



THE GROWTH OF THE CONNECTED VEHICLE DATA MARKET – THE  
IMPLICATIONS OF PERSONAL DATA AND EMERGING US LEGISLATION

06

# Market development challenges

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## 06 | MARKET DEVELOPMENT CHALLENGES

This report highlights the broader challenges identified in the research that could materially limit or impact the development of the connected car data market.

The first challenge identified was OEM underinvestment. There are considerable costs associated with transmission, storage and operations, which may force manufacturers to limit how much they invest. Secondly, competition with other technologies presents a significant challenge. Smartphones already dominate consumers' digital experiences, and if OEMs do not actively develop innovative services due to associated costs and difficulty with achieving critical mass for app development, users' own devices may be seen as a cheaper, easier alternative. Other challenges that will be explored in this report include consumers' resistance to targeted advertising in their vehicles, mandated sharing of connected car data and the enhanced technological requirements needed to keep up with this rapidly changing market.

Key Findings	<ul style="list-style-type: none"><li>● <b>OEM underinvestment:</b> the costs associated with the transmission, storage and operational management of connected car data are considerable and growing as data volume and complexity increases. OEMs may choose to limit investment in developing the connected vehicle data market which would stifle growth.  However, the research indicates that whilst investment is being carefully managed across a range of priorities, connected car data remains high on the agenda for most industry players.</li><li>● <b>Competition for the Infotainment Platform:</b> OEMs' derive brand and wider economic value from the Infotainment platform but are now challenged on two fronts:<ol style="list-style-type: none"><li>1. Devices brought into the car (notably Smartphones) could come to dominate consumers' in-car digital experience if connected car data is not actively developed by OEMs to deliver innovative consumer services. However, dominance by BYO devices was seen as unlikely in the medium term because the value of core car data and the use cases it enables, will continue to drive major data market growth.</li><li>2. The major cost of building and maintaining the embedded infotainment systems, and the difficulty of achieving critical mass for app development, means that many OEMs are looking to embed this capability from Apple and Android or allow them to mirror the software from a smartphone.  Android Automotive OS is gaining significant traction, bringing the advantages of the huge Android developer market and scale platform investment.  OEMs need to consider carefully the degree of integration of such systems to avoid losing value opportunity from 'core' connected car data – and so strengthening the platform provider's competitive position in the market. Pressure to give up underlying vehicle data is likely to increase in future and OEMs will need to innovate and support the delivery of new services if they wish to maximise the value and benefits of their data.</li></ol></li><li>● <b>Advertising Revenue Models:</b> of extracting value from vehicle data may face challenges that mean they may not become as significant in the connected car market as they have in other markets. The car is regarded as a very personal</li></ul>
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	<p>place and many of the experts we interviewed suggested that consumers may resist targeted advertising in this environment.</p> <ul style="list-style-type: none"> <li>• Mandated wider sharing of connected car data: on-going lobbying for the extension of US Right to Repair legislation, and sharing data for improved vehicle safety could create new costs for OEMs, potentially without any corresponding direct return for the OEM, albeit society and others in the ecosystem would still derive benefits</li> <li>• Enhanced Digital Capabilities: will become critical to OEMs as they seek to access the new opportunities in connected vehicles, key areas include: <ul style="list-style-type: none"> <li>○ Data Centricity: to continue to improve the efficiency of R&amp;D and manufacturing operations with advanced digital capabilities in areas such as machine learning/AI and analytics.</li> <li>○ Digital Centricity: the car will become a ‘living product’ - with continuous upgrades in lifecycles of months, if not weeks. To delivery this, OEMs will need to apply digital business and technology skills throughout the development, production and support phases.</li> <li>○ Customer Centricity: delivering consumer data enabled services opens up a new direct and ongoing engagement between OEMs and consumers. Maximising this opportunity will require the development of new forms of customer engagement and management capabilities.</li> </ul> </li> </ul>
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This study identified a range of wider market factors that could constrain or otherwise impact the development of the connected car data marketplace:

- Investment prioritisation by OEMs that may constrain market development and growth
- The competition for position in critical areas of the in-car architecture and the impact this might have on market development
- Potential changes to the advertising model of funding digital services
- Potential legislative moves, beyond those discussed in Section 5, on data sharing that might shift the dynamics of the evolving market ecosystem
- The digital capability shifts required of OEMs in particular to effectively grow and compete in the connected car data marketplace

### 1.1. Economic Risk – OEM Under-Investment

The costs associated with the transmission, storage and operational management of the resulting data are significant and growing rapidly as the number of connected vehicles and the amount of data collected per vehicle per annum increases.

*“I think one of the important things to understand with this data is ...that the cost to retain the information is astronomically high and can destroy the business or the business model for retention”*

Michelle Avary, WEF

*“Data Access Requests [relating to PII] may become an issue... a lot of the car companies... realized when they were doing their data mapping exercises, that if they received a significant number of data access requests, then this was going to cost them a lot of money”.*

Joe Jerome, Policy Counsel, Centre for Democracy & Technology

There is a risk that OEM under investment will stifle growth. This could be manifest in different ways, depending on the strategic stance of each OEM e.g.:

- Some could de-prioritise investment in the wider development and monetisation of connected car data in the face of other challenges or opportunities – possibly deciding to take a ‘watching brief’ at this stage and focus investment on other priority areas e.g. EV or AV development.

- Others could revert to treating telematics and data purely as cost elements – minimising capabilities to address only mandated data provision.

Alternatively, investment could be focused solely on driving operational and performance benefits of core connected car data rather than the broader value. This would have the effect of decelerating but not stifling innovation and overall market development.

A possible outcome of OEM under-investment could be that a larger proportion of new value creation is left in the hands of those developing services on ‘Bring Your Own’ (BYO) or ‘brought-in’ devices – with smartphones (and smartphone-centric organisations) taking the primary position in the literal and figurative eyes of the consumer. This, despite smartphones frequently operating on lower quality data than that generated by the vehicle.

However, overall the research suggests that whilst investment is being carefully managed across a range of priorities, connected car data remains high on the agenda for most industry players. Amongst the long-established OEMs, some have invested significantly in the use of connected car data e.g. GM, Toyota and BMW. This is expected to extend to more OEMs as they establish the required capabilities (see Section 6.5).

In an increasingly competitive automotive industry, it is possible that driving operational efficiencies using connected car data may become ‘table stakes’ for OEMs. New OEMs such as Tesla have been ‘data enabled’ from the start and so well positioned to utilise data to drive operational efficiency and innovate new data-enabled services

OEM investment profiles are therefore more likely to affect the pace of growth in the market and the degree to which risk and revenue sharing approaches are used rather, than its fundamental structure.

## 1.2. Structural Risk – Infotainment platforms and the ‘battle for the dashboard’

There has been much discussion of the ‘battle for the dashboard’ within the motor industry and the media - most of it focused on whether automakers or Global data companies (the ‘data giants’) will win out for control of the screen(s), and the associated data, in a connected car.

Broadly, there are two important subsets of value for the OEMs within the connected car data market:

1. The value driven from the ‘core’ or ‘lower-level’ connected car data, generated by a variety of sensors in the vehicle, much of which is closely related to the movement and operation of the vehicle.
2. The value derived from non-core or ‘higher level’ data related to the use of the infotainment system in the vehicle. This is important for many reasons, including:
  - This is a key part of the interface with the driver, both for the collection of data (e.g. a drivers navigation destinations, radio preferences, etc. – which may be considered PII, if it can be linked to the individual), and for the delivery of data-enabled services to the driver (e.g. real-time traffic information).
  - The infotainment platform that the driver uses – or at least some aspects of it (e.g. navigation) – may not be the one embedded in the vehicle, but may be brought in by the driver e.g. a smartphone - either standalone or tethered to the in-car system using for example, Apple CarPlay or Android Auto.

The OEM is in prime position to leverage the value from the ‘core’ connected car data, but that is not necessarily the case for the value associated with the infotainment platform. While the core data set is of huge value and will underpin large markets, the higher-level data also has considerable value and the infotainment system provides the display on which many data-enabled services reach the consumer. It is the latter that this section explores in more detail.

There are potentially two platform types capable of enabling the infotainment data value:

- A brought-in or BYO device – typically a smartphone.

- The vehicle's embedded or 'native' infotainment system.

There are important implications for the way that each of these might develop, and/or which may become dominant in the eyes of the consumer.

### 6.2.1 BYO / Smartphones Data Value

BYO devices are not dependent on access to data from the vehicle itself – a smartphone can use its own sensors and data to deliver some services similar to that enabled by vehicle data. For example, using its own location and positioning capabilities to deliver navigation services.

Whilst these capabilities may not typically be as high quality as the 'native' capabilities within the vehicle, BYO providers are likely 'fill the vacuum' if connected car data itself is not used by OEMs to innovate and deliver key consumer services.

Smartphones and their providers do have some clear advantages over the in-car platform. They have established, enormous and mature developer communities, delivering consumer apps. In the words of one industry executive:

*“Can OEMs cultivate the app ecosystem on the native platform - surely the BYO platforms have already won this space?”*

Anonymous Automotive Industry Executive

The wider model of smartphone providers also means that they are well-placed to provide seamless – or at least portable – services that join up different aspects of the consumers lifestyle, including motoring.

The general view amongst research participants, however, was that dominance by BYO devices was an unlikely scenario in the medium term. As discussed in earlier sections, the value of core car data and the use cases it enables, not only customer facing, but also B2B and B2B2C, will continue to drive major data market growth.

*“There is generally a conservative approach (based on this data) at present, but automakers are definitely looking at this as an opportunity to gain valuable data insights that will further enhance vehicle safety, products, and services available to consumers.”*

Steve Gehring, Vice President Vehicle Safety & Connected Automation, Global Automakers

### 6.2.2 Native or Embedded Infotainment Platform Data Value

Many participants in the research felt that the more critical issue is who takes the prime position on the in-car (embedded or native) infotainment platform. (Whilst used primarily for running the infotainment system, embedded systems also control some aspects of the in-car environment e.g. air-conditioning/climate control.)

Historically, OEMs dominated this space by developing their own operating systems. One of the largest initiatives in this space being Automotive Grade Linux (AGL) - used by Toyota, Jaguar Land Rover, Nissan and others.

The continued development of multiple infotainment operating systems (either by individual OEMs or consortia) could mean that none reach 'critical mass' in the market. In particular, app development could be constrained – because developing services for multiple platforms is less cost-efficient, and each will have limited reach. This could restrict innovation and hence the range and richness of services available.

These factors, together with the significant cost of developing and maintaining sophisticated infotainment operating systems led the majority of the research participants to the view that OEMs will increasingly look to 'buy in' this capability.

Until recently, Blackberry's QNX Automotive was the leading option in this space, but there is an increasing trend toward the use of Android Automotive OS (developed by Google and Intel in conjunction with a number of OEMs). GM, the Renault-Nissan-Mitsubishi alliance, Volvo, VW Group having already adopted this approach.

Widespread adoption of Android Automotive OS could be a key enabler for this developing market:

- Bringing to bear the massive developer base already focused on building applications for this environment (offsetting the key smartphone advantage).
- Creating the environment for open innovation that has been the driver of success in the wider Android app market.

*"We feel that as with smartphones, open innovation is critical to secure the biggest possible variety. It looks as though the industry will gravitate towards an Android platform and Google Automotive Services to achieve this although only time will tell."*

David Green, Chief Digital Officer, Lynk & Co"

In taking a 'buy-in' approach however, there are significant issues to be navigated by the OEM in relation to data access and preservation of value.

OEMs selecting a 3<sup>rd</sup> party infotainment platform contractually agree to share data with the platform provider. The range of functionality supported by the platform, and the degree of access to connected car data available to the platform provider are often subject to negotiation.

Whilst typically a third-party infotainment system would not have direct access the full range of 'core' connected car data, contractual agreements could involve OEMs sharing this data with the platform provider. In this there is the risk that the OEM dilutes the value that they themselves can derive from the connected car data – and that the platform provider's strength in the market is further enhanced.

As several contributors to the research put it: there is a risk that in data terms, OEMs are reduced to just providing a 'dumb pipe' through which others innovate the value.

### 1.3. The Advertising Revenue Model

Many digital services (e.g. smartphone apps) are seemingly 'free' to consumers. They 'pay' for the service by allowing the service provider to gather their data and by agreeing to receive advertising as part of the service. The advertisers pay the service providers for positioning and presenting the advertisements.

The most sophisticated data platforms collect data from all aspects of a person's digital experience in order to better target advertising to that person. This is big business - \$24.1 billion of Google's \$27.77 billion revenue for Q3 2018 was from advertising driven in this way.

#### 1.3.1. Advertising-Led Services in Vehicles

There are already advertising-led services being provided in the connected car data marketplace. For example, Waze, the smartphone app navigation service, with 30m+ users in the US, offers personalised advertising about local amenities, when it detects that the car is stationary.

However, market-wide the use of advertising-based models based on connected car data is still in its infancy. Advertising models could be a major driver of market growth if privacy, security and driver reaction can be successfully addressed.

The in-car setting means different implications for the various aspects of advertising models. Data collection to build an understanding of generic, or specific user insights is readily facilitated by the connected car infrastructure. However, the presentation of advertising material is challenged by the fact that users are not continuously focused on in-car displays – and there are important safety implications. In future AV settings, this limitation may be removed enabling vehicle occupants to focus more fully on display screens.

Presentation is less of an issue for audio advertising, but the value add is likely to be more incremental to that which is already being generated by radio/content providers.

There are also advertising led services that could be enabled by vehicles but do not require the presentation of advertising material within the car. For example, the pricing of billboard space could be optimised if data was available for each location based on such factors as: number of vehicles passing, their origin and destinations, the quality profile of the vehicles. etc.

### 1.3.2. Considerations for the connected car Advertising Model

As OEMs prepare to share connected vehicle data with wider markets they will need to reflect on the debate about the ethical use of data. In particular:

- Customers are becoming increasingly aware of data collection, due to issues such as the Cambridge Analytica scandal.
- Data privacy legislation, such as the CCPA (in part, a response to such issues) may lead to significant numbers of consumers opting out of data collection or use. This would impact the advertising-led model at its very source.

The advertising industry has been lobbying for changes to emerging data privacy legislation to mitigate this impact. They have formed coalitions of interest to progress this (e.g. Privacy for America), with the further purpose being to educate and inform consumers of the benefits of the current advertising-led model.

In the in-car context, better targeted broadcast advertising would likely be seamless to consumers, who would not necessarily realise that the advertising was targeted at them. More overt targeting of content via say, the infotainment screens or even the dashboard of their vehicle might be more problematic – not only for reasons of safety or inconvenience, but because the car is regarded as a very personal place and participants in this research have suggested that people may not want adverts pushed to them in that context.

*“People think of their cars as their second home and personalizing that with a barrage of different types of advertising, well... I get that there's some potential value there to companies - I just question whether that's really what users want.”*

Joe Jerome, Policy Counsel, Centre for Democracy & Technology

*“Driving is a profoundly personal thing... and I can tell you right now there isn't a single individual that wants to be advertised to inside their car.”*

Doc Searls, Berkman Klein Center, Harvard University

Consumers may choose to opt-out of data collection in future. They are likely to still be able to access services but might find that there is reduced functionality or that payment is required to enable the product.

Ultimately, consumers that have defaulted to opt-out of data collection – realising the impact on their ‘free’ services – may decide to opt back in in order to continue receiving them, and avoid the incremental payments but it may be a painful journey for advertisers and advertising-led services along the way – and could impact significantly the way in which the market for some services powered by connected-car data develop.

## 1.4. Mandated wider sharing of Connected Car data

The mandated collection and sharing of vehicle data may impact on the way OEMs share data and on the commercial prospects of some use cases. Mandated sharing of data is not a new phenomenon as the collection and provision of emissions data has been required since 1996 and Right to Repair legislation in Massachusetts in 2012 led to the development of a USA-wide approach for sharing data with independent repair shops and other parts of the aftermarket.

These earlier data sharing initiatives largely pre-date the connected car but lobbying for the sharing of connected car data is currently underway in both the EU and USA. The implications of any legislation in this area are likely to be important in the development of the market for a number of reasons, including:

- Wider mandated data sharing might impose significant new costs on OEMs without any corresponding direct return as did the original requirement to provide emissions data. This might exacerbate the economic risk outlined in Section 6.1.1 above.
- It could change the economic value of some data e.g. if it is mandated that some OEM data must be provided free of charge to some other stakeholders, then the OEM's ability to get value from that data (at least in its raw form) will be reduced in some cases.
- By changing the nature of access to certain data, it might create the need for new players in the market (e.g. to facilitate the mandated sharing of data) or change the balance between players in the market.
- Wider access (potentially at no charge) would enable more players – including those beyond the motor industry – to innovate new services based on this data. This expansion of open innovation could stimulate market growth

Participants in the research highlighted two main areas where such wider sharing of data might gain greatest traction. These were the potential extension of Right to Repair legislation (discussed above) and the sharing of safety-related data.

#### 1.4.1. Potential Mandated Sharing of Safety Related Data

Whilst not as developed in a legislative or formal lobbying sense, there is also a body of opinion that suggests it should be mandatory for OEMs to share data that could result in improved vehicle safety.

The main precedent here is the Event Data Recorder (EDR), that records technical vehicle and occupant information for a brief period of time (a few seconds) before, during and after a collision, for the purpose of monitoring and assessing vehicle safety system performance. In 2013, the fitment of EDRs became mandatory on all cars sold in the USA and Canada irrespective of the country of manufacture. The format and a minimum standard for the type of data and sampling rates recorded by the EDR were also standardised.

In another safety related initiative in the European Union, from 2018 it became mandatory for all new cars to be able to communicate with emergency services automatically in the event of a collision (eCall), opening up a voice channel and providing data that would speed the emergency response in the event of an accident.

Calls for wider sharing of any data that might improve safety were further invigorated by the misfiring Takata airbag issue.

The wider mandated sharing of data has the potential to bring significant societal benefits, particularly in relation to safety. It can also positively impact consumers' support for, and trust in, the use of connected car data.

As the source of the vast majority of the data, OEMs have a pivotal role to play. Fair compensation will be an important aspect of any future data-sharing model.

#### 1.5. Digital capabilities are becoming a core feature of vehicles

Services based on connectivity and connected car data are an increasingly valuable part of the vehicle proposition.

*“The value of a vehicle used to be mainly on hardware and a little on software. With connectivity and ADAS, this is shifting. Ultimately, this will be more like 40% hardware, 40% software and 20% content... when vehicles are autonomous.”*

Franck Louis-Victor, Renault-Nissan-Mitsubishi Alliance

This transition in value toward software and content and connected car services (i.e. the connected car data market) is precipitating fundamental shifts in the automotive industry – with many OEMs focusing significant investment in this area.

Addressing this challenge requires enhanced capabilities, augmenting those typically held in the industry. Successful development of these capabilities is critical to the growth of the connected car data market – and to the core competitiveness of OEMs.

These capabilities are focussed particularly around data and customer centricity, as set out below.

### 1.5.1. Data Centricity

The industry is already using data at scale to drive and improve the largely automated manufacturing processes employed by modern automakers to build.

Improving the efficiency of R&D and manufacturing operations (applications focused in Level 1 in the data usage model described in Section 2) will require increasing use of connected car data and the application of machine learning/AI and analytical/insight generation capabilities.

The expanding provision of end-user digital services and the increasing value of PII in these services (operating at Level 3 in the model), together with the significantly higher level of customer engagement needed to make them successful will require OEMs to become responsive and creative in the way they allow data, including personal data, to be used. They also have the opportunity to engage with data marketplace providers like wejo to enable the wider technology community to develop the innovative services and products powered by connected vehicle data operating within parameters set by the OEM. Either approach requires the OEM to understand the data and the ways it is being used.

This will necessitate wide-scale implementation and operation of the robust data security, privacy, compliance and associated processes that apply in this space.

### 1.5.2. Digital Centricity

Consumer expectations are being set by the applications they use in a variety of different smart environments and they increasingly demand a similar experience inside their vehicle.

This is already a significant factor in vehicle purchase decisions and is only set to increase as Millennials become a larger part of the car-buying consumer base.

The use of connected car data, both at the operational level and in value added services also drives the evolution of the car towards a 'living product' that continues to develop throughout its whole lifecycle - with continuous upgrades and new services.

OEMs historically steeped in manufacturing skillsets and product lifecycles measured in years will need to apply digital business and technology skills throughout the development, production and support phases –aligning to software and service development lifecycles measured in months if not weeks.

*“This is a major challenge for OEMs with more than 100 years of history, experience and culture of manufacturing hardware – they are not agile enough for ‘digital cars’. There is a risk that they do not or cannot make this transition. The connected car needs to be considered as a living product with ongoing enhancement and new customer touchpoints”*

Franck Louis-Victor, Renault-Nissan-Mitsubishi Alliance

### 1.5.3. Customer Centricity

Delivering connected car data enabled services to consumers opens up a new direct and ongoing engagement between OEMs and drivers (and between providers of data enabled services and drivers e.g. dealerships or 3<sup>rd</sup> parties). The frequency of contact will shift from the current yearly servicing touchpoints (or even longer car buying cycles) to potentially, daily interaction via in-car services.

These new services enabled by connected car data offer OEMs the opportunity to re-engage with the consumer/driver and, as a result, develop deeper brand loyalty. This will require the development of new forms of customer engagement and management capabilities – in everything from customer strategy through service delivery, into ongoing support.

## Conclusion

Although the connected car data market certainly faces challenges, the evidence suggests that these can - and will - be overcome. Concerns about under-investment due to costs associated with transmission, storage and management of the resulting data represent a clear barrier to investment. Despite the challenges, connected car data is still high on the agenda for most players in the automotive industry.

The continued development of embedded infotainment systems could mean that none reach critical mass and that app development is significantly constrained, leading to the conclusion that OEMs may choose a more cost-effective “buy in” options instead. The concept of in-car advertising is still in its infancy, so not yet accepted by consumers. To keep up with rapidly evolving technologies, OEMs will need to consider the application of machine learning/AI. This is a highly competitive market, with a clear need for manufacturers to offer customers the best possible technologies and driving experiences.

The key enablers of market development emerging from the research are identified in the next report.