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

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Societal benefits & opportunities from the connected car data market

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In this second report from our series we look at how the rapidly expanding connected car data market offers huge untapped potential for consumers, and for society as a whole.

Study participants cited safety as the biggest and most important benefit to society, with connected technology making vehicles safer for drivers, passengers and other road users. This new data allows for faster, more efficient emergency service responses and also encourages drivers to behave more responsibly. In this chapter we will examine how the connected car market can also bring about significant improvements in the efficiency of public transport and road systems; improving productivity, reducing travel costs and minimising fuel emissions. We will also explore how this new data has the potential to help the socially isolated reconnect with friends and family and access essential services and leisure activities.

The most important topics in the societal context identified by the research were:

- Safety benefits
- Transport efficiency & environmental benefits
- Mobility reintegration

> *"Most effective change [in the context of the exploitation of data] happens when data is collected and used for very tangible, graspable reasons, answering questions like "How does this make things better?" and then determining what data you need to pull together to do this. For example, "Improving Car Safety" needs to pull together OEM car performance data, information on accident blackspots, driver behaviour data, etc, etc. Car people need to think about "social physics" and the wider societal basis for successful change."*
>
> Professor Sir Nigel Shadbolt, Oxford University

Safety Benefits

Participants in this research unanimously highlighted improved safety as the biggest overall benefit of connected cars and their associated data.

> *"The ability of the automotive industry to use this data to help them design and build safer product is going to be very important."*
>
> Harry Lightsey, Hawksbill Advisors

NHTSA statistics show that in 2017, more than 37,000 people were killed in road traffic accidents in the US. An additional 2.35 million people are injured or disabled. It is estimated that road accidents cost the US c. $230 billion per year.

Connected car data can drive safety improvements and reduce these impacts in a number of different ways:

- Vehicle safety
- Road safety
- Driving behaviour
- Emergency Services response

Vehicle Safety

Connected cars allow safety critical vehicle components such as the braking system to be monitored in real-time with issues flagged to the driver immediately and fed back to OEMs as input to the ongoing R&D processes that improve car safety (e.g. enhancements to ABS design).

Currently it can take a significant time for an OEM to understand and address a defect because of the inefficiency of the feedback loop from customers and dealers. If the defect involves a safety issue, the production fix is typically available in c. 18 months – whilst for less critical defects, it may take two years or more. Meanwhile, new cars coming of the production line could still carry that known flaw.

Connected car data can be used to drastically reduce the time to identify and fix safety issues in new models and apply such fixes Over-The-Air (OTA). This both reduces the number of recalls required and potentially increases the proportion of cars/drivers reached by recall actions.

> *"The whole concept of being able to address an issue through software downloads into the vehicle has always been viewed both by the federal regulators and by the industry as something that could substantially improve safety.*
>
> *Tesla has been able to do this for several years now. In a typical recall situation, a manufacturer considers the response to be substantial if it gets over 50% of the vehicles actually come into the dealers to be repaired.*
>
> *The Takata airbag recall - which is the largest recall that the industry's ever undertaken and is now into several years and on which the industry has spent untold millions - still has response rates of only 60-70 percent. So, you can see the huge potential."*
>
> Harry Lightsey, Hawksbill Advisors

Combining data across OEMs has the potential to further improve vehicle safety. For example, in 2013 several OEMs initiated large scale safety recalls because of misfiring Takata airbags, but it is thought that the problems could have started up to a decade previously.

> *"Almost every single automaker in almost every single car around the world were using Takata airbags, which would deploy randomly… sending shrapnel inside the vehicle cabin and causing serious injury. It could have been avoided if automakers could have collected the exact parameters of when these airbags were deployed so they were able to analyse what had happened."*
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> Michelle Avery, World Economic Forum

Many vehicles are already fitted with advanced driver assistance systems (ADAS) that can take over safety-critical functions from the driver under certain circumstances e.g. autonomous emergency braking (AEB). Future AEB implementations based on V2V (Vehicle to Vehicle) communications will be able to detect and react to possible problems sooner.

Road Safety Improvement

Connected car data can be used to improve the design and operation of roads to reduce accidents. This includes:

- Analysis of historical traffic flows can inform road and related infrastructure planning, ensuring roads are 'fit for purpose' for the projected volume of traffic.
- Analysis of accident data, including data from vehicle Event Data Recorders (EDRs), can be used to inform road design, at both a specific (e.g. was a particular accident due to a flaw in the road layout?) and aggregated (e.g. identification of accident 'blackspots' – based on both actual collisions and 'near misses' suggested by heavy braking behaviour) level.

In a V2I (Vehicle to Infrastructure) context, when connected cars are able to communicate with city infrastructure like 'smart roads' (e.g. with adaptable lighting, signage and lane markings) and traffic control systems (e.g. traffic lights), accidents are likely to be significantly reduced. Ultimately it may be possible to

all but eliminate collisions by having smart infrastructure proactively control the flow of traffic i.e. the speed of cars and the distance between them.

Other data enabled services could improve road safety by informing the driver in real-time about adverse surface weather conditions (combining meteorological data with data from aggregated vehicle light level, precipitation and other sensor data) or even warn of heavy pedestrian traffic based on data acquired by vehicle cameras or infra-red sensors.

"Data is being generated at a rate where the 2nd order benefits are not being fully considered or evaluated. For example, what can CAVs [Connected and Autonomous Vehicles] environmental or contextual data tell us about what's happening OUTSIDE the car? How can car data input to and help with some of the problems in the 'external' space?

Professor Sir Nigel Shadbolt, Oxford University

Driving Behaviour Improvement

By using various parameters on vehicle dynamics (e.g. braking, acceleration, steering input) and data from other sensors (e.g. lidar/radar/camera inputs on proximity to other cars), connected car data can determine how safely a particular driver is using a vehicle.

An important example of the use of this data is in Usage Based Insurance (UBI), where data gathered about how a vehicle is driven is used to inform the insurance premium to be paid.

Widespread adoption of UBI should result in an increase in safe driving as drivers become much more aware of, and can influence, how their driving impacts the cost of insurance.

USAGE BASED INSURANCE (UBI)

Usage Based Insurance is often cited to be one of the driver-centric use case with the highest potential value in the developing connected car data marketplace. Frost & Sullivan estimate the value opportunity of UBI to be $25-$40 per car per annum – making the US market potentially worth some $3.7-£5.8 Bn pa. by 2030.

What is Usage Based Insurance?

One form of UBI is based on measuring how much a driver is actually using the vehicle – this is Pay As You Drive (PAYD) insurance. It is most useful for low mileage drivers or when there is pooled use of a vehicle.

Another form of UBI measures how someone drives, and determines whether their driving behaviour makes them more or less likely than average to have an accident – this is Pay How You Drive (PHYD). PHYD and PAYD models can be used together to provide a full insurance service.

In PHYD, a baseline is established by using anonymised and aggregated data on many drivers, with analysis to define the risk of different driving behaviours. A specific individual's driving is then compared to this profile to determine their specific risk, and an insurance premium is set accordingly. The amount a driver actually pays can then vary monthly – increasing for poor driving behaviour, or decreasing with good driving behaviour.

What Driving Behaviour is Measured?

The fitting of 'black boxes' to collect data on driving behaviour is not new – especially as a way of offering insurance to newly qualified drivers with no other 'track record'. Early approaches typically focused only on where and when a car was being driven. These are known risk factors in existing underwriting models.

Connected car data offers a much more granular understanding of individual driving behaviour, based on:

- Vehicle dynamics analysis - input from connected car sensors e.g. how gentle or aggressive is vehicle acceleration, braking or steering
- Vision based analysis - input from connected car cameras or other sensors e.g. how close is a vehicle driven to the one in front/behind, lane changing, what is the speed relative to other vehicles, how often does the driver become distracted (diverting their eyes from the road or instruments)
- In commercial applications (e.g. Fleet Management), other metrics are added e.g. adherence to speed limits, frequency of breaks. These tend to be viewed as unacceptably intrusive for personal drivers.

Current Examples of UBI

Toyota's UBI offering is based on driving behaviour deduced from vehicle dynamics data. Drivers are provided with a safe driving score and tips after each journey. Gamification is also enabled e.g. drivers shown their national ranking in terms of safe driving score, or how they compare to drivers of similar vehicles.

FICO – more well known as a provider of fraud detection services in the Financial Services industry – has used their data analysis capabilities to develop a Safe Driving Score. This predicts the likelihood of future driving incidents by evaluating driving behaviour (acceleration, braking, cornering, speeding, smartphone distraction). The service is primarily aimed at the Fleet Safety Management market – but could readily be adapted to UBI. FICO's approach is interesting in that data is gathered via a partner smartphone app (using the phone sensors). Whilst this data is poorer quality than connected car data, it means that the identity of the driver is assured e.g. fingerprint authentication to the app. This is not currently easy to do for non-smartphone based UBI.

Implications for the Motor Insurance Industry

This is a major development for the motor insurance industry. Not only does it fundamentally change the basis for risk analysis, but it promises to improve the actual driving behaviour of road users, reducing accidents. Together with the other safety benefits of connected car data use, the impact is expected to be significant.

> *"Connected car data will significantly reduce the cost of insurance – not necessarily because Usage Based Insurance will make premiums cheaper, but the improvements in safety that will be possible will reduce the number of accidents and thus claims."*
>
> Ian Adams, Vice President of Policy, TechFreedom

Emergency Response Improvement

eCall (Emergency Call) became mandatory across Europe in 2018, and the NHTSA (National Highway Traffic Safety Administration) is reviewing whether similar services should be available in the US.

eCall speeds intervention by emergency services in the event of a severe traffic accident, opening a voice call to the emergency response number and automatically sending critical data to emergency services, including VIN, vehicle type, vehicle location and direction of travel.

eCall is expected to reduce the response time by emergency services by 50% in rural areas and 40% in urban areas, leading to a reduction of fatalities – estimated at up to 2,500 saved lives per year across Europe.

Future connected data enabled services could extend the utility of eCall e.g. by detecting multi-vehicle collisions and putting hospital emergency units on standby, advising response teams on the number of

occupants in vehicles, or (with appropriate consent) ensuring that any relevant health data about occupants is available to response teams.

Transport Efficiency and Environmental Benefits

Improved transport efficiency and the associated environmental impact were the second major category of societal benefit that was cited by participants in this research. The key advantages were seen as:

- Time and cost savings for drivers and passengers
- Increased productivity for people and public services
- Reduced pollution with associated health and environmental benefits
- More effective use of key resources in urban environments

Time and Cost Savings for Drivers and Passengers

The use of connected car data can materially reduce journey times, and so save on the cost of fuel. There are several ways in which this can be achieved.

Analysis of connected car data can be used in smart infrastructure to enable active management of traffic and congestion by changing traffic routing dynamically in response to accidents or other events that may cause congestion. Drivers can be notified of traffic issues on their journey ahead, allowing them to follow an alternative recommended route.

V2X communications will enable the 'platooning' of vehicles (especially those with some degree of autonomy) – controlling their speed and separation. Research by the University of Cambridge suggests that such 'co-operative' approaches can increase the volume of traffic using a given road network by 35-45% without lengthening average journey times.

Aggregated connected car data also has an important part to play in improve the design and operation of roads and the associated traffic control infrastructure to improve the flow of traffic.

Increased Productivity for People and Public Services

A consequence of reducing average journey times and optimising resource use is increased productivity (and the associated economic benefits), including:

- Workers spending less time travelling to/from work are able to devote some or all of the time saved to work activities, and may arrive at work less stressed than previously.
- Commercial drivers (e.g. buses, cabs, ride-hailing services, haulage companies) are able to complete more journeys in a given period due to the reduction in journey times.

Reduced Pollution and Associated Environmental and Health Benefits

The desire to contain the damaging impact on health and environment helped drive the introduction of the connected car as California laws regarding vehicle emissions in 1994 created a need for telematics.

Pollutants emitted from transportation contribute to poor air quality. These pollutants include particulate matter, nitrogen oxides, volatile organic compounds, and compounds that are known or suspected to cause cancer or other serious health and environmental effects. Examples include benzene, formaldehyde, and diesel particulate matter.

Transportation is also a major source of greenhouse gas (GHG) emissions in the US, with c. 30% of national GHGs directly attributable to transportation.

The US Environmental Protection Agency (EPA) already has in place programs aimed at reducing pollution from transportation that is projected to prevent, annually, 40,000 premature deaths, 34,000 hospitalizations and 4.8 million workdays lost in the US by 2030.

Connected cars will make a major contribution to reducing the impact of vehicle emissions:

- Fuel consumption, engine performance and other data can be used to improve the fuel efficiency of the vehicle itself, with the potential to dynamically update engine maps to ensure optimum efficiency in certain conditions e.g. in various climates.
- Delivering the journey efficiencies outlined in Bi and Bii above will also have a positive impact. Reducing journey times by 10%, and making that journey less 'stop/start' is likely to yield more than a 10% reduction in the fuel burnt emissions released.
- New connected car data enabled services can help to monitor air quality in a dynamic way, not just in urban areas but more widely.

> *"Some partnerships are likely in this space – maybe for gathering environmental or air quality information in a very dynamic way to plan/inform environmental protection action. Some fleet managers are using temperature, altitude, etc. sensors in this way already."*
>
> Jessika Lora, CEO & Founder, CarForce.io

More Effective Use of Key Resources in Urban Environments

Connected car data can lead to fewer vehicles on the road by enabling car pooling and ride sharing or refining the scheduling and routing of transit systems. In time, the notion of car ownership may change completely especially if AVs become widespread and could lead to fewer privately owned vehicles operating in urban environments.

Analysis of historical and real-time connected car data enables more effective multi-modal transport integration optimising the use of public transport e.g.

- Informing which journeys/routes would benefit most from improved public transport.
- Identifying areas where alternative transport approaches could be incentivised because they are more effective than driving e.g. micro-mobility solutions, cycle lanes or further pedestrianisation
- Better integration (e.g. scheduling frequency and timing) of transport options.

Other resources that can be optimised using connected car data include:

- Parking –connected car data can be used to inform the amount of parking capacity required, the geographical location of parking facilities (e.g. 'park and ride' facilities to encourage public transport use), dynamic routing of vehicles to available parking, , and dynamic parking pricing.
- Kerb time – in particularly busy environments, time at the kerb to load cargo or passengers is valuable and can be a cause of congestion as vehicles 'double park' or re-circulate when they cannot find space. Connected vehicles can engage with smart infrastructure to identify vacant space or allow for pre-booking.
- Congestion and emissions zones

> *"In NY, Chicago and elsewhere you have micro transportation, commercial deliveries & ride sharing companies – that leads to a battle for kerb space – dropping off passengers vs deliveries. It is becoming a public infrastructure challenge to not have this impeding traffic. How do you get an outcome that helps everyone?"*
>
> Anonymous Motor Industry Executive, Detroit

Mobility re-integration

Innovative services enabled by connected car data could deliver considerable social and economic benefits by re-integrating excluded groups into mobility.

Estimates suggest that in 2018, social isolation (of which loss of mobility is a key contributing factor) adds about $6.7 billion annually to Medicare's costs. Source: Coalition to End Social Isolation and Loneliness.

> *"There's a lot to be said for the resurrection of dead capital associated with those who are not otherwise involved in the economy due to mobility issues…. Say the elderly, who are not fully integrated and there is a cost associated with that - not only in terms of what productivity they can bring, but also in terms of the real medical cost to isolation.*
>
> *Social isolation is something I think that connected vehicles – and especially autonomous vehicles - can help address… we can talk about safety all day long, but enabling mobility and social isolation are the ones that are not immediately apparent, I find, to a lot of policymakers."*
>
> Ian Adams, Vice President of Policy, TechFreedom

By far the largest group in this context is the elderly – who may become isolated because they lose access to the mobility that allows them to get out and see family or friends or go shopping. Others who for any reason may not be able to get a driving license, might find it difficult to go to/from – or even get – work.

Re-mobilising these groups will make them more economically active, either by enabling them to re-enter the workplace, or by increasing their ability to be active consumers.

Mobility-as-a-service (or transport on demand) enabled by connected vehicles and delivered through services such as ride sharing can start to make a beneficial impact in this space.

Conclusion

Research participants overwhelmingly identified improved safety as the biggest and most important benefit of the connected car market. This new data makes roads and vehicles safer in a number of ways, and also improves the response times of emergency service vehicles.

As well as being able to make vehicles safer, the availability of accurate, real time data makes it possible for manufacturers to initiate large scale recalls when issues are identified, significantly reducing the risk of accidents. Road planners can respond to environmental challenges and create a safer, smarter and more efficient infrastructure, while features such as Safe Driving Scores encourage drivers to behave responsibly. Environmental benefits include reduced pollution and improved health, and connected car data can also help the socially isolated regain access to the outside world.

In the next report, we will identify key stakeholders and discuss the benefits and opportunities the connected car market presents to them.