIT's robotic mobility group, and Emilio Frazzoli, a professor of aeronautics and astronautics, to develop a full software solution to handle autonomous driving.

Deal highlights

Some of our recent deals

Finoba

Lightweight component processing and machining firm

Clearwater International advised the shareholder of Finoba Automotive on the disposal of its shares to China National Machinery Industry Corporation

Faurecia

Automotive equipment supplier

Clearwater International advised Faurecia on the acquisition of Chinese in-car infotainment and technology company Jiangxi Coagent Electronics

Orlando Management

Private equity firm

Clearwater International advised Orlando Management AG on the sale of Beinbauer Group to H.I.G Capital

Buchbinder

Car rental company

Clearwater International advised shareholders of Buchbinder on the sale of the company to Europcar Group

Alantra

Private equity firm

Clearwater International advised Alantra Private Equity on the cross-border acquisition of MD Moldes, an automotive lighting mould manufacturer, based in Portugal

BENTELER

Global automotive component supplier

Clearwater International advised BENTELER on the planned sale of the Norwegian aluminium die casting business to Chassix, Inc.

Meet the team

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