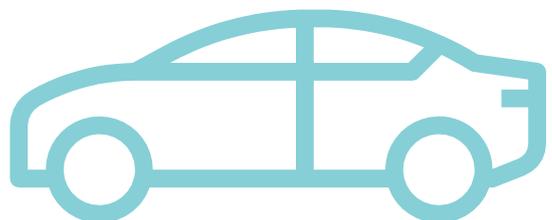




# THE AUTOMOTIVE DIGITAL TRANSFORMATION AND THE ECONOMIC IMPACTS OF EXISTING DATA ACCESS MODELS



## Preface

This research paper is a collaboration between the management consultancies QUANTALYSE and Schöenberger Advisory Services. It is a study written upon request from Fédération Internationale de l'Automobile - Europe, the Middle East and Africa (FIA Region I). The purpose is to provide an assessment of the economic impact of vehicle data access models on the European automotive aftermarket over the short to mid term. A consumer survey; analysis of aftermarket insights and of technological and legislative trends; more than 20 interviews with experts, senior executives; and quantitative modelling experience serve as the foundation for findings presented in this paper.

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The information and views set out in this report are those of the authors and do not necessarily reflect the opinions of FIA Region I. Neither the companies, nor any person acting on their behalf, may be held responsible for the use which may be made of the information contained therein. QUANTALYSE and Schöenberger Advisory Services wish to express their gratitude to all the individuals and their organisations that were contacted during the preparation of this report for sharing their insights.

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## Executive Summary

The European aftermarket, the segment of the automotive value chain that keeps the vehicle on the road after it has been sold, serves around 320 million passenger vehicles and light commercial vehicles. Generating a value of over €240 billion per annum, it is a significant contributor to the European automotive industry, which is facing major transformational challenges in the next decades.

The sector is experiencing disruption from (i) the shift from traditional internal combustion engines to electrified powertrains; (ii) the integration of connectivity capabilities; (iii) new tech players entering the business with advanced skills; (iv) mobility as a service; and (v) autonomous driving solutions. These forces, together with an uncertain economic climate, are increasing competitive pressures on auto makers. In turn, this is raising the ambitions of vehicle manufacturers to gain more control over the relationship with the car driver/owner and monetize vehicle generated data. Here, it can be expected that the automotive sector will further move towards contraction and that this will subsequently lead to further price pressures both in the primary market as well in the aftermarket.

Vehicle manufacturers are developing their own data access models including the preferred “extended vehicle” model (and “neutral server”) where in-vehicle data can only be accessed via an external backend server under their governance. However, strong concerns have been raised about this approach over recent years due to shortcomings from a technical, legal and competition law perspective.

Firstly, this study examines the position and arguments of key (independent) actors and experts in the value chain, reviews technical assessments of this and alternative approaches, presents the latest activities of vehicle manufacturers, draws parallels to other technical developments and summarizes the relevant legal frameworks.

The gathered evidence confirms that the treatment of in-vehicle data access - similar to general data access - does not follow a clear roadmap shared by all stakeholders and that there is insufficient consideration of pan-European regulation developments such as the Digital Single Market or PSD2 in Open Banking. Valuable lessons can be learned from more mature and data-driven businesses such as the software or the telecommunications industry.

A second important element of this study is the voice of the European consumer which has been assessed by means of thorough market survey in four key European countries. The survey in turn clearly confirms a strong price elasticity of consumers for the choice of repair, maintenance and insurance providers and a high interest in service quality, speed and connectivity services.

While consumers are open to new data-based services, they maintain a strong interest in being able to choose their service provider rather than being steered based on data they do not control nor have full transparency about. They value the customer centricity and quality of services of independent garages and want to continue to see them as a credible alternative to franchised garages also in the future.

Thirdly, the study attempts to quantify the economic impact of unregulated in-vehicle data access on the independent aftermarket in Europe. We identified likely domains of impact, like paying manufacturers for

necessary vehicle data, prognostics for repair/maintenance in garages, or the competitive advantages due to one-sided monitoring of data traffic of the independent operators by manufacturers. The impact analysis takes into consideration the serious shortcomings from a technical, legal and competition law perspective including:

- Costs - Service providers are being charged to access vehicle data which has been generated by motorists;
- Restrictions - Independent service providers are facing restricted access to certain data streams which prevents provision of services;
- Delays - Car data is not being communicated in a timely manner to independent service providers which prevents provision of services;
- Monitoring - There are strong concerns that the server-based data access models are allowing for business monitoring.

The results of the analysis indicate potential impacts that are expected to take gradual effect depending on the degree of connectivity of the car park. By 2025 a potential loss of €15 billion for independent stakeholders; or 12% of their current annual market volume will occur. A further increase of the loss is expected by 2030 when all vehicles are connected, and the independent market will have eroded to such an extent that €33 billion is potentially lost. In addition, consumers would have to carry the burden of a spend increase by €15 billion in 2025 or an additional 9% compared to today. A further increase to €32 billion annual loss for consumers is expected by 2030.

These outcomes reveal that if the current data access models are utilised in the long term, the negative impacts on independent aftermarket service providers will allow for OEMs to further integrate themselves into the aftermarket themselves, and in turn offer them much stronger control over relations with the end consumer. This would have the effect of ultimately reducing consumer choice, reducing competition and ultimately meaning for lower societal benefits to be accrued.

The strategy to reach critical mass for unlocking the full connected services potential in the sector with maximum innovation and benefit for European citizens is: (i) to safeguard a level playing field by having a robust regulatory framework regarding data read/write and driver access; (ii) to make technical connectivity future-prove, avoiding mistakes already made in other sectors; and (iii) to involve the consumer and independent organisations in standardization efforts.

# 1 Introduction

In this study we rely upon mainstream business and academic literature as well as publicly available and well-known frameworks of the automotive aftermarket.

## 1.1 Background

Since the turn of the century, the European automotive sector has been subject to a variety of EU Regulation amendments that have safeguarded the consumer from mono/oligopolistic developments regarding open access for independent players as compared to the vehicle manufacturers.

The EU Commission facilitates competition by creating a level playing field for all players in the aftermarket. The aftermarket complements the automotive manufacturing market of original equipment by keeping vehicles on the road after production. A well-functioning competition effectively yields a stronger consumer position, lowers costs for European citizens and promotes innovation.

It is a consequence of that very innovation in the last decade that telematics was at last developed in the automotive sector. The introduction of telecommunications-based transmission and digital processing of vehicle data has made automobiles nowadays increasingly 'connected' by embedding it with send/receive capability by modems, sensing the environment through sensors, providing networking and internet access to passengers.

However, operators active in the automotive aftermarket are faced with significant uncertainty and are increasingly experiencing the lack of level playing field regarding open and fair in-vehicle data access. This regulatory vacuum has led vehicle manufacturers to claim the exclusive right to provide a telematics platform, which has been introduced as the 'Extended Vehicle' or 'Neutral Vehicle' approach.

## 1.2 Purpose

This issue of fair and equal access to (in-)vehicle data has been subject to a longstanding debate spanning a variety of European legislative initiatives, such as the Block Exemption Regulation (BER), the Type Approval regulation, the eCall legislation and in 2018 the European Commission's Communication on automated and connected cars.

Several consumer and aftermarket stakeholder organizations have repeatedly urged the Commission to propose a binding legislative solution on open-access, secure and transparent networks for connected cars, as well as in-vehicle data, driver interface and communication access.

As the Commission's Communication on vehicle connectivity fails to provide sufficient clarity for independent service providers to ensure their equal data access rights, this study intends to examine the potential consequences of existing data access models on independent operators and consumers.

More specifically, it aims to provide clarification on five points: (i) a view on the value of the aftermarket to the consumer; (ii) an outline of the main recent developments and challenges ahead; (iii) a description

of the issues regarding data access; (iv) a consumer perspective on the topic; and (v) estimates on the potential economic impact of an unregulated in-vehicle data access.

## 2 European aftermarket

This section provides an overview of the European landscape of the automotive aftermarket.

### 2.1 Segment

#### 2.1.1 The automotive value chain

A vehicle lifecycle passes through various stages, such as R&D, product development, sourcing, logistics, manufacturing, new vehicle sales, financial services, aftermarket, used car sales until the very end process of recycling. The automotive industry that sustains this lifecycle forms a complex interconnected network of many players distributed over various sectors, geographical regions and companies.

The 'automotive value chain' comprises a multitude of companies that deliver added value to the vehicle during its lifecycle. The automotive value chain is often<sup>1</sup> divided by the point of new vehicle sale into the 'upstream' (raw materials processing, manufacturing, chemicals, parts, etc.) and downstream (repair, maintenance, information technology, mobility services, etc.).

This study focuses on the specific subsegment of the 'aftermarket' within the downstream sector. It is the value generated by market players offering vehicle related services and parts, **after** a new vehicle sale has taken place. Figure 1 provides a schematic of the scope.

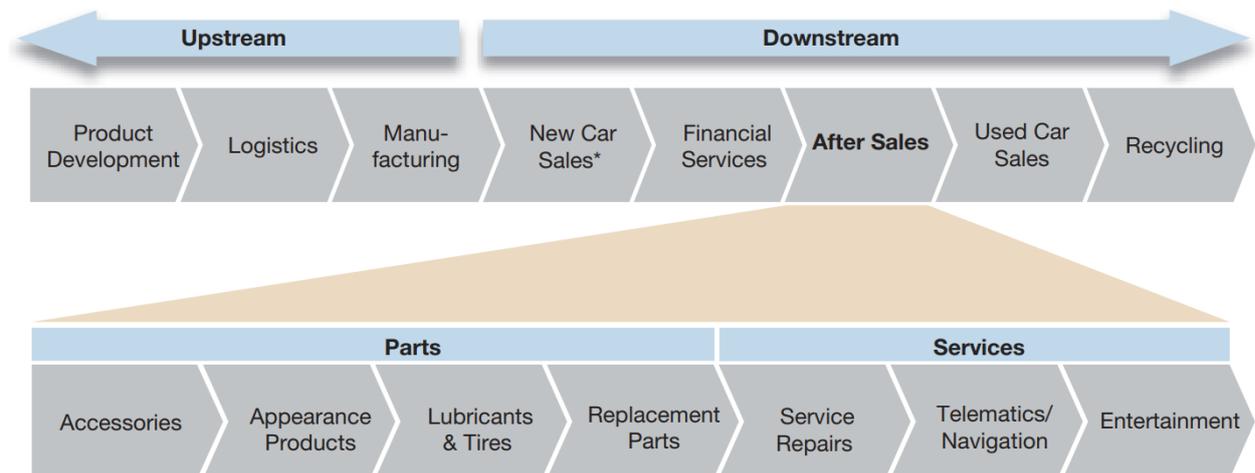


Figure 1 : Scheme of automotive upstream and downstream activities with focus on after sales. Source: Capgemini.

<sup>1</sup>The Aftermarket in the Automotive Industry: How to Optimize Aftermarket Performance in Established and Emerging Markets, Capgemini Consulting, University of St. Gallen, 2010  
<https://www.capgemini.com/wp-content/uploads/2017/07/tl-The-Aftermarket-in-the-Automotive-Industry.pdf>

### 2.1.2 Relevance

In Europe, over 12 million people are employed in jobs related to the automotive and road transport sector including 5 million jobs linked to mobility (transport, road construction etc..), more than 4.3 million to the “wider automobile use” (dealers, repairers and aftermarket operators), and around 3.3 million to the manufacturing of vehicles and components.<sup>2</sup>The automotive aftermarket is a distinct and substantial component of the automotive value chain. Aside from the (concentrated) car makers, there are almost a million companies involved in the aftermarket, of which the overwhelming majority SME's, and the aftermarket sector employs circa 5 million people<sup>3</sup>.

Furthermore, about half of the EU's GDP is composed by household expenditure. As a share of it, the annual cost of EU citizens keeping their vehicle in operation (services, repair, parts, maintenance, etc.) is a sizable 3% in 2017, which is about equal to the expenditure<sup>4</sup> on purchasing new vehicles. Therefore, the automotive aftermarket is a material part of the economy and stands next to car manufacturing as a complement with equally important value.

### 2.1.3 Composition

The European aftermarket is comprised of two major components: sales of replacement parts and services. On average, the aftermarket subsegment of parts<sup>5</sup> is slightly larger representing about 55% than the services segment with 45% in 2018. Figure 2 visualizes that segmentation. For the purpose of this study, we assume that this split will not change in the near future as both parts and services are similarly impacted by price increases due to the increasing technological complexity of both elements.

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<sup>2</sup> GEAR 2030 Final Report, 2017

<sup>3</sup> The European Automotive Aftermarket, Sylvia Gotzen, EESC meeting on SMEs, Crafts and Professions Category, 2013; <http://old.eesc.europa.eu/resources/docs/presentation-by-sylvia-gotzen.pdf>

<sup>4</sup> Eurostat 2016, Household expenditure by purpose in the EU  
<https://ec.europa.eu/eurostat/news/themes-in-the-spotlight/household-expenditure-2016>

<sup>5</sup> The changing aftermarket game – and how automotive suppliers can benefit from arising opportunities, McKinsey, June 2017

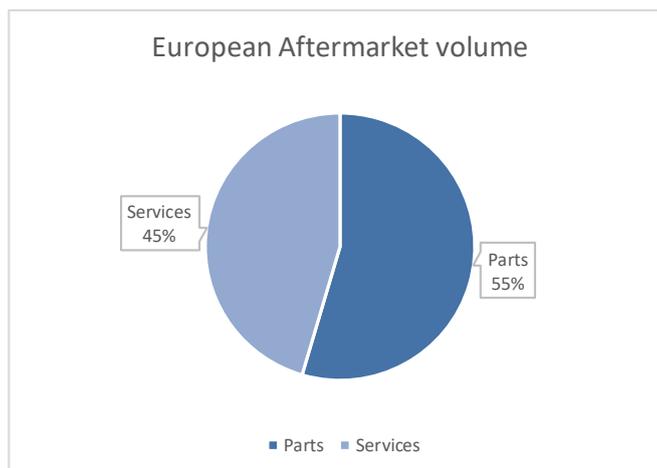


Figure 2: European aftermarket split into services and parts

The European aftermarket encompasses all parts and services purchased for passenger and commercial vehicles after the original sale. These services are repairs after an accident, repairs of wear and tear effects, repairs of mechanical and electronic failures, maintenance, tires services, diagnostic products, workshop equipment, accessories and consumables such as lubricants or oil. The value of the aftermarket is driven by labour costs and parts prices.

We differentiate between the retail dealerships owned and franchised by car manufacturers also known as original equipment manufacturers (OEMs) (in our study referred to as OEM channel) and independent garages, retailers and operators, referred to as Independent Aftermarket (IAM) channel and Independent Operators (IO). In addition, there are players at wholesale and retail level but for the purpose of this study we have not differentiated the different degrees of contribution at various levels of the value chain.

## 2.2 Stakeholders

### 2.2.1 A complex structure

Regarding aftermarket stakeholders, the breakdown used by McKinsey in their most recent study<sup>6</sup> on the automotive aftermarket provides a clear overview by capturing the variety and the marked differences between stakeholders (B2B and B2C customers of the IAM), which have formed the Alliance for the Freedom of Car Repair and Mobility (AFCAR, marked with a \* in Figure 3). Figure 3 illustrates the view on the main players.

<sup>6</sup> Ready for Inspection – The Automotive Aftermarket in 2030, McKinsey & Company, June 2018

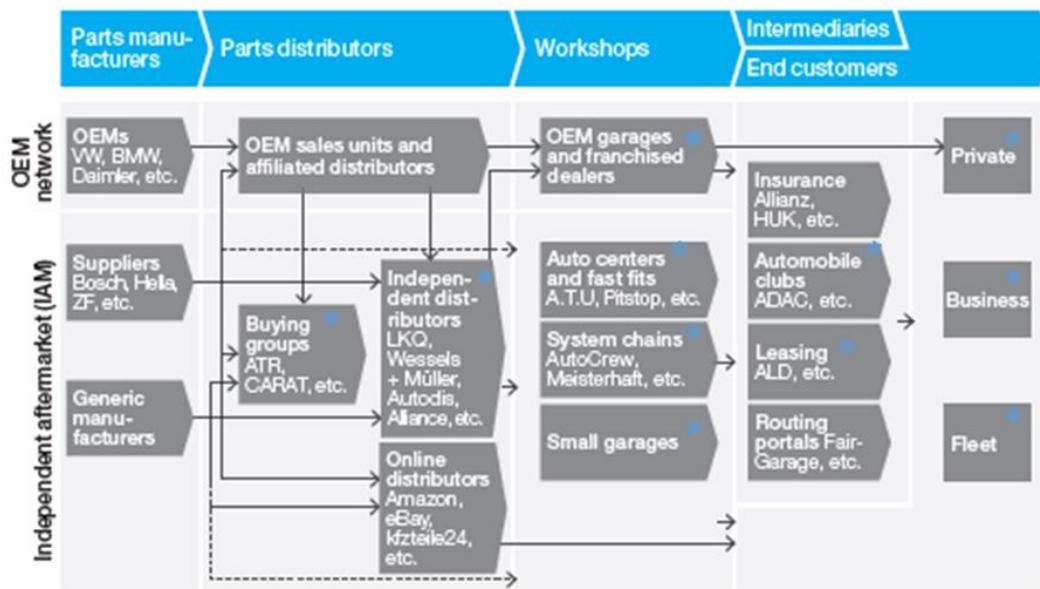


Figure 3: European aftermarket structure and key stakeholder groups. Source: McKinsey, own additions.

More refined breakdowns of intermediaries can be identified such as emerging mobility portals, car sharing or vehicle subscription providers, but for the purpose of this study, we focus on the main players.

### 2.2.2 Main aftermarket players

The European aftermarket is divided into two large camps of market players: OEM and IAM, as described in section 1.1.3. Overall, both share the market by circa 50%-50%, although on individual country level deviations like 70%-30% or 40%-60% occur, depending on the presence of OEMs and their distribution network. The parts market belongs for circa 40% to the OEMs<sup>7</sup>.

Recent studies identify a third camp, namely technology companies or Digital Players (DP), as described in section 2.1. Figure 4 visualizes the overall market shares of automotive market players.

<sup>7</sup> <https://ww2.frost.com/frost-perspectives/ageing-car-parc-europe-paves-way-evolution-oem-and-independent-aftermarket-iam-relationship/>

<sup>8</sup> The automotive aftermarket in 2025, Trends and Implications, Stern Stewart & Co., Quartz, September 2018, commissioned on behalf of CLEPA

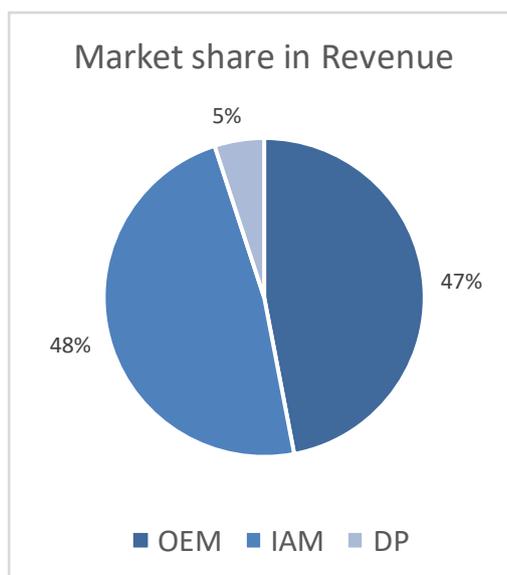


Figure 4: Revenue market shares of OEM, IAM and DP in 2017 for Europe.

Public market information or studies about the size of the DP segment are scarce, limited or only partial estimates exist. Their percentage market share today may still be relatively small: at least in Europe smaller than in the US, where it amounts to about 3% - mainly through online selling of parts<sup>9</sup>. Studies predict at least 10-15% year on year growth by 2022 for B2C online part sales in the U.S. and Western European markets. If we extrapolate the DP segment at that rate, it may evolve in the range of [7%, 10%] in 2030 for parts only. With services added, DP likely could acquire a market share in the range of [20%, 30%] in 2030. We assume a market share of at most 5% for DP in Europe in 2017.

Traditionally, both the OEM and IAM players have focused their competition on market shares on each other. As the current and future role of DP in the automotive value chain is at this stage difficult to quantify due to a lack of publicly available data, their impact is excluded from the quantitative study. However, there are numerous scenarios developed in various market studies, which expect that they shall grow fast and will erode more or less proportionally the current market shares of the two incumbent market players.

### 2.2.3 OEM and IAM in equilibrium

The share of the aftermarket captured by IAM and OEM captive garages/franchised dealers is generally assumed in the industry to be 50:50 as a pan-European average (parts and labour revenues combined). Depending on the age of the vehicle and the country, this share may vary. For example, the IAM share is as high as 70-80% in Eastern European countries (70-80%) and as low as 1-3% with vehicles up to 3 years old. Up to the age of 4-5 years vehicles tend to be serviced predominantly by the OEM channel.

<sup>9</sup>Strategic Analysis of eRetailing in the Global Automotive Aftermarket, Frost & Sullivan, research report 2016; <https://www.forbes.com/sites/sarwantsingh/2017/07/18/amazon-ebay-step-up-their-game-plan-for-automotive/#3e117fa178f9>

Extended warranties and customer loyalty programs of franchised dealers are gaining importance in order to keep customers in the OEM network. The IAM predominantly services vehicles older than 4-5 years and is considered to be a more economic choice for customers. It tends to be more popular during economic downturns<sup>10</sup>. As independent garages tend to have lower marketing budgets to invest in branding and PR and are continuously forced to invest in brand specific tools and trainings, they are disadvantaged vis a vis captive workshops when it comes to consumer recognition. Initiatives such as Right 2 Repair or 'My Car My Data'<sup>11</sup> contribute to a better awareness of consumer choice. Figure 5 illustrates the survey results.

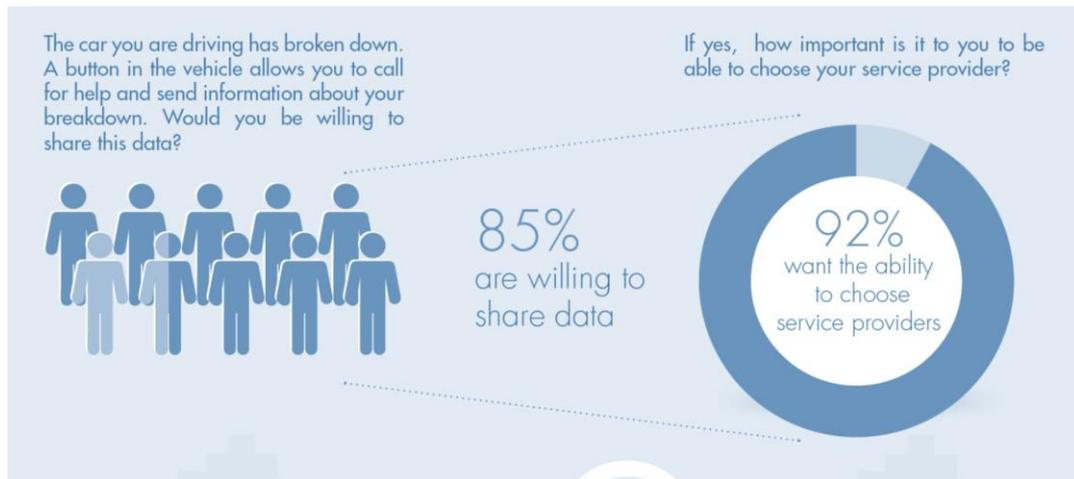


Figure 5: Consumer willingness to share data. Source: My Car My Data, FIA Region 1

Following up on the previous 'My Car My Data' poll, a consumer survey has been conducted in 4 of the largest EU member states<sup>12</sup> examined the role of the IAM in the eyes of consumers as part of this study. It confirmed that independent garages enjoy high popularity and are clearly preferred over OEM dealerships when it comes to repair and maintenance work. Figure 6 provides an overview of the distribution of the survey outcomes.

	Maintenance	Repair	DIY
Independent garage	56%	61%	61%
OEM garage	38%	36%	25%
DIY	5%	3%	15%

Figure 6: Consumer preferences for aftermarket channels. Source: Research Now SSI

<sup>10</sup> Ageing Car park in Europe Paves Way for the Evolution of OEM and Independent Aftermarket (IAM) Relationship Frost, & Sullivan, 2016

<sup>11</sup> [http://mycarmydata.eu/docs/FIA\\_survey\\_2016.pdf](http://mycarmydata.eu/docs/FIA_survey_2016.pdf)

<sup>12</sup> Assessment of the potential consumer response to the Extended Vehicle approach, Global report | Research Now SSI, December 2018

All respondents unanimously declare that independent garages are generally cheaper than captive garages but that they consider them just as competent and stay very loyal to them.<sup>13</sup> Figure 7 gives an overview of the results for the main countries investigated.

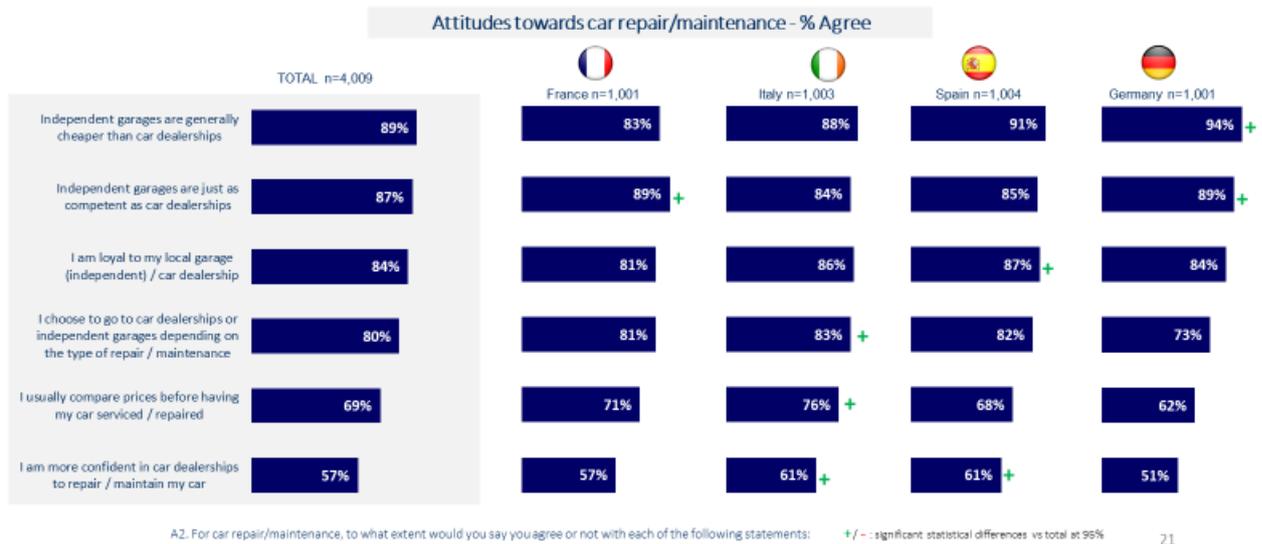


Figure 7: Consumer attitude towards car repair/maintenance. Source: Research Now SSI

The comparably higher customer centricity of independent garages has also helped them to continuously adapt their services with the customer in mind. Comparisons show that services such as online appointment scheduling, customer-specific filterable online shops for parts and accessories as well as service configurators are currently more likely to exist with independent providers - and they also have a stronger presence and wider ranging offers in workshop portals than OEM workshops.<sup>14</sup>

The aftermarket has been in the focus of OEMs for several decades as it offers stable revenues and higher margins than new vehicle sales and given the uncertainties of new vehicles sales, this trend is expected to continue. Traditionally manufacturers who produce parts or modules both for the OE market as well as for the aftermarket have a significantly higher share of the aftermarket business in their profits than in their total revenues. Thus, the aftermarket has been a significant contributor to the OE business. Given the tremendous opportunities that the connectivity and digitization of vehicles offers, the aftermarket will become even more important as innovations such as predictive maintenance mature.

While the OEM/IAM balance in the aftermarket has been relatively stable over the past decade, which is a feature of a well-functioning competitive environment, it is expected that this balance is at risk. Several automotive market studies expect a significant shift in revenue and profit pools in the next years not only between OEMs and IAM players but also towards new digital/tech entrants.

<sup>13</sup> Ibid.

<sup>14</sup> Digitalisierung im Aftersales: Erfolgsfaktor für neue Geschäftspotenziale, Deloitte, 2016

## 2.3 Vehicles in operation

### 2.3.1 Inflow

In 2017, total sales of new Passenger Vehicles (PV) and Light Commercial Vehicles (LCV) in Europe accounted for circa 17.5 million units, which represents 18% of global motor vehicle sales. It was the first year since 2007 (automotive and liquidity crisis) that new vehicle sales surpassed 15 million again. In 2018, new vehicle sales remained largely stable.

While new vehicle sales give an indication on the health of the automotive economy overall, the size of the car park is more relevant for the aftermarket as these services are provided during the several lives of a vehicle where a life usually begins and ends with a change of the owner of the car.

Depending on the primary purpose of a vehicle, i.e. private use or use as a (commercial) fleet vehicle, the first life can last between several months and several years. We estimate that on average a European car has 4 to 5 owners. Every owner, be it a commercial fleet owner or a private person, has specific requirements and preferences for an aftermarket services provider. As a general rule applies that the older the vehicle, the more likely it is that it is being serviced in the Independent Aftermarket (IAM) and the larger the fleet owner, the more focus is being put on Total Cost of Ownership (TCO).<sup>15</sup>

### 2.3.2 Car park size

The scope of this study is the aftermarket for PV and LCV and excludes medium and heavy commercial vehicles and buses, as these first two segments cover 98% of the EU car park and the aftermarket structure for these vehicles is significantly different. Figure 8 provides a comprehensive overview of the composition.

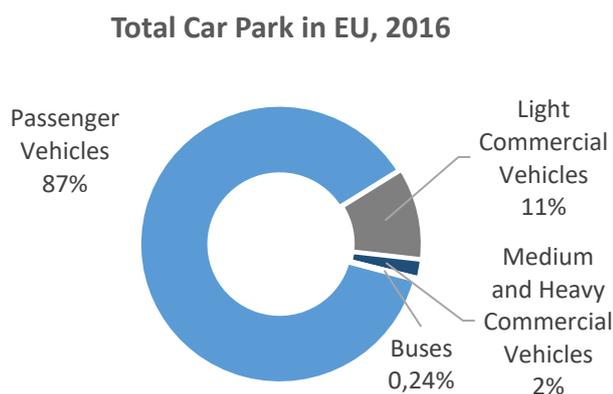


Figure 8: PV and LCV represent 98% of the EU car park. Source: ACEA.

<sup>15</sup> Ageing Car park in Europe Paves Way for the Evolution of OEM and Independent Aftermarket (IAM) Relationship Frost, & Sullivan, December 2016

Over the past years, the car park in the European Union continued to rise at a rate of 1-2% per year. The latest figures available are from 2016 when the EU car park consisted of 257 million PVs and 31.5 million LCVs, in total 288.5 million units.<sup>16</sup> Figure 9 illustrates the recent evolution for our scope.

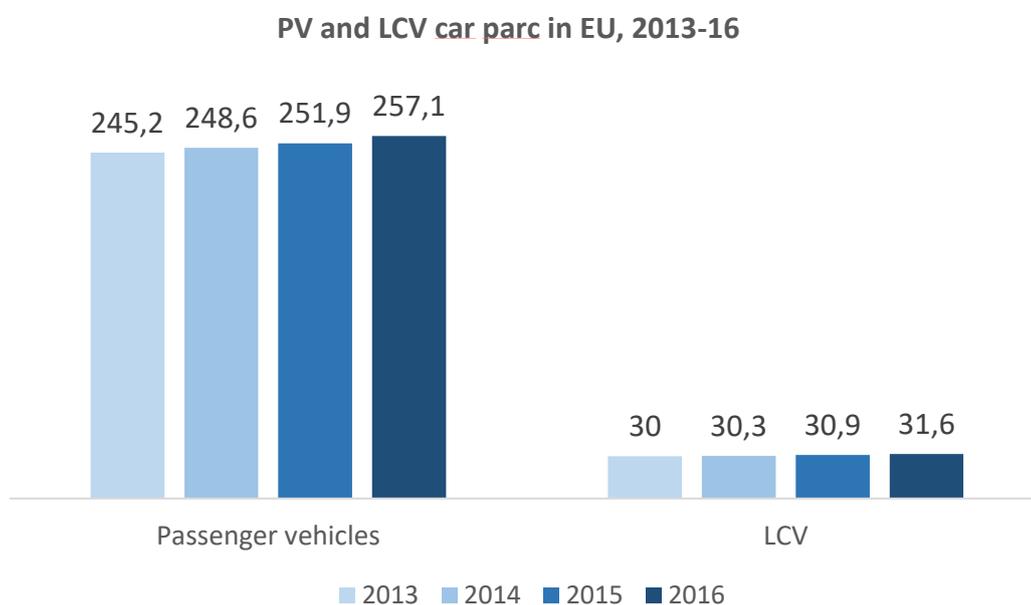


Figure 9: EU car parc with consistent rise 2013-16. Source: ACEA.

For the purpose of our subsequent economic analysis and in order to align baseline figures with other European aftermarket figures available, we have adapted the geographical scope to cover Europe as a whole (excluding Russia and Turkey) and thus estimate these two segments (PV and LCV) to total about 320 million units in 2017.

### 2.3.3 Car park age

The second most important driver for the aftermarket is the age of the car park. Over the past years, the European car park has continued to age and as of 2016 it was on average 11 years old.<sup>17</sup> Vehicles in Luxemburg have the lowest average age with 6.3 years and vehicles in Lithuania have the highest average age with 16.9 years. Figure 10 illustrates the steady evolution of the average age.

<sup>16</sup> ACEA Report Vehicles in use, Europe 2018

<sup>17</sup> <https://www.acea.be/statistics/tag/category/average-vehicle-age>

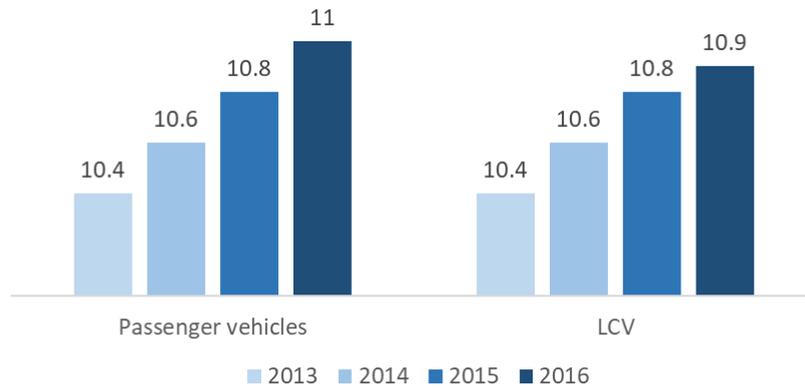


Figure 10: EU vehicle age at 11 years with consistent rise 2013-1. Source: ACEA.

There are vehicles on the road with lifetimes well beyond the average of 11 years, but it is a point where the occurrence diminishes. Figure 11 illustrates that median and mean are close.

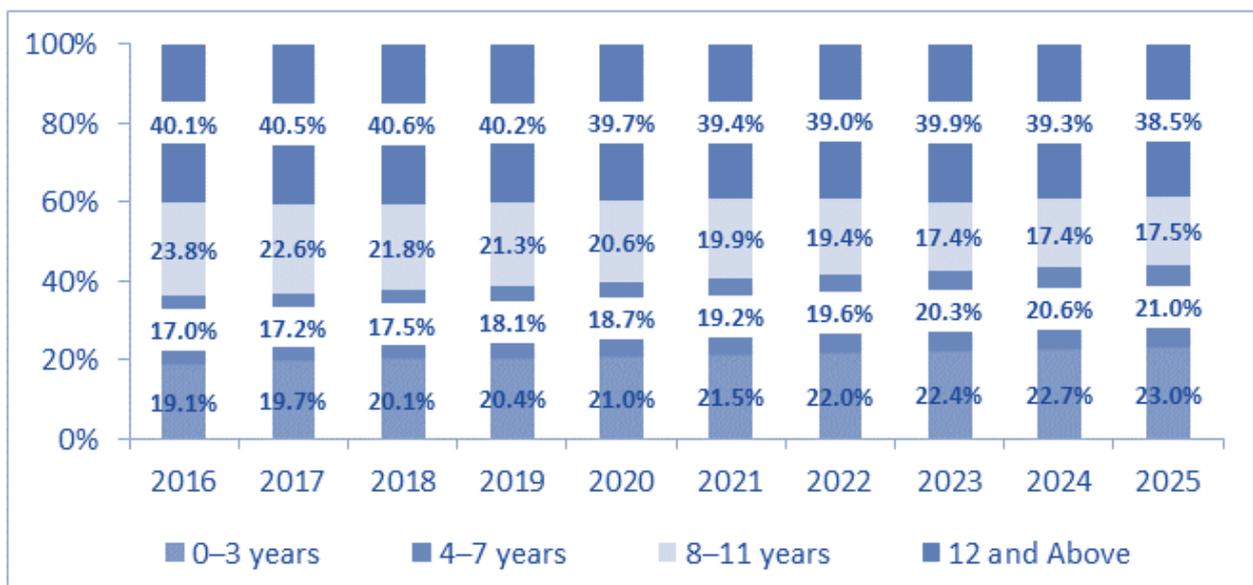


Figure 11: Typical distribution of vehicle parc over age segments [Frost]. Source: Frost & Sullivan.

Typically, OEMs dominate the aftermarket for the most part of the younger vehicles. A majority of customers believe that not using OEM parts and service during the warranty period may render it void, which is not true and regulated in the Block Exemption Regulation but explains this temporary price insensitivity of vehicle owners. With increasing vehicle age, price sensitivity returns to normal.

Overall one observes that OEMs dominate the 0-3 years segment, compete with IO in the 4-7 years segment, level off in the 8-11 years segment and are mostly absent in cars above 12 years old. Figure 12 illustrates (as an example) that partitioning.

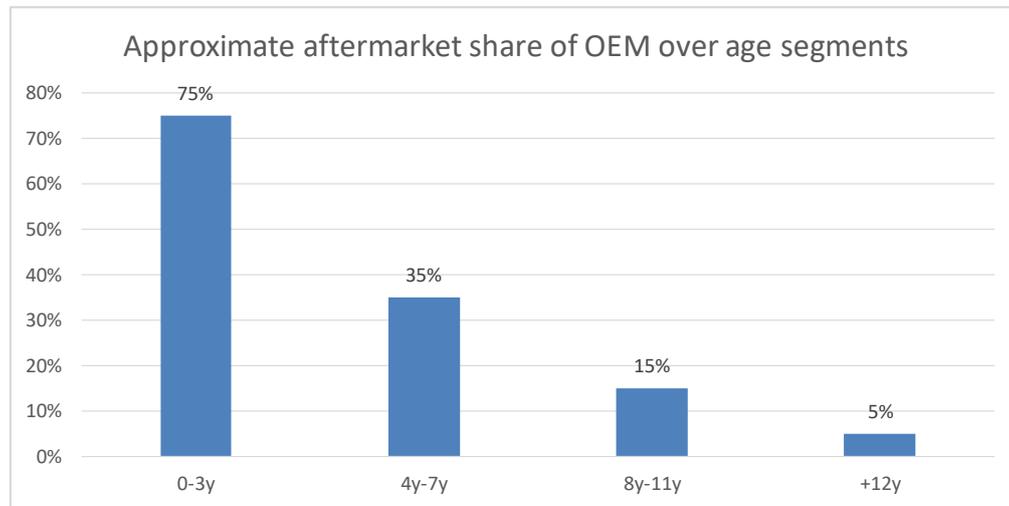


Figure 12: Approximate OEM aftermarket share over age segments (illustrative).

## 2.4 Value

### 2.4.1 Volume

From a more quantitative perspective, the automotive value chain comprises of the cumulative value of every company's revenue for its intermediation in the vehicle lifecycle.

The total sum of those revenues in a year represents a market volume, a useful metric to assess size and growth. In general, the aftermarket size in literature is defined as the total of annual gross worth of direct and indirect sales generated by the automotive aftermarket industry per year. It includes taxes and profits.

There are also other metrics, like for example job count, profit, value added, but the revenue metric is most prevalent in automotive literature and moreover it has the advantage that it allows for a meaningful comparison with other industries.

Worldwide, the full automotive value chain amounts to circa €3.8 trillion<sup>18</sup> in 2017, with about one fifth (circa €800 billion) generated by the global aftermarket<sup>19</sup>. Figure 13 illustrates the focus/scope of our study.

<sup>18</sup> Throughout this text the quantity trillion is defined as 1 000 000 000 000, billion as 1 000 000 000. E.g. 1 B€, and 1 000 000 as 1 M€.

<sup>19</sup> Ready for Inspection – The Automotive Aftermarket in 2030, McKinsey & Company, June 2018

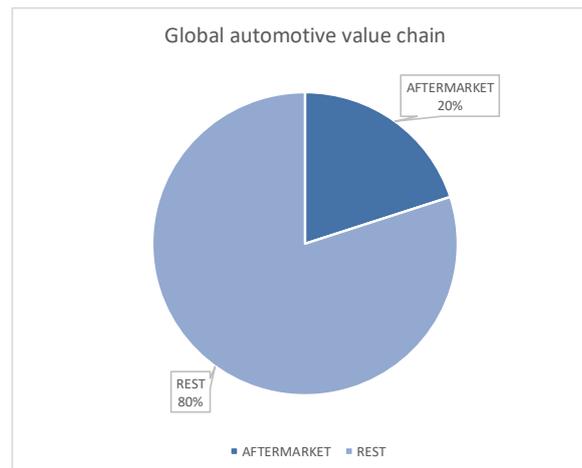


Figure 13: Annual revenue share of aftermarket in the whole automotive value chain. Source: McKinsey.

When compared to other heavy industries, the aftermarket may not seem so large on an annual basis. However, when viewed from the perspective of the motorist, and taking into account accrued cash flow value stream over the 11 years lifetime of a vehicle in Europe, then only 40% stems from the sale price, while 60% is spent in the aftermarket<sup>20</sup>. The relative importance of the aftermarket thus depends on the eye of the beholder.

It is also worth noting that the aftermarket accounts for approximately 50% of the total OEM/OES profits, as compared to their activity of manufacturing (28%) and selling new cars (18%). Margins of OES on aftermarket revenue are typically in the range [20%-30%], according to the Capgemini study, while for IAM the margins are on average in the range [10%, 15%] (disclosures during our interviews).

The *European* aftermarket itself represents<sup>21</sup> about 30% of the global worldwide aftermarket. Figure 14 illustrates the relative weight of Europe's aftermarket on a worldwide aftermarket level.

<sup>20</sup> The Aftermarket in the Automotive Industry: How to Optimize Aftermarket Performance in Established and Emerging Markets, Capgemini Consulting, University of St. Gallen, 2010

<sup>21</sup> Ready for Inspection – The Automotive Aftermarket in 2030, McKinsey & Company, June 2018

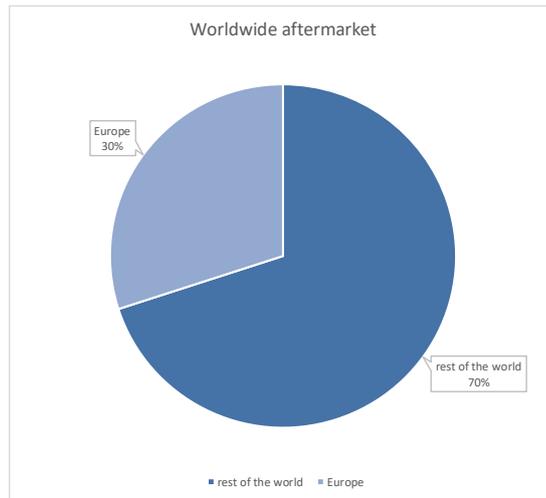


Figure 14: Share of European aftermarket. Source: McKinsey.

Some recent studies have used a baseline for the European automotive aftermarket of 314 million light vehicles with an average age of 10.7 years and a value of 242 billion € in 2017.<sup>22</sup> This value contains both parts and labour. Another value that was recently used in an aftermarket review was the aftermarket of parts with a retail value of €112 in 2017.<sup>23</sup>

We decided to select as a basis for volume these compiled figures by McKinsey, since we could reconcile these best with other recent reports and studies, to sanity check our quantifications.

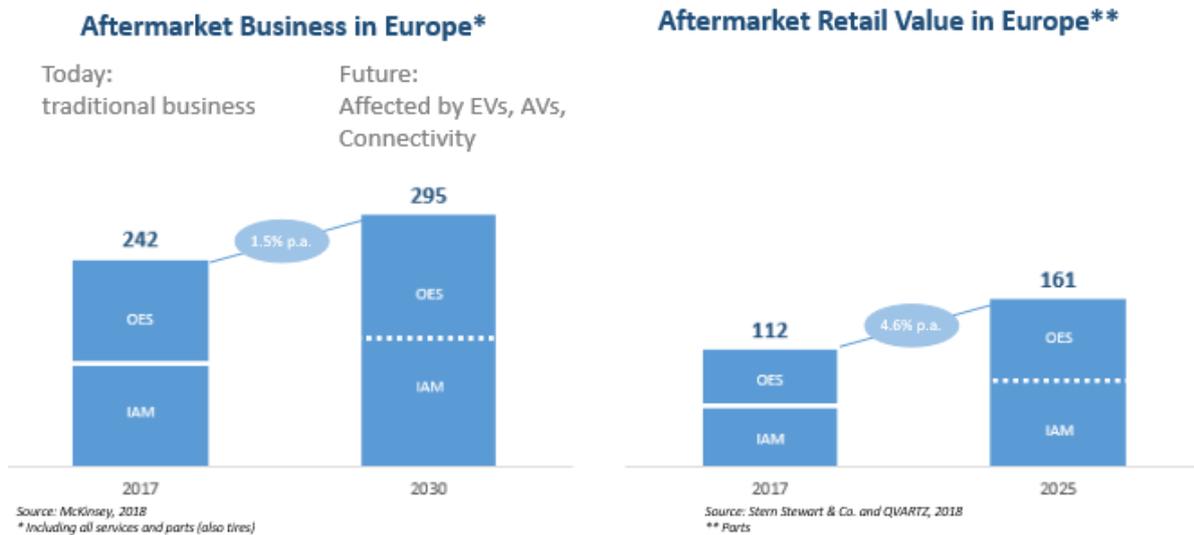


Figure 15: Projections of Aftermarket value in Europe 2017 and 2030.

<sup>22</sup> Ready for Inspection – The Automotive Aftermarket in 2030, McKinsey & Company, June 2018

<sup>23</sup> The automotive aftermarket in 2025, Trends and Implications, Stern Stewart & Co., Quartz, September 2018, commissioned on behalf of CLEPA

The aftermarket volume in Europe, for the scope as defined above, for the year 2017, amounts to **€250 billion**. That is an important reference figure and input further in the text for quantifications.

## 2.4.2 Recent volatility in vehicle sales and heading for contraction

Being the secondary market of the automotive industry, i.e. dealing with all services and parts sales *after* the sale of a new passenger vehicle (PV) or light commercial vehicle (LCV) by the dealer or OEM to the consumer, the automotive aftermarket dynamics follow to a large extent the cyclical development of the primary automotive market.

The primary automotive market has reached pre-crisis levels since the last liquidity crunch in 2007/08 and subsequent automotive crisis with the lowest EU wide vehicle sales in 2011. The current cycle is expected to be passed its peak with most OEMs announcing lower year on year sales in 2018 and even profit warnings.

Up to August, 2018 has been a very good year in terms of volumes of new vehicle sales. However, the September 1 introduction of stricter emissions tests known as the Worldwide harmonized Light vehicle Test Procedure (WLTP) had a distorting effect in the second half of 2018 with August sales peaking ahead of the new regulation and September/October/November/December sales showing significant reductions overall, with some brands bucking the trend (e.g. Spain month October BMW +35%) while others seeing substantial decreases (e.g. Spain month October Audi -56%, Renault -47%). For the whole of 2018, EU sales of passenger cars grew by only 0.1% 2017 with a differentiated picture per market - of the large markets the UK, Italy and Germany declined in 2018.<sup>24</sup>

Bearing in mind these distortions combined with weakening industry sentiment and consumer confidence indicators<sup>25</sup>, it can be expected that the automotive primary market will further move towards contraction. This will subsequently lead to further price pressures both in the primary as well in the aftermarket. In other words, competitive tensions are expected to rise.

## 2.4.3 Past and future

Considering the volume evolution, the aftermarket revenue<sup>26</sup> in 2005 amounted to €166 billion in Europe. The aftermarket demonstrated thus a compound annual growth rate (CAGR) of 3.2% over 2005-2017.

For the coming period over 2018-2030, studies<sup>27</sup> predict about half of that rate, namely 1.5% CAGR, realizing almost €300 billion in 2030. The CAGR allows to compare returns across asset classes. We remark that these reported figures are not adjusted for inflation. Growth is present in the Eastern European market, while status quo is expected to reign in Western Europe. Forecasts beyond 2030 have little meaning. The forecast means that the total aftermarket is considered quasi constant and merely shall

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<sup>24</sup> ACEA, Passenger Car Registrations, 16.1.2019, Commercial Vehicle Registrations, 22.11.2018

<sup>25</sup> European Business Cycle Indicators, 3<sup>rd</sup> Quarter 2018, Technical Paper 025, October 2018

<sup>26</sup> The Aftermarket in the Automotive Industry: How to Optimize Aftermarket Performance in Established and Emerging Markets, Capgemini Consulting, University of St. Gallen, 2010

<sup>27</sup> Ready for Inspection – The Automotive Aftermarket in 2030, McKinsey & Company, June 2018

follow inflation targets (1% to 2%). Changes in the market will be rather on the players' market shares level.

### 2.4.4 Pricing differences

It is a well-known fact and consumers experience it on a daily basis that OEM prices for parts or services are on average substantially more expensive than IAM alternatives, even for the standardized parts or services.

A recent 2016 UK study<sup>28</sup> reveals that "...prices in the IAM sector are between 45% and 80% lower than at OEM workshops for tyres, batteries, brakes and starter motors. However, labor rates remained about 45% lower at IAM."

According to a French Competition Authority publication<sup>29</sup> differences in the hourly labor rates charged by authorized repairers and independent repairers are also significant around 50%. Figure 16 shows the deviation between authorized and independent repairers for France.

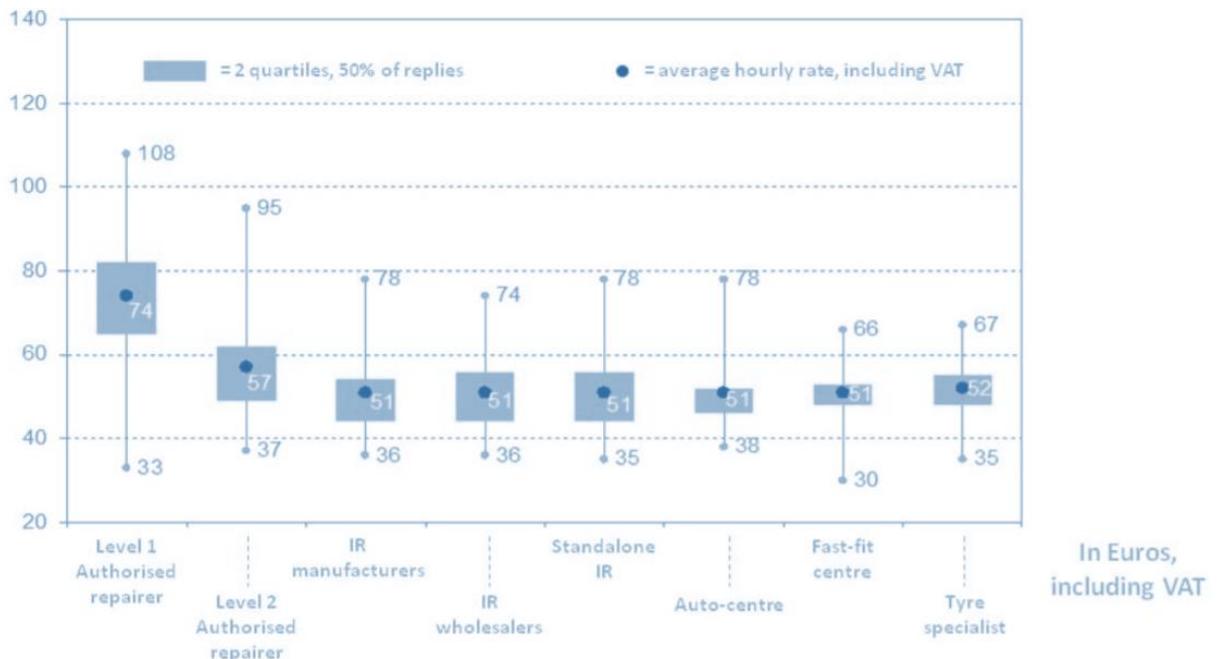


Figure 16: Differences between IAM and OEM channels in hourly rates, France, 2012. Source: GIPA 2011 Repairers Study, page 93.

<sup>28</sup> The Importance of the automotive aftermarket to the UK economy, SMMT in association with Frost & Sullivan, 2017; <https://www.smmt.co.uk/wp-content/uploads/sites/2/SMMT-Importance-of-automotive-aftermarket-to-UK-economy-2017.pdf>

<sup>29</sup> Opinion no. 12-A-21 of 8 October 2012 on competition in the vehicle repair and maintenance sector and the spare parts manufacturing and distribution sector, Autorité de la concurrence, 2012; [http://www.autoritedelaconcurrence.fr/doc/12a21\\_en.pdf](http://www.autoritedelaconcurrence.fr/doc/12a21_en.pdf)

The significance of the price gap is observed worldwide, and not only in Europe. For example in the US, a study<sup>30</sup> by the Alliance of American Insurers, found that the cost of OEM parts averaged 60% higher than identical parts certified by the Certified Automotive Parts Association (CAPA).

Pricing differences may vary across countries in Europe, and across market subsegments, but overall we assume that a range of [30%,70%], or on average **50% difference** between OEM and IAM, is realistic. This pricing ratio of 50% is an essential element of the existing market equilibrium today and it is an input for calculation of impacts further in the study.

#### 2.4.5 Expenditure

Given the annual size of the aftermarket divided by the total number of units, one obtains:

*European average annual expenditure per vehicle  $\approx$  €750.*

Although informative, this estimate represents a simple average that assumes that all vehicles and prices are equal. Since granular data about the type of vehicle (brand, list price, age) that OEM and IAM garages serve are not publicly available, we will approximate the annual spend for each with high-level inputs from the previous sections. More advanced calculations are possible, but in first order this may suffice.

Therefore, we take into account (i) the total number of vehicles annually serviced in the two markets and (ii) the average price discount of 50% of the previous section. These two constraints can be written as follows:

$$\left\{ \begin{array}{l} N_{IAM} + N_{OEM} \approx 320\,000\,000 \\ \overline{Spending}_{IAM} \approx 50\% * \overline{Spending}_{OEM} \end{array} \right.$$

where we denote

- $N_{IAM}$  as the number of vehicles served exclusively by IAM,
- $N_{OEM}$  as the number of vehicles served exclusively by OEM,
- $\overline{Spending}_{IAM}$  as the average customer spending level at IAM, and
- $\overline{Spending}_{OEM}$  as the average customer spending level in OEM aftermarket.

<sup>30</sup> Special Report, Aftermarket Parts: A \$2.34 Billion Benefit for Consumers, 2013, PCIAA  
<https://www.repairerdrivennews.com/wp-content/uploads/2015/06/PCI-Crash-Parts-Report.pdf>

Since there are two fundamental unknowns to solve, we have to link them through one additional equation, in order to solve. For example, the fact of the market shares of 50/50, allows us to use the information that the (unknown) number of vehicles times the average OEM spend should yield half of the market volume of €250 billion:

$$N_{OEM} * \overline{Spending_{OEM}} = 50\% * 250 B€.$$

With basic algebra applied, it yields the rounded<sup>31</sup> average annual aftermarket spending per segment:

$$\left\{ \begin{array}{l} \overline{Spending_{OEM}} \approx 1,170 \text{ €} \\ \overline{Spending_{IAM}} \approx 590 \text{ €} \end{array} \right.$$

And the approximate number of vehicles<sup>32</sup> serviced by each market segment also follows:

$$\left\{ \begin{array}{l} N_{IAM} \approx 213 \text{ million vehicles} \\ N_{OEM} \approx 107 \text{ million vehicles} \end{array} \right.$$

These results indicate that about 2/3 of the total vehicle park is serviced by IAM, while OEMs service only one third. It is thanks to the higher pricing of the OEMs, that they are able to generate about the same revenue as IAM, while servicing only half as many vehicles.

This outcome is also aligned with the aftermarket 'rule of thumb' that OEM services vehicles mainly during the first 3 or 4 years (warranty period). Considered over the average lifetime of a vehicle, which amounts to circa 11 years in Europe, this corresponds indeed to almost 1/3 of the average lifetime.

<sup>31</sup> In this study, figures may not be adding up exactly, or deviate slightly because of applied rounding or simplifications.

<sup>32</sup> Remark that the number of vehicles serviced by a workshop is distinct from the number of workshop visits for the vehicle, one is a metric of the car park of a garage, while the other a frequency count per vehicle over a period, usually a year. As a rule of thumb one may assume one or one and a half visits per year, but it varies by age group and location.

### 3 Trends

In this section we provide a view on the major trends in the automotive aftermarket with most relevance to the topic of in-vehicle data access.

#### 3.1 Changes in power balance

The European Automotive Aftermarket is – just like the entire automotive industry – undergoing tremendous changes, which are affecting the relationship between the various players with new, numerous and powerful players entering the value chain at virtually all points. Figure 17 illustrates this.

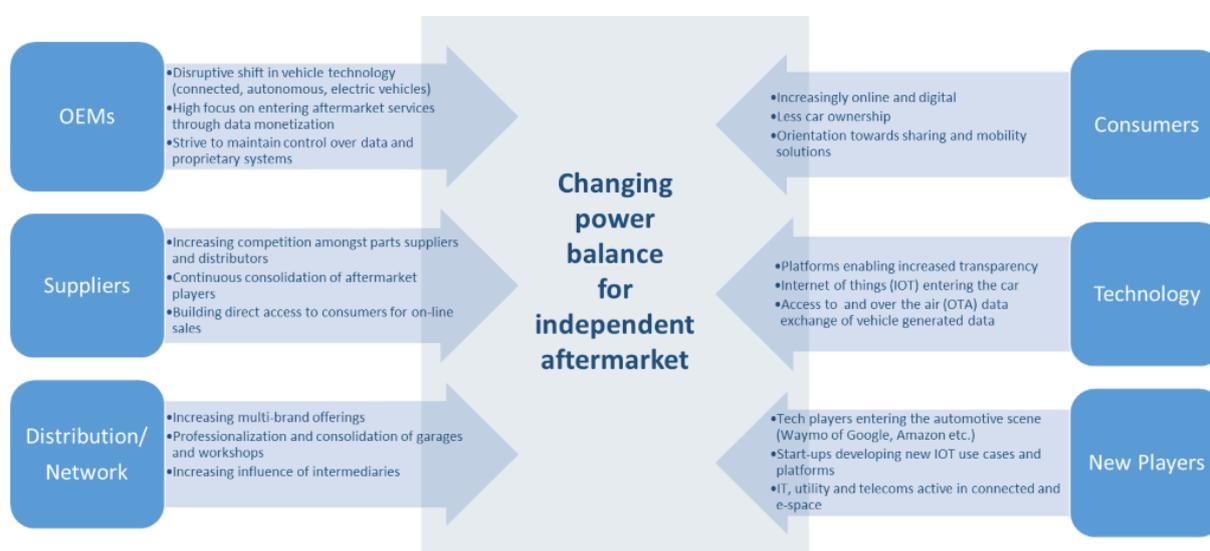


Figure 17: Automotive trends relevant to the independent aftermarket (excl. macroeconomic trends).

Some of the trends, relevant when reviewing vehicle data access, are the following

- Full connectivity of European car park by 2030, either embedded or retrofit<sup>33</sup>
- Telematics systems are increasingly embedded on-board<sup>34</sup>
- Connectivity prices will rise<sup>35</sup>
- Share of data-based services will rise<sup>36</sup>
- Access to data provides competitive advantage<sup>37</sup>

<sup>33</sup> Connected car App based dongle solution as shortcut to connectivity, Roland Berger, September 2016

<sup>34</sup> Berg Insight, September 2018

<sup>35</sup> The 2018 Strategy & Digital Auto Report, The future is here: winning carmakers balance metal and mobility, PwC, 2018

<sup>36</sup> The automotive aftermarket in 2025, Trends and Implications, Stern Stewart & Co., Quartz, September 2018, commissioned on behalf of CLEPA

<sup>37</sup> Ibid.

- Share of services and diagnostics products will rise<sup>38</sup>
- Spare part modules becoming more expensive in line with sensor rise for autonomous vehicles<sup>39</sup>
- Traditional spare parts margins continue to decrease<sup>40</sup>

In previous decades, the digital transformation in the automotive sector was most of the time on engineering improvements, such as sensors and TCU's, however in today's world increasingly more attention is given to human/machine interface and software protocols.

In the context of assessing vehicle data access, we consider the role of technology companies and digital players (DP) such as Google, Apple or Amazon extremely important as they have been successfully operating in the data economy for several decades. Connectivity, data and processing power are exploding and build the basis for completely new forms of cooperation, collaboration and competition.

The connectivity between cars and other devices as well as the infrastructure will be affected by this trend even though the precise speed of its acceleration can only be assumed.

### 3.2 Connected Car Park

Connected vehicles – and at a later stage autonomous vehicles - are considered to be the driver for disrupting the traditional business models of automotive aftermarket players. By 2025, almost 70% of the European car park is expected to be connected either via proprietary connectivity and telematics systems built-in to the vehicle (e.g. Volkswagen Car-Net, Mercedes Me, GM's OnStar) or by retrofit solutions via the OBD interface and/or the smartphone.<sup>41</sup> Figure 18 illustrates the projected fast-paced evolution.

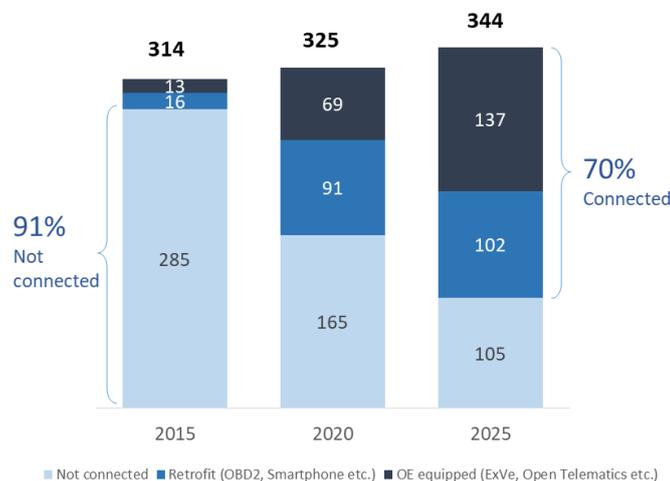


Figure 18: Rise of connected vehicles in Europe 2015-2025. Connected vehicles (PV and LCV) in Europe in Millions. Source: Roland Berger

<sup>38</sup> Ready for Inspection – The Automotive Aftermarket in 2030, McKinsey & Company, June 2018

<sup>39</sup> Yole Development, 2015

<sup>40</sup> Industry Report Vehicle Spare Parts in Germany, Markus Partners, 2017

<sup>41</sup> Connected car App based dongle solution as shortcut to connectivity, Roland Berger, September 2016

There is a unanimous view that the OBD technology as well as smartphone-integrated solutions, while currently and in the next few years vital for entering the connectivity space and experimenting with first service offerings, are only transitional technologies that – after peaking around the year 2025 - will gradually be replaced by embedded on-board telematics systems.

### 3.3 The future of Repair and Maintenance Information (RMI) based services

In order to get a view on the opportunity of digitizing automotive aftermarket services, we have to imagine the way current services will be altered based on data and connectivity. “Service and maintenance channels will [...] shift from a model based on selling and servicing via dealers to one founded on selling and servicing over digital links and, increasingly, via social media.”<sup>42</sup> Moreover, the repair and servicing process will start in the vehicle, where the data quality determines the service quality.

New services will include<sup>43</sup>:

- *Upstreaming and remote issue resolution*
  - Issues can be resolved using digital tools and Over The Air (OTA) data exchange. This means that physical visits to repair shops are no longer needed.
- *Predictive maintenance*
  - This is already happening in machine-based industries and is expected to be applied to vehicles as well. This will provide consumers with more safety and less breakdowns.
- *Planned maintenance.*
  - Maintenance schedules can be planned in line with the wear or usage of parts or modules of the vehicle in order to be efficient. Spare parts can be delivered just in time.
- *Diagnostics systems*
  - Vehicle diagnostics applications—especially aftermarket devices and apps—allow drivers to use data gathering in the vehicle to diagnose engine problems, improve the maintenance of a vehicle, boost fuel efficiency and reduce costs.
- *In-vehicle payment services*
  - Many parties are currently developing applications that can be used for paying for applications in the car with which a driver can automatically pay for any consumed services, electronic car features (OTA updates and upgrades) or even non-car related items such as food and drinks.

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<sup>42</sup> A new era for the automotive industry - How cloud computing will enable automotive companies to change the game, Accenture, Sep 2015

<sup>43</sup> Tec enabled transformation – the one trillion dollar opportunity for industrials, McKinsey, November 2018

These are just examples of the evolving new services related to Repair and Maintenance Information (RMI) but it is clear that access to in-vehicle data will form the basis for providing any such service.

### 3.4 OEM activities

Most OEMs pursue a strategy of keeping control over the aftermarket as traditional income sources come under pressure and new revenue models only just start to evolve (e.g. subscription models, mobility related services).

Some OEMs have even started to extend their aftermarket service offering by setting up repair chains for older vehicles (PSA: Euro Repair, VW: Stop + Go). VW already started 10 years ago and struggled initially to achieve the targeted growth but continues to pursue this model.

But most attention is dedicated these days to technological developments. In order to match tech giants' R&D spending<sup>44</sup>, VW recently announced to significantly raise its investments in electric and self-driving cars as well as new connectivity-based services by €5 billion to almost €44 billion in the next five years.<sup>45</sup> As can be seen in Figure 19, especially Amazon is setting itself more and more apart from any other of the Top 5 R&D spenders.

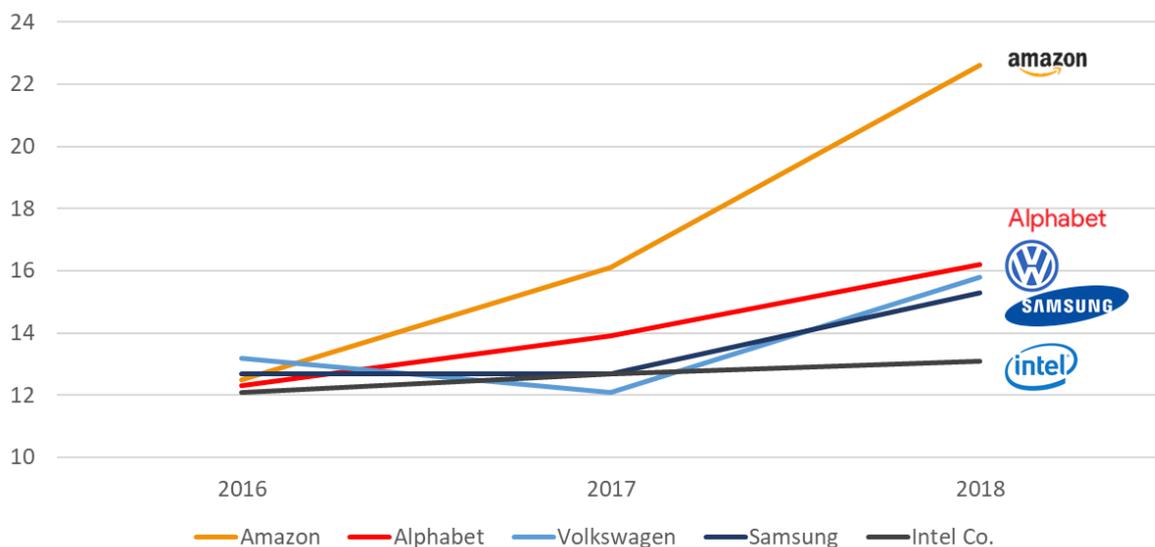


Figure 19: Top 5 global R&D spenders (billion Dollars), 2016-18. Source: Statista, PwC

<sup>44</sup> Data driven business models in connected cars, mobility services and beyond, Gabriel Seibert, Wolfgang Gruendinger, BVDW Research No. 01/18, April 2018

<sup>45</sup> [http://www.volkswagenag.com/en/news/2018/11/VW\\_Group\\_investing\\_in\\_future.html](http://www.volkswagenag.com/en/news/2018/11/VW_Group_investing_in_future.html)

### 3.5 Tier 1 suppliers need to take position

Tier 1 suppliers like Bosch, Faurecia, Continental, ZF or Valeo have long been stuck in the middle between supplying automotive solutions to OEMs for serial production at competitive terms and providing spare parts to the aftermarket on which basis a subsidization of the OE business has been possible. Typically, the share of revenues from the OE business would be 60-70% with profit margins in low single digits whereas aftersales revenue would represent a revenue share of 30-40% and profit margins of 20-40%.

Tier 1 suppliers also have to move from hardware makers to software makers as today sometimes 70-80% of a project for an OEM are software related.<sup>46</sup> The changing dynamics in the industry force Tier 1 suppliers to take a position and many have started to also move into the direction of becoming mobility suppliers, such as Bosch stating to become a supplier of “connected mobility services” or Continental setting up a vehicle data sharing platform.<sup>47</sup>

Many have joined the race to become platform providers such as ZF with Openmatics (connectivity platform for trucks, buses and fleet). However, the recent announcement that Bosch’s Drivelog (a platform for all services around a car for drivers) is to close down after 6 years of business for profitability reasons<sup>48</sup> indicates that even for the largest aftermarket players it is very challenging to compete in the disruption game.

### 3.6 IAM players fighting for relevance, consolidation for scale

IAM spare parts distribution companies have recently undergone a wave of consolidation and it is expected that this trend is to continue. Economies of scale are required in order to withstand the competitive pressures.

The IAM has a strong position in European genes and the potential to challenge new digital entrants through its skills and customer proximity. The IAM has proven over and over again that – given a level playing field – it can very well fulfil customer requirements. Increasing cost pressures throughout the automotive customer base will increase the need for cost efficient processes and low-price spare parts including an increasing demand for recycled OE parts, increasingly referred to as “green parts” for their environmental benefits.<sup>49</sup>

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<sup>46</sup> <https://www.handelsblatt.com/today/companies/solid-state-continentials-plans-to-build-e-car-battery-factory-are-serious-boss-says/23582878.html?ticket=ST-1939242-MML6yR7mfsxdvmRfJed-ap1>

<sup>47</sup> Continental and Hewlett Packard Enterprise Launch Blockchain-Based Data Monetization Platform, <https://www.continental-corporation.com/en/press/press-releases/2019-02-26-cooperation-hpe-164552>

<sup>48</sup> <https://www.automobilwoche.de/article/20181119/NACHRICHTEN/181119918/wir-bedauern-sehr-diesen-schritt-gehen-zu-muessen-bosch-macht-werkstattportal-drivelog-dicht>

<sup>49</sup> <https://www.automotiveworld.com/news-releases/partnership-signed-between-indra-automobile-recycling-and-groupe-psa-to-increase-the-use-of-re-used-spare-parts/>

### 3.7 Platformization and ecosystems

Virtually all players of the automotive industry have started to explore building up or participating in platforms and ecosystems as are already common for example in the consumer goods industry (Amazon). The latest announcement came from VW declaring that it will start offering services from its platform We in April 2019<sup>50</sup>. There are four types<sup>51</sup> of platforms in the automotive industry<sup>51</sup>

- Connected Car Platforms of OEMs
- Supporting IT platforms
- Platforms for smartphone integration
- “Connected Car Platform as a Service” approaches

Digital players have a head start as they were born digital and have been fine-tuning these business models for nearly two decades. OEMs and some Tier 1 suppliers have joined the battle but given the many options find it hard to focus their efforts.

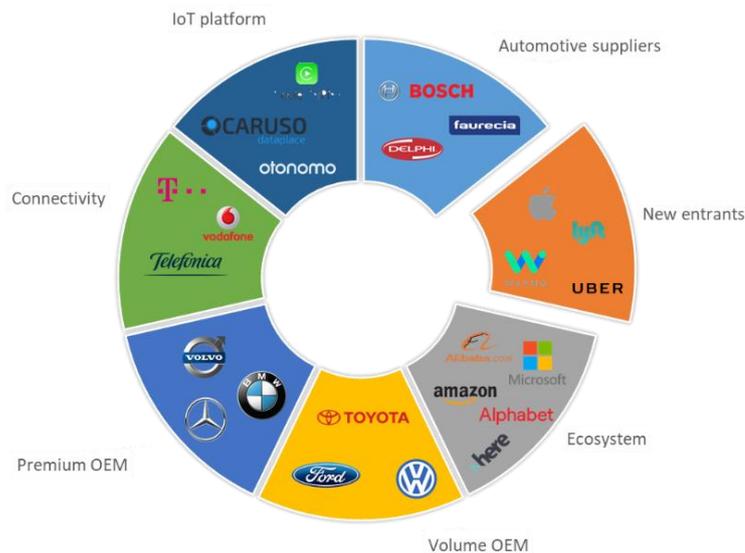


Figure 20: Key groups of actors in the connected mobility sector (illustrative). Source: Accenture, own research

### 3.8 Evolving new marketplaces for in-vehicle data

The last years have seen a steady evolution of new marketplaces aggregating in-vehicle data and we believe that they play an important role in the monetization of in-vehicle data as they bring along the consequent digital approach of independent tech companies. OEMs as well as IO have started to explore

<sup>50</sup> <https://www.volkswagenag.com/en/news/stories/2018/08/volkswagen-develops-the-largest-digital-ecosystem-in-the-automot.html#>

<sup>51</sup> Connected-Car-Services: eine Klassifikation der Plattformen für das vernetzte Automobil, Micha Bosler, Christopher Jud, Georg Herzwurm, HMD (2017) 54: 1005, July 2017

the cooperation with these marketplaces as they have recognized the potential role these marketplaces could play in the discussions around the Neutral Server concept of ACEA. We have selected two such market places as examples of two very different backgrounds, one with European automotive heritage and shareholders and one with non-European roots.

The first one is Otonomo, an automotive data service platform that was set up only in 2015 in Israel and is estimated to have 7 million vehicles on its platform by 2018. Otonomo cooperates<sup>52</sup> with the majority of OEMs and with 75 mobility service providers in order to process and monetize anonymized vehicle data on the basis of drivers'/consumers' consent which they have given when buying the vehicle.

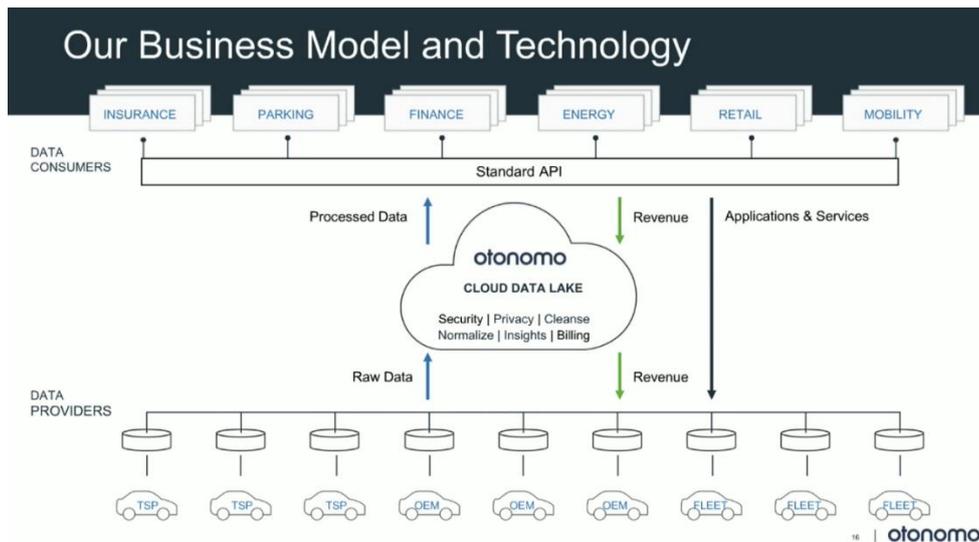


Figure 21: Otonomo Business Model and Technology. Source: Otonomo

In 2018, Otonomo responded to the new requirements of the GDPR faster than many other established players were able to<sup>53</sup> and ultimately positioned itself as a Neutral Server platform provider in cooperation with Daimler.<sup>54</sup> In January 2019, this Neutral Server solution in partnership with Daimler has been showcased at the famous Consumer Electronics Show CES in Las Vegas<sup>55</sup>

Otonomo is an example of evolving driver and vehicle data monetization techniques and of a start-up are quickly adapting to tackle the challenges of established automotive players. Consent management of increasing granularity than today will be important in this context. There must be full transparency to the consumer/driver, to what exactly consent has been given and how driver and vehicle data are being used. Currently, the consumer is largely unaware of when or how his/her data is being monetized.

Since November 2017 the Caruso data place is live. It aims to formulate a new mobility data standard including an open vehicle data catalogue and act as an intermediary. Caruso has been founded by four parties, and as of November 2018 this number has increased to 11 organisations involved in the project

<sup>52</sup> 5 Ways To Monetize Data in the Auto Industry, Niranjana Manohar, Frost & Sullivan, Ben Volkov CEO, Otonomo, Louwrens Appelcryn, Director, Octo, Apr 12 2018

<sup>53</sup> <https://otonomo.io/news/>

<sup>54</sup> <https://otonomo.io/going-live-with-the-first-neutral-server-securely-opening-the-doors-to-automotive-data/>

<sup>55</sup> <https://globenewswire.com/news-release/2019/01/10/1685883/0/en/UPDATED-Daimler-Partners-with-Otonomo-to-Provide-Connected-Car-Customers-with-New-Services-while-Delivering-on-the-Promise-of-Data-Privacy.html>

(TecAlliance, ATR International, Eucon Group, Carat, DVSE, Global One, Mobivia, Wessels+ Müller SE, LKQ Corporation and Osram). Most recently, the exploratory exchange between Caruso and OEMs has intensified with the intention to also bring this stakeholder group to the platform.

Recent reports welcome the advancement of platforms like Caruso but also see the role of OEMs in them critically. “The potential for data aggregation across car brands and other sources creates some possibilities for these platforms to provide a counterweight to monopolistic behaviour by the manufacturers. However, manufacturers' control over the data supply and access to the in-car human interface ensures that they retain substantial leverage over these platforms.”<sup>56</sup>

Despite the known limitations of the current technology and the risk that its costs might be too high for some use cases, Caruso considers solutions such as the Extended Vehicle as a first step made on which basis it continues to work with a still small number of OEMs and other partners in order to make its data marketplace, which is free of charge, gain traction in this evolving mobility data field

It should be noted that both platforms are not perceived in the market as being truly neutral given their ownership structure and shareholders' interests. The different approaches make it increasingly complex and resource-intensive for third party providers to cooperate with all such evolving parties.

### 3.9 Key stakeholders and third parties interested in a competitive aftermarket

Prior to providing a brief description of the key stakeholders of the automotive aftermarket who have a particular interest in a competitive and transparent aftermarket, it is worth taking note that over the past decades OEMs have entered many of the businesses of these stakeholders. They have set up captive organisations active in the same field of business with the intention to increasingly capture market value by moving up or down the value chain and to position the brand of the OEMs in the mind of consumers.

OEMs have expanded into automotive leasing (e.g. Athlon acquisition by Mercedes), fleet management (e.g. participation of VW in Fleetlogistics<sup>57</sup>), telematics (VW and WirelessCar<sup>58</sup>), automotive insurance (e.g. BMW and SwissRe), car rental (e.g. VW and Euromobil), car sharing (e.g. BMW/Mercedes and Car2Go, DriveNow), and used car trading (VW, Mercedes and Heycar). All OEMs have either via new venture funds or directly taken stakes in new connectivity and mobility ventures (GM and ride hailing company Lyft, Volvo and car valet start up Luxe, Ford and electric scooter sharing company Spin, Toyota and ride hailing company Grab). These developments are relevant when evaluating competition aspects.

#### 3.9.1 Rental companies

Most rental companies have adapted their business model and are offering a multitude of mobility services today like car sharing or ride hailing, often referred to as Mobility as a Service (MaaS).

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<sup>56</sup> Access to digital car data and competition in aftersales services, Bertin Martens, Frank Müller-Langer, Joint Research Centre of the European Commission, September 2018

<sup>57</sup> <https://www.fleetnews.co.uk/news/fleet-industry-news/2019/02/08/volkswagen-fleet-services-buys-majority-stake-in-fleet-logistics>

<sup>58</sup> <https://www.reuters.com/article/us-volkswagen-digital-volvo/volkswagen-buys-volvos-connected-car-unit-for-122-million-idUSKBN1O115H>

They benefit from their longstanding operational experience in managing large fleets of vehicles, keeping them and the services offered to their customers up to date and compliant with various regulations. Therefore, they are interested in offering innovative services in numerous areas including maintenance (fleet management, remote diagnostics, vehicle recovery etc.). Rental companies are the owners of their vehicle fleet and have over the past years increased the residual value risk exposure by remarketing the vehicles themselves.

Automotive OEMs have expanded their position in the value chain and no longer are merely suppliers of vehicles to rental companies but also direct competitors through their various mobility businesses. For example, Car2Go started out as a collaborative effort between Europcar and Daimler, with Daimler taking over Europcar's stake entirely in 2018. Shortly afterwards, Car2Go merged with BMW's Drivenow carsharing service. MaaS will serve cities and consumers' need for a flexible on-demand mobility which is environment-friendly and can deliver promised societal benefits. Data needed to develop the new services to be delivered are crucial to avoid anti-competitive transport monopolies.

Rental companies are concerned about potential abusive use of vehicle data access by OEMs in the following way (source Enterprise)

- Excessive prices for data access
- Withholding data
- Manipulating transfer speeds or other performance criteria
- Impacting the running of competitors' applications by changing interfaces, delaying information etc.

Enterprise Holdings has submitted a clear and comprehensive proposal for key principles in the discussion about access to in-vehicle data, which is in line with the views expressed by FIA and AFCAR.<sup>59</sup>

As providers of clean and affordable pay-as-you-go road transport, vehicle rental operators will play a key role in any integrated mobility as a service platform and transport policymakers need to engage with them.

### 3.9.2 Leasing companies

“Globally, Europe is the leading market in both size and maturity with a very high penetration of operating leases, making this market the most attractive for the development of service-oriented solutions”<sup>60</sup>

In addition to rental companies, leasing companies are one of the key operators in the MaaS platforms ecosystem. Operating leasing companies provide not only financial services but also many other services related to a vehicle including service and maintenance, tyres services, fuel management, replacement vehicles, reporting, car procurement. The business model of operating leasing companies includes the lessor to take the full risk on Repair & Maintenance costs and/or tyres costs in addition to the residual value risk for the vehicle.

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<sup>59</sup> A Balanced Approach on Access to In-Vehicle Data to protect Fair Competition and promote Innovation and Consumer Choice in the new Mobility Ecosystem, Enterprise Holdings, March 2018

<sup>60</sup> Embracing the Car-as-a-Service model – The European leasing and fleet management market, Roland Berger, January 2018

Therefore, it is in the leaser's interest to keep a tight control over these costs as well as minimum standards of quality, which many companies achieve by having established advanced sourcing, procurement and controlling processes as well as setting up a preferred network with clear Service Level Agreements (SLAs). These networks can – depending on location and vehicle brand – consist of captive or independent workshops.

With their in-depth knowledge of the vehicle market, leasing companies are able to take a comprehensive and long-term view of vehicle costs and performance. This allows them to determine precisely the total cost of using of a vehicle over a period of several years, ensuring the right vehicle for the client/consumer is chosen from a wide range of different brands.

While at the beginning of the continuous development of the European leasing industry bank owned and independent leasing providers used to be the norm, OEM or importer owned leasing companies, so called captive leasing companies, started to enter the market around the turn of the millennium. Since then, European captive leasing companies have seen a steady growth of their business in recent years and continue to play an important role in support their parent OEM's strategies to engage alongside to automotive value chain and turn from a car manufacturer into a mobility provider.

For example, Daimler Financial Services will be renamed to Daimler Mobility in 2019 and aims at “having the most data”. It will play a crucial role in monetizing vehicle data by developing and selling data-based mobility services. Its revenues doubled between 2009 and 2017, as shown in Figure 22.

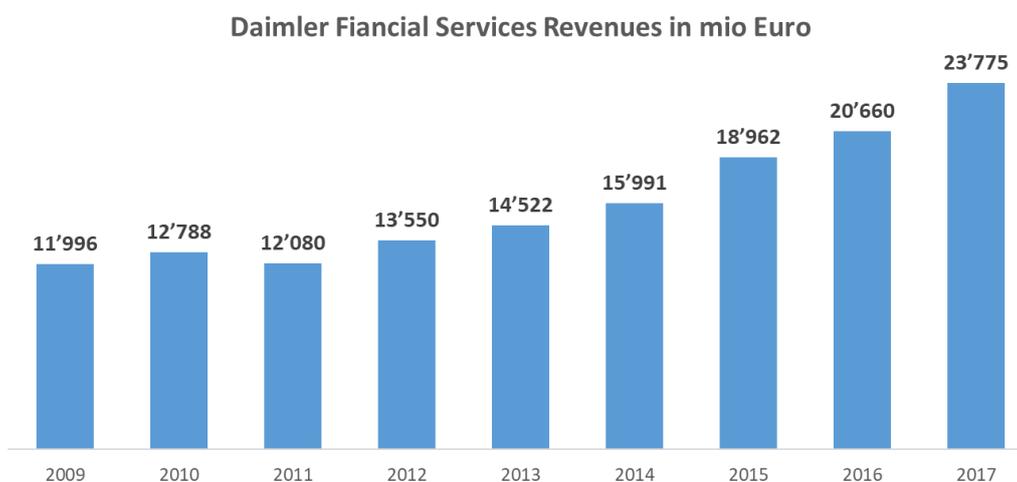


Figure 22: Rise of OEM captive financial services, example Daimler. Source: Daimler Financial Services

Both captive and independent operational leasing firms own and service multibrand fleets, including fleets of the fast growing segment of car sharing or ride hailing providers. As such, the interoperability of data access is a basic requirement to avoid complexity costs. Captive companies play an important role in the envisaged mobility ecosystems of OEMs. They are less dependent on other vehicle brands than those of their parent OEM. So even when assuming a level playing field with regards to access to data, captive lessors will have a certain advantage over independent leasing companies because they simply need to set up less interfaces to be able to service their customers.

### 3.9.3 Insurance companies

With motor insurance (third party liability, collision damages) being a traditional product of incumbent insurance companies, in the past years also OEMs, dealer groups, leasing companies and other new entrants have started to offer insurance services and to manage the risks related to them.

Similar to the Financial Services industry with the rise of Fintech ventures, the insurance industry is facing increasing activity and disruption efforts by digital players and start-ups. On the other hand, vehicle data offers new possibilities for enhancing insurance services by adding driver tailored services, usage based insurance (UBI) premiums, digitalizing the claim handling process and making more educated risk assessments.

### 3.9.4 Roadside Assistance providers

These organizations provide fast and comprehensive support after a vehicle breakdown and thus are relying on efficient ways of data exchange in order to streamline communication as well as parts and tool provisioning processes. Real time and direct access to in-vehicle data would allow Roadside Assistance companies to pre-empt breakdowns or at least accelerate the time it takes to provide breakdown support. At a time when customer experience is steeply growing in importance and increasingly based on data, Roadside Assistance providers will not be in the position to improve customer experience without fair and uncompromised data access.

### 3.9.5 Automobile Clubs

Automobile and Touring Clubs are organisations that aim to protect the rights and interests of all road users, to ensure safe, affordable and clean transport for all by maintaining the benefits of personal mobility.

These clubs are often involved in providing motorists with many of the services described previously either as the actual service providers or orchestrators of such services. They provide consumer information and advice about vehicles such as estimates about the total costs of ownership (TCO) or total costs of mobility (TCM) for motor transport as well as relevant trends and developments in the motor world.

FIA Region I represents 35 million members<sup>61</sup> all over Europe and is thus an important voice of the consumer, a topic that will be further explored in the next chapter.

As for the connectivity trend, European motorists support and welcome this trend as it makes driving safer and more convenient. However, they are keen to understand how their personal and their vehicle data are being shared and to be given a choice on whether or not to share their data and if so to decide with whom<sup>62</sup>, as shown by Figure 23.

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<sup>61</sup> <https://www.fiaregion1.com/>

<sup>62</sup> What Europeans think about connected cars, My Car May Data, FIA Region 1 with Research Now, January 2016

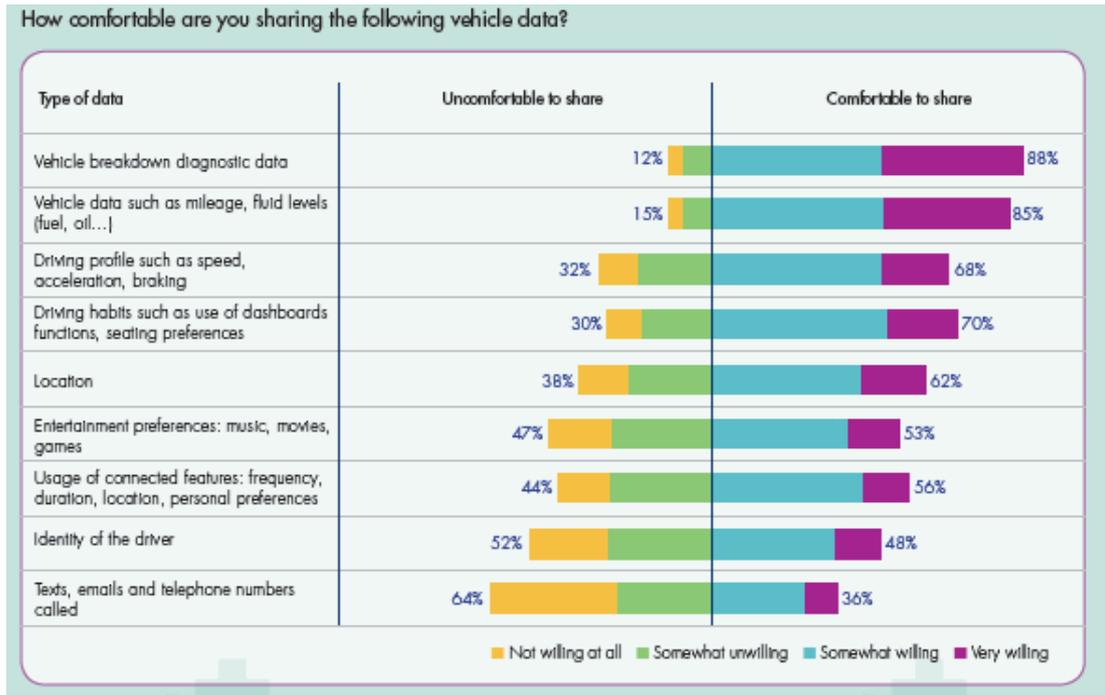


Figure 23: Survey results reveal that consumers are well aware and opinionated about the types of data. Source: FIA.

FIA Region 1 being the representative of the European automobile clubs has summarized their position with outlining three objectives:

- **Data protection:** drivers should retain ownership of data and give informed consent on its use
- **Free choice & portability:** drivers should have the right to choose their preferred service providers and freely consent to data being transmitted by their vehicle
- **Fair competition:** a variety of service providers should have the right to develop safe products & functionalities.<sup>63</sup>

FIA Region 1 has manifestly repeated and advocated these objectives in subsequent responses to developments with regards to the Extended Vehicle.

<sup>63</sup> Policy position on car connectivity, FIA, April 2016

## 4 Data Access

In this section, we focus on aspects of the organization, i.e. accessing and processing, of data generated by the vehicle and its drivers.

### 4.1 Telematics

#### 4.1.1 Internet of Things

As shown in the above section on key automotive trends, vehicles are becoming increasingly connected. That evolution started already in the seventies with the global computerisation wave. The data generated induced the need for telecommunication of informatics over distance, coining the broad term telematics. In academic literature the term telematics has still a broad meaning, although it is rather used nowadays referring to automobiles and over-the-air send/receive capability.

Nowadays, many tools and equipment have embedded connectivity and exchange their data, because sensors are getting smaller and cheaper, modems more advanced, and high-speed low power virtual networks are omnipresent. Adding to that the capacity to be connected to the internet (or the cloud), telematics is seen as part of the Internet of Things (IoT) wave. Car makers rather prefer the term "extended vehicle", which strategically emphasizes that the data should be seen as part of the vehicle, and hence belonging to the manufacturer, rather than to the owner of the vehicle.

Compared to many other devices in the IoT era, the connectedness of vehicles is actually lagging behind.

- Primarily, that is because most standardization activities of IoT devices are confined to very specific verticals. In every industry, fights for dominance take place, with lots of parallel (but disjointed) standards development. Therefore, car makers need to look beyond their own sector for standardisation efforts already established, allow for cross-domain interaction with other machines/devices, and aid system interoperability/compatibility. If not, it will afflict the automotive sector with fragmentation and postpone reaching critical mass, to the detriment of all market players, and the consumer.
- Secondly, the issues of data ownership, access rights to cloud data, read/write access to on-board data, access rights to the driver, and lack of industry stakeholders' legal protection slow down the investments in innovation and global growth potential of the IoT for vehicles.
- Thirdly, the major players (OEMs) are followers in telematics solutions, not leaders. Other players have much earlier identified the telematics value pool and have developed advanced telematics via tethered solutions. By embedding the internet tether on-board, OEMs now try in one movement to impose also the telematics platform of their choice. Some interviewees perceive this merely as a way of buying even more time, and likely enough time to catch up with the other players, as regulators struggle with fast-paced technological follow-up.

Remotely accessing vehicle data is thus not a new development, but, with the growing connectivity it is a rapidly developing area. The automotive sector is undergoing a time where different telematics implementations and data access solutions coexist, and the lack of regulation or standardization prohibits reaching critical mass. In line with the maturing of different vehicle and connectivity technologies, there are a number of data access models being developed and different solutions proposed.

The main model for remote vehicle access being promoted and advocated by OEMs is the 'Extended Vehicle' concept, where vehicle data are transmitted to an external server where they subsequently can be accessed by third parties. While the technical solutions for access to in-vehicle data as proposed by ACEA, the Extended Vehicle and also the amended proposal of the Neutral Extended Vehicle (Nevada), are still relatively new and still not widely implemented in the industry, the number of studies dealing with the topic from technical, regulatory and legal perspectives is rapidly growing.

As this option appears to be the solution of choice by most OEMs and the one being officially promoted in the EU, this study is predominantly focusing on it while trying to also shed a light on relevant previous, parallel or potential future developments. The IAM stakeholders are due to smaller size, larger count and wide diversity much less unified than the relatively concentrated group of OEM players, which explains the apparent lack of marketing of an alternative common IAM model.

#### 4.1.2 OBD – Europe in the footsteps of the US

Before turning to the Extended Vehicle and Open Telematics Platform, we would like to elaborate on data access via the On-Board-Diagnostic interface (OBD connector) as it is currently the most common way to obtain in-vehicle data and has formed the basis of many new business activities in the automotive aftermarket. It is currently the only way which allows independent, direct, real-time and free of charge access to in-vehicle generated data.

The need to regulate emissions and the mass adoption of electronic fuel injection by OEMs in the 1980s enabled this electronic way of accessing and interacting with a vehicle's computer system. The OBD technical standard originates from the United States of America where in 1991 the California Air Resources Board (CARB) mandated OBD for all new vehicles sold in California. In 1996 a US standard known as OBD2 and previous iterations of OBD were retroactively classified OBD I. Among others a harmonised OBD connector was defined, which later on was copied into UN Regulations becoming a world standard.

The USA OBD2 standard was simplified and converted into EOBD requirements which have been applied in the EU since 1998 based on Directive 98/69/EG and later on incorporated in the Type Approval regulation.<sup>64</sup> While European OEMs had to equip vehicles to be exported to the US with OBD-2 since 1996, the introduction of EOBD- took place gradually in the EU. Today, the majority of the European car park is equipped with a standardised OBD connector, which can be accessed via a generic scantool via wires or remotely through a dongle, a retrofit solution that by now has become a mass market product and thus widely affordable. The adoption of dongles in Europe is likely to grow from 0.9 million in 2016 to 4.1

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<sup>64</sup> Directive 98/69/EC of the European Parliament and of the Council of 13 October 1998 relating to measures to be taken against air pollution by emissions from motor vehicles and amending Council Directive 70/220/EEC, Regulation (EC) No 715/2007 of the European Parliament and of the Council of 20 June 2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information

million in 2023<sup>65</sup> and we estimate the current connectivity via a dongle to be 30-40% of the car parc. Figure 24 illustrates some solutions to implement telematics via various data and connectivity models.

Access for aftermarket actors via the OBD connector has become an established model and increasingly business models have started to successfully grow around it. There is a large number of scan tools available in the market that connect to the on-board CAN bus, read out and interpret what OBD codes mean, read out live sensor data and allow remote actuator tests.

OBD devices can transmit the information to a nearby smartphone so the driver knows the importance of an error code if such a fault happens. Remote diagnostics are expected to grow in the future by using the telematics system as the communication link. OBD access for RMI requires certification of the service provider. This certificate differs per OEM brand and there are no standardized rules for this certification.

Consequently, and despite the limitations of this way to access vehicle data, it has become very popular and supported a number of start-ups to be established based on the access and commercialization of data such as Munic, Octo, Ryd (formerly Tanktaler), PACE from Pace Telematics, Carly, TEXA CARE.

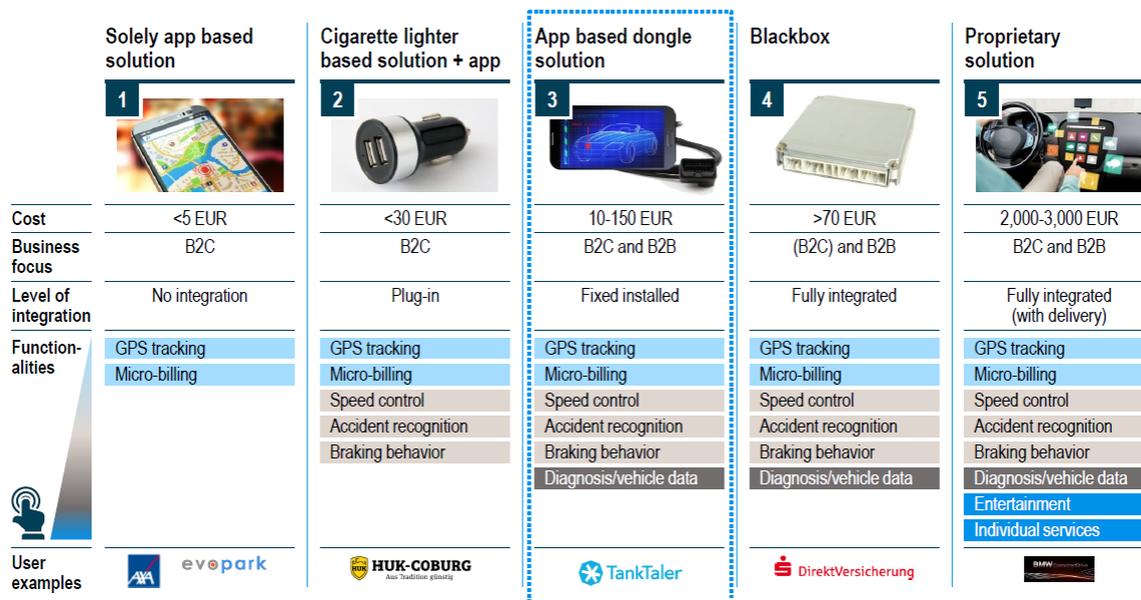


Figure 24: Overview of connectivity solutions. Source: Roland Berger

Based on interviews with several start-ups, this telematics data model innovation trend continues with a number of young companies developing new value propositions based on vehicle data available via the OBD port. But also OEMs, suppliers, spare parts distributors, insurance companies (e.g. Mobly platform by Baloise insurance), automobile clubs, telecommunication operators, telematics services providers, rental and leasing companies have embraced this trend and have piloted or already introduced dongle based services to the market like for example Continental, Bosch Drivelog Connect, Telekom Car Connect

<sup>65</sup> Connected car App based dongle solution as shortcut to connectivity, Roland Berger, September 2016

Adapter. As mentioned earlier, Bosch's drivelog platform announced its termination, which is a sign of the increasing competitive landscape and the difficulty to make such a business profitable.

Repeatedly over the past and until today, several OEMs have announced to close the OBD data access, for example by means of a so called "security gateway" that requires the use of proprietary equipment and/or electronic certificates provided by the OEM and at the cost of the independent service provider. As such, OEMs are claiming the ownership of vehicle/driver data and along with that, also in-vehicle interface access to the driver.

#### 4.1.3 Extended Vehicle – the European OEM approach

Since 2013, the European automotive OEMs have been working on the so-called Extended Vehicle project with the objective to create the standard for a web-based data platform which can be accessed by third parties. Third party providers can thus retrieve and receive data from vehicles via the IT centres of the manufacturers (backend server). The web platforms themselves are designed by each manufacturer.

In 2017, an extensive review by the Transport Research Laboratory (TRL) on behalf of the European Commission's Directorate for Mobility and Transport of the European Commission came to the conclusion that the Extended Vehicle is the worst of all options.<sup>66</sup> Figure 25 shows some of the other existing models, evaluated according to various qualities.

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<sup>66</sup> Access to In-Vehicle Data and Resources, Final Report, TLR, May 2017

Technical solution	Data provision conditions – consent	Fair and undistorted competition	Data privacy and protection	Tamper-proof access and liability	Data economy
On-board Application Platform	Green	Light Green	Green	Yellow	Grey
In-vehicle Interface	Green	Grey	Green	Yellow	Grey
Data Server – Extended Vehicle	Green	Red	Green	Grey	Grey
Data Server – Shared Server	Green	Yellow	Green	Grey	Grey
Data Server – B2B Marketplace	Green	Yellow	Green	Grey	Grey
<b>Assessment of compliance with WG6 guiding principles</b>					<b>Rating</b>
Compatible with guiding principles					Green
Minor issues with compatibility or issues that could be addressed with low cost/impact					Light Green
Issues with compatibility or issues that could be addressed with medium cost/impact					Grey
Significant issues with compatibility or could be addressed with high cost/impact					Yellow
Incompatible with guiding principles in current form					Red

Figure 25: Assessment of data access forms with guiding principles. Source: TRL

The main shortcomings of the Extended Vehicle are:

- Lack of real-time access to data
- Bidirectional communication from and to vehicle/driver not possible for third parties
- Monitoring of third party activities by OEM possible
- Limited data set
- Aggregation of data in vehicle not possible
- No reconciliation with historic data possible

The fact that the Extended Vehicle has been put into ISO standards<sup>67</sup> strongly suggests that the Extended Vehicle is a concept that is widely supported and offered by all OEMs. However, the actual number of OEMs offering a functioning Extended Vehicle solution today remains very small and there is a widely expressed doubt about the concept even amongst industry players itself. For many insiders of the

<sup>67</sup> ISO 20077-1:2017, Road Vehicles -- Extended vehicle (Extended Vehicle) methodology -- Part 1: General information, and ISO 20077-2:2018, Road Vehicles -- Extended vehicle (Extended Vehicle) methodology -- Part 2: Methodology for designing the extended vehicle

automotive industry, the Extended Vehicle/Nevada concept is not deemed to survive in the long term as too many flaws are already identified, which prevent any mass usability.

A thorough technical analysis<sup>68</sup> conducted on behalf of AFCAR in 2018 confirms these above-mentioned shortcomings, but moreover verifies that the Extended Vehicle concept is by design advantaging OEMs e.g. via dominant access to in-vehicle data on apps level (Level 3), exclusive driver access, better off-board access and earlier access to the driver. Nevertheless, some OEMs continue to work on the Extended Vehicle with Daimler being the first OEM to officially launch a Neutral Server offer for its customers<sup>69</sup> coinciding with a Neutral Server offering announced by Otonomo<sup>70</sup> who are believed to be in cooperation with several OEMs and IO on the topic.

While a 'neutral' server approach would reduce the control that OEMs can take over the supply of data, experts on the matter agree that this would only shift the issue of data control and privileged access to other players and it would not solve the issue of behavioural incentives of the server provider to maximise their benefits from providing access to the data. "Servers may be 'neutral' in the technical sense of reducing the intermediary role of the OEM but they are not necessarily neutral in the economic sense."<sup>71</sup>

As the analysis of currently available alternatives confirms, OBD – while being far from being the best option for connectivity in the future - at this stage offers a number of basic functionalities for the aftermarket. **Studies and stakeholder opinion unanimously confirm that the Extended Vehicle/Nevada concept offer even less functionality and its limitations will prevent it from succeeding.** The On-Board Application Platform continues to have most advantages from all aspects and remains the favoured option for the majority of IO.

#### 4.1.4 Extended Vehicle in relation to general technological trends

We believe that the protective Extended Vehicle position taken by OEMs with regards to RMI data is not necessarily or at least not exclusively aimed against the IAM players as there has been a healthy competitive coexistence for many decades. It is rather an expression of fears for increasing control of digital players over automotive revenue streams. The European automotive industry currently acknowledges that it is technologically lagging players like Tesla, Waymo (the Google subsidiary running autonomous vehicles) and that it aims at mirroring the Apple System (BMW).

##### 4.1.4.1 From cars to computers on wheels – the “new software defined car”

As vehicles are becoming smart phones on wheels or “computers on wheels”<sup>72</sup> with 100 million lines of code in an average car and rapidly accelerating software penetration, many look for parallels to the developments in software that have taken place in the past decades in order to illustrate the expected implications of the Extended Vehicle approach. Figure 26 illustrates the complexity involved.

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<sup>68</sup> OEM 3rd Party Telematics – General Analysis, Knobloch & Gröhn Gbr, December 2018

<sup>69</sup> <https://media.daimler.com/marsMediaSite/en/instance/ko/Mercedes-Benz-customers-benefit-from-new-data-services.xhtml?oid=42066649>

<sup>70</sup> <https://otonomo.io/going-live-with-the-first-neutral-server-securely-opening-the-doors-to-automotive-data/>

<sup>71</sup> JRC

<sup>72</sup> David Sedgwick, Cars Become Computers on Wheels, AUTOMOTIVE NEWS, Apr. 21, 2014, [www.autonews.com/article/20140421/OEM06/304219993/cars-become-computers-on-wheels](http://www.autonews.com/article/20140421/OEM06/304219993/cars-become-computers-on-wheels).

Tesla is still the predominant example of a software company building cars whereas all other traditional OEMs are car companies offering software. In this context the new term “new software defined car” is being used more and more frequently as it makes the difference to a mechanical car very clear. Increasingly, software upgrades will deliver new functions faster than ever previously thought possible.

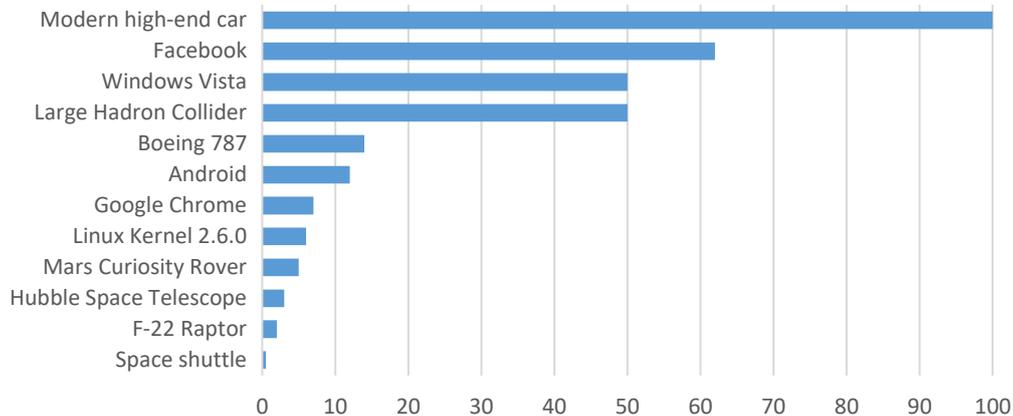


Figure 26: Software size in million lines of code. Source: NASA, IEEE, Wired, Boeing, Microsoft, Linux Foundation, Ohio.

#### 4.1.4.2 OEM platforms and ecosystems

Most OEMs have started to build their own platforms (e.g. BMW with IBM, Toyota with NTT, Ford’s Commercial Solutions’ Transportation Mobility Cloud) and are testing new, faster routes to product innovation (e.g. Mercedes-Benz Vans adopting the Automotive Grade Linux open platform) and telecom as well as IT services providers are lining up as partners for OEMs to provide for example advanced OTA solutions or open 5G-ready connected car platforms featuring blockchain-enabled security.

Car manufacturers’ connected car platforms provide connected car services of the respective OEM brands and are in general divided into a frontend and a backend. The frontend covers all aspects that are perceived or seen by the owner or driver like the screen in the cockpit or an app for mobile devices. In addition, OEMs operate a web portal where drivers register to get access to paid services. The backend includes all processes and data flows that occur in the background during service processing.

The supporting IT platforms are based on the processes of the backend and are provided by information technology companies. These IT service providers offer platform-based solutions that help car manufacturers to handle the backend. Accordingly, the option arises for the OEMs to outsource the entire backend - or selected parts of the backend - to a specialized service provider. This eliminates the need for automotive manufacturers to build up the necessary resources and IT skills. This explains, why today the likes of Android (Google), Apple, Linux, IBM, Microsoft have a strong position in cars, starting from infotainment first, then telematics/fleet management and ultimately diagnostics.

While ACEA has been promoting the off-board Extended Vehicle solution, not all manufacturers have eagerly followed this approach and only three (BMW, Mercedes, PSA) can today offer any such solution.

In addition, most of them have started to develop and already offer proprietary on-board telematics solutions (GM, Ford) and it is commonly understood within the industry that this is the trend going forward. In addition, there is still quite a number of OEMs who can offer neither on- nor off-board solutions.

Existing proprietary on-board systems offer promising features like native touchscreen interface, speech recognition, real time access to signals, secure and standardized process for app development, test and release showing that technically full access to the driver is already possible today. The Human Machine Interface (HMI) is thus becoming more and more seamless, a fact that is considered to be one of the key elements in driver experience and interaction. OEMs have started to apply Artificial Intelligence (AI) technology to enhance their service offerings. For example, Skoda invested in the Israel based start-up Anagog, which processes data from over 100 smartphone apps and uses AI to predict mobility patterns. The technology will be used to recommend parking spaces, offer personalized insurance and enhance dealership experience.

OEM concepts are for example VW Car-Net, Daimler Mercedes Me Connect, BMW Connected Drive, Hyundai ccOS connected car operating system, GM OnStar, Volvo and Google, Linux with Asian OEMs and Ford, Google with Renault, Fiat.

Over the past months there have been several announcements of OEMs (Volvo, Renault-Nissan-Mitsubishi) to cooperate more closely with Google with now reportedly also Toyota allowing Google deep access to its vehicles.<sup>73</sup> We expect these dynamics and the accelerating pressure to use data efficiently to be able to apply AI technology, to play a crucial role in the different competitive positioning of OEMs where a lack of a common standard is contributing to expensive proprietary 'silo' developments and millions of sunk costs.

#### 4.1.4.3 Open vs closed systems

The OEM platforms for connected services are proprietary in nature offering little customization or design flexibility. It is not surprising that a number of providers are starting to develop open platforms in order to bring flexibility through platforms that allow for example for semiconductor sensors and semiconductor components to be interchangeable depending on the application or customer specifications. Nevertheless, the DNA of automotive OEMs is to protect their proprietary systems and to operate wherever possible closed systems. The Extended Vehicle is such a closed system.

Again, parallels can be drawn from the tech industry starting with Microsoft and Apple personal computers where Microsoft chose the more successful open strategy allowing their operating systems to be installed on any PC, which gave it significant market shares. Later on, though, legislation was required to prevent Microsoft from applying unfair Netscape browser bundling practices.

A Harvard Business School<sup>74</sup> paper differentiates a platform's openness/closedness by four aspects and gives example platforms. Figure 27 illustrates these criteria.

Aspect of closedness/openness of a platform	Linux	Windows	Macintosh	Apple IO
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<sup>73</sup> <https://www.bloomberg.com/news/articles/2018-09-21/toyota-is-said-to-agree-to-add-android-auto-in-its-cars>

<sup>74</sup> Opening Platforms: How, When and Why?, Thomas R. Eisenmann, Geoffrey Parker, Marshall Van Alstyne (2008-08-31), Harvard Business School Entrepreneurial Management Working Paper No. 09-030

Demand-side use (end-user)	open	open	open	open
Supply-side user (application developer)	open	open	open	closed
Platform provider (hardware/operating system (OS) bundle)	open	open	closed	closed
Platform sponsor (design & intellectual property (IP) rights owner)	open	closed	closed	closed

Figure 27: Comparison of common computer platforms

The conclusions of a study<sup>75</sup> on open cars expresses what most software specialists and IT professionals confirm – that open systems are superior and already in use of modern cars today.

- *“To qualify as an open car, an automotive product must be open for technology upgrades, aftermarket products and security researchers. It must have open interfaces and openly disclosed software and hardware. It will thrive if it is associated with open developer platforms. The open car does not need to run on open data. It can protect data privacy and security as well or better as proprietary automotive products do today. It does not need to run on open source software either. But the open car will likely run better on open source software, judging by the fact that many cars already run open source software today.”*
- *“The closed car remains controlled by its original manufacturer, which is in most cases a large company with a strong brand, good safety track record, well-capitalized, subsidized or supported by governments, and generally considered more trustworthy than many smaller companies. The original manufacturer of a closed car retains the power to decide if and when updates and upgrades are offered for the closed car, with what functionality, and at what price. Owners of closed cars will have less options and may have to discard an automobile with a fine motor and design if its original manufacturer does not offer updates that are attractive, reasonably priced or perhaps even necessary from a safety perspective in the rapidly evolving world of connected, autonomous cars.”<sup>76</sup>*
- *“Compared to the closed, proprietary car, the open car comes out ahead based on technology, competition, sustainability and environmental policy considerations.”<sup>77</sup>*

Open systems are considered to be safer and more secure. The main reason behind that is the fact that open and open source systems attract more developers and this leads to a swarm intelligence effect. The best example is Linux, which is nowadays widely used also in vehicle software technology as Automotive Grade Linux.<sup>78</sup>

Specialists on the topic agree that in order to increase security, systems should be opened as “obscurity means insecurity. Security is a process. For software, that process is iterative. It involves defenders trying to build a secure system, attackers -- criminals, hackers, and researchers -- defeating the security, and defenders improving their system. This is how all mass-market software improves its security. It’s the best

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<sup>75</sup> Open Cars, Lothar Determann, Bruce Perens, 32 BERKELEY TECH. L.J. Issue 2 (2017)  
<sup>76</sup> Ibid  
<sup>77</sup> Ibid  
<sup>78</sup> Automotive Grade Linux (AGL) is an open source project hosted by The Linux Foundation that is building an open operating system and framework for automotive applications. AGL was launched in 2012 with founding members including Jaguar Land Rover, Nissan, Toyota, DENSO Corporation, Fujitsu, HARMAN, NVIDIA, Renesas, Samsung and Texas Instruments (TI). (Wikipedia)

system we have. And for systems that are kept out of the hands of the public, that process stalls. Smart security engineers open their systems to public scrutiny, because that's how they improve."<sup>79</sup>

Independent of the chosen technology, the fact that even tech giants have started to ask for global regulation confirms that policy makers not only in the EU but across the world need to take action when it comes to paving the road to a common data approach.<sup>80</sup>

#### 4.1.4.4 Parallels to other industries – Walled Gardens

Many industry representatives compare the proprietary systems of OEMs with Apple's iOS and request a more open approach. Other famous examples include the battle of systems between video recorders in the 70s, the different internet protocols, the proprietary Apple dongle interface vs USB, and Intel with its microprocessor technology. Apple is often being quoted by some OEMs as a benchmark for controlling an entire ecosystem and with its iOS applications and a clear motivation is to be included in all the most profitable value chains built on their platform (payments, ads, data, video, music etc.). This is also confirmed by the fact of OEMs hiring former Apple executives into key positions.<sup>81</sup>

Such approaches are also commonly termed *Walled Gardens*. A Walled Garden is a closed ecosystem in which all the operations are controlled by the ecosystem operator.

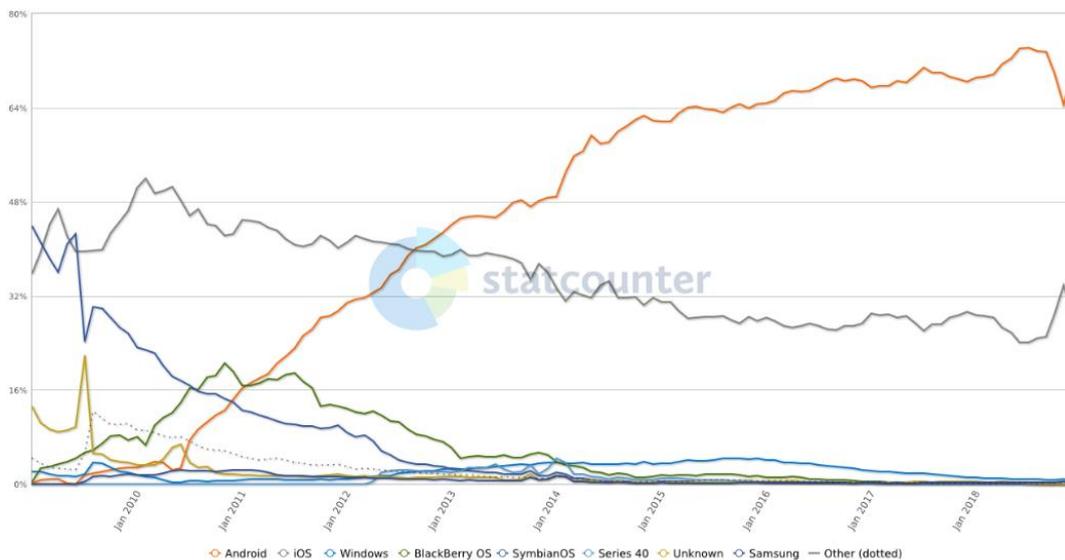


Figure 28: Market share of mobile operating systems in Europe, Jan 2009-Nov 2018. Source: Statcounter.

<sup>79</sup> The Insecurity of Secret IT Systems, Bruce Scheier, 14<sup>th</sup> February 2014, [https://www.schneier.com/blog/archives/2014/02/the\\_insecurity\\_2.html](https://www.schneier.com/blog/archives/2014/02/the_insecurity_2.html)

<sup>80</sup> Google's top policy chief calls for 'common rules of the road' globally for tech regulation, CNBC, 19 January 2019, <https://www.cnbc.com/2019/02/10/google-policy-chief-tech-regulation-global-common-rules.html>

<sup>81</sup> [https://europe.autonews.com/automakers/vw-hires-apple-exec-autonomous-mobility-role?utm\\_source=daily&utm\\_medium=email&utm\\_campaign=20190110&utm\\_content=article7-headline](https://europe.autonews.com/automakers/vw-hires-apple-exec-autonomous-mobility-role?utm_source=daily&utm_medium=email&utm_campaign=20190110&utm_content=article7-headline)

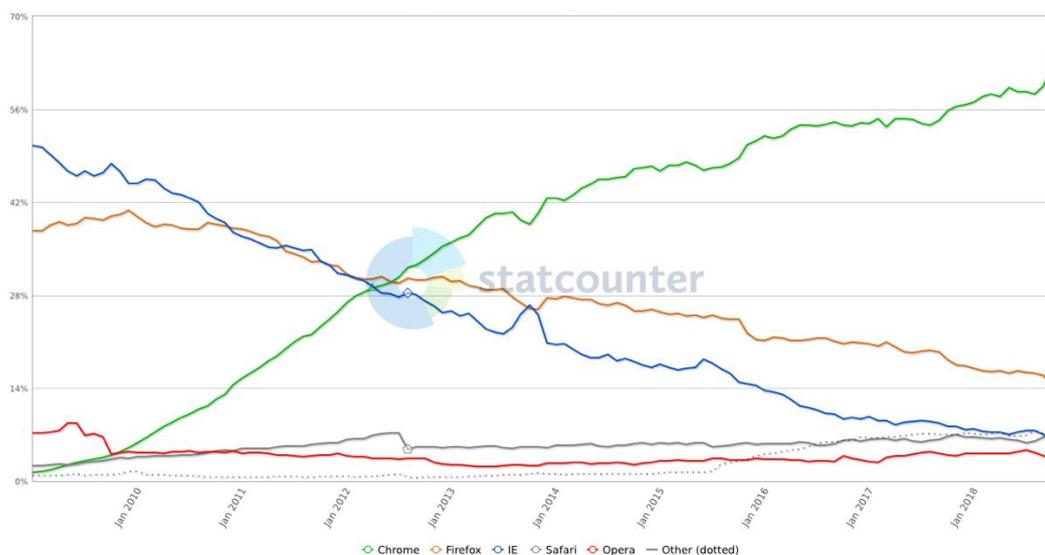


Figure 29: Market share of browsers in desk top devices in Europe, Jan 2009-Nov 2018. Source: Statcounter

As seen from the above examples and recent business developments<sup>82</sup>, such closed systems tend not to be sustainable in the long run but in the short term they are considered the most profitable business models while open ecosystems eventually bring more value to society.

#### 4.1.4.5 Move from closed to open standards and embedded technology in automotive systems

The strong, defensive position of incumbent automotive OEMs towards their proprietary and bespoke in-house systems is based on the significant investments into these systems, a conservative, engineering focused mindset and a deeply rooted concern over security and outsourcing to third parties. They consider in-vehicle data highly commercially sensitive data and that uncontrolled access to them might provide a path to intellectual property. However, in the light of the fast-moving increasing connectivity of vehicles and with fast advancing OTA technologies, OEMs are increasingly turning to open source technologies.

Today, OEMs cannot keep pace with the short development cycles of software businesses. Some of them, like for example Volvo<sup>83</sup> or Renault-Nissan-Mitsubishi, decided and announced that they would embed Google's technology (e.g. voice-controlled Google Assistant, Google Play Store, Google Maps and other Google services) into their vehicles' systems, i.e. providing Google with deep access to their vehicles' systems.

Therefore, it is a common view that "OEMs should move to open up their in-car digital service platforms to third-party app developers, ideally supported by standardized operating systems across vehicles and even across OEMs. This would trigger the creation of collaborative ecosystems where drivers would benefit from wider ongoing innovation, supported and enabled by the standardization, scalability, processing power and connectivity of the SMAC ecosystem."<sup>84</sup>

<sup>82</sup> <https://www.cnbc.com/2019/01/09/apple-walled-garden-starting-to-show-cracks.html>

<sup>83</sup> <http://europe.autonews.com/article/20181129/ANE/181129670/volvo-picks-polestar-2-to-debut-embedded-google-android>

<sup>84</sup> A new era for the automotive industry - How cloud computing will enable automotive companies to change the game, Accenture, 2015

Transparency advantages will outweigh benefits from relying on a few trusted manufactures. Interoperability will require open, standardized interfaces communication protocols and open platforms.

#### 4.1.4.6 Activism entering automotive software development

Open standards alone are, however, not a guarantee for compliance by OEMs. Tesla is an example that while using open standards-based Linux software, it failed for over six years to abide by open source software licenses (e.g. General Public License, GPL) and to disclose its code. Forced by the not-for-profit activist Software Freedom Conservancy (SFC) who rightfully proved that Tesla has not been abiding by the open source code, Tesla finally announced to open-source its vehicle security software for free to other automakers.<sup>85</sup> It is using this announcement for positive PR claiming that this move has been done for a safer self-driving future. The notion that by opening up their code, Tesla’s vehicle security software would become close to a standard setter is most likely also playing a role in this decision.

#### 4.1.4.7 In-vehicle data monetization

Data are transforming not only the automotive industry but the entire economy and the world’s most valuable companies are data driven (see Figure 30).



Figure 30: Global most valuable companies by market capitalization. Source: Wikipedia, Financial Times.

There is a full awareness about the success of data driven business models and as all of the above-named companies have started to enter the automotive business, OEMs are looking for ways to pre-empt a power shift. They have started to explore routes of data monetization and there is a number of studies analysing the huge potential of data monetization in the automotive industry. Most of these studies are aimed at OEMs but also suppliers of OE parts and equipment. McKinsey estimates that car-generated data could become a global 450 - 750 billion Dollars value pool by 2030 whereby 45% of this value is generated by new revenues, 40% by cost reductions and 15% by increased safety and security.<sup>86</sup>

<sup>85</sup> <https://www.open-electronics.org/tesla-announced-to-open-source-its-software-to-make-autonomous-vehicle-safer/>

<sup>86</sup> From buzz to bucks – automotive players on the highway to car data monetization, McKinsey, May 2016

While this is still a very new area for them, several business models are starting to evolve between OEMs, data aggregators and third party service providers ranging from bartering models over brokering models to Data as a Service models.<sup>87</sup> Figure 31 illustrates these models.

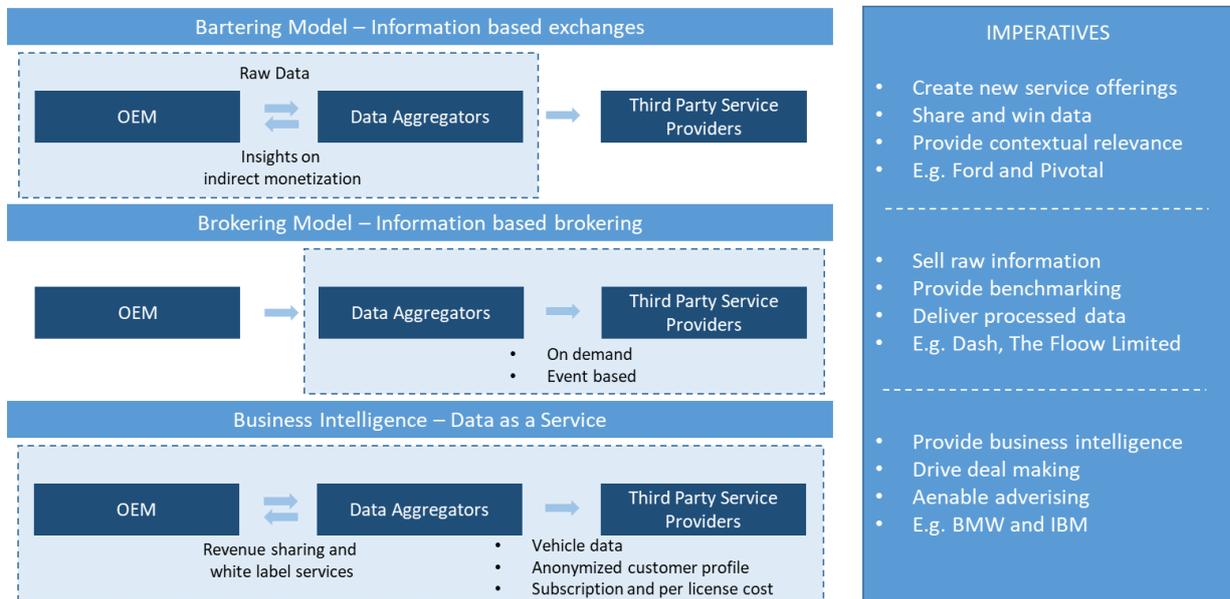


Figure 31: Evolving data monetization business models in car industry. Source: Frost & Sullivan.

With regards to Repair and Maintenance Information (RMI), data represent the following sources of value creation<sup>88</sup>:

- **New revenues**
  - Predictive/remote maintenance recommendations
  - Onboard delivery of vehicle related services
  - On-board sale of spare parts
  - Fleet management solutions
  - Remote car performance configuration
  - Targeted advertisements and promotions
  - Data reselling
- **Cost reduction**
  - Warranty costs reduction
  - Usage based insurance
  - Early recall detection and software updates
  - Repair process e.g. predictability of parts delivery/stockage
- **Increased safety and security**

<sup>87</sup> 5 Ways To Monetize Data in the Auto Industry - Evolving Business Models & New Opportunities, Frost & Sullivan, 12 April 2018, <https://ww2.frost.com/event/calendar/are-car-companies-going-profit-your-driving-data/>

<sup>88</sup> From buzz to bucks – automotive players on the highway to car data monetization, McKinsey, May 2016

- Breakdown-call service
- Preventive maintenance

As software is increasingly the basis for service offerings, automotive OEMs look for software-based practices common in other industries to price the use of their in-vehicle data. A common method is the cripple ware or feature-limited approach. It used to be commonly applied by photo camera producers where cameras were equipped with identical chips and the low-end price models would have limited features activated whereas high-end cameras would have enabled full features. The rationale behind this approach is to keep production complexity as low as possible while addressing customer segments with different price sensitivities and functionality requirements. Over the past years, software providers have further fine-tuned this approach and it is now a common approach to offer free or cheap basic versions of programs or applications with the option to upgrade them for a fee or a flat rate on a subscription basis.

Tesla has been applying this approach with its Model S where for both the S60 (basic version) and S75 (premium version) had the same battery but different ranges based on battery. By paying an additional fee, the S60 battery could be unlocked to achieve the same range as the S75. During hurricane Irma in Florida this option became public when Tesla allowed some customers in emergency to use this option for free. Thus, owners were reminded that their smaller battery capacity was simply due to a software-limited feature also known as cripple ware.

Classical OEMs still do not yet widely apply this approach but some have announced big plans with it, e.g. by 2025 Audi wants to achieve an additional annual operating profit of 1 billion € with digital services via the myAudi customer portal by the year 2025.<sup>89</sup>

#### 4.1.4.8 Consideration of the entire mobility data landscape and evolving blockchain solutions

The complexity of data exchanges in the context of smart cities, mobility and infrastructure development is enormous and requires regulators to look beyond ecosystems being built by automotive players. Fair, secure and safe access with effective interoperability of applications and systems will be the smallest common denominator of all parties involved. Aspects (analog to machine-to-machine or M2M) to consider are:

- V2I – Vehicle to Infrastructure
- V2D – Vehicle to Device
- V2H – Vehicle to Home
- V2G – Vehicle to Grid
- V2V – Vehicle to Vehicle
- V2P – Vehicle to Pedestrian

The degree of connectivity, security concerns, number of different players and parties accessing different systems at different level has caused many players to start to develop blockchain based solutions, for example for the management of authentication and authorization rights or for following the entire life of a vehicle from cradle to grave. Many use cases have been developed from supply chain management to car sharing interactions to preventing odometer fraud and both OEMs and suppliers are already

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<sup>89</sup> <https://www.audi-mediacycenter.com/en/press-releases/year-of-new-departures-audi-informs-its-shareholders-about-the-companys-transformation-10218>

embracing most of them in pilot projects. Many forward-thinking groups and companies have started to develop blockchain protocols and standards. Governments, communities and Not-for-profit organization have also started to apply solutions based on the blockchain as they allow for trusted, decentral and immutable data handling. Even though blockchain is still a nascent technology, its role in pushing the need for a digital identity and data self-sovereignty is significant.

“Any kind of transaction involving the world outside the company will in future be based on blockchain.”  
– Tier 1 supplier Faurecia’s CIO.<sup>90</sup>

As blockchain is an even younger field of investigation and legislation is still very immature, we believe that its steady development in and outside the automotive industry adds impetus to the request to provide market participants with a clear regulation on the fair and undistorted access to in-vehicle data.

#### 4.1.5 Evaluation of Extended Vehicle in recent studies

Several studies have analysed the technical features of the Extended Vehicle and its suitability as a future-proof way to connect in-vehicle data. All of them see serious disadvantages of the Extended Vehicle. Figure 32 provides an overview of the main observations by independent parties over time.

Date	Title	Author/ Institute	Key finding	Legislation	Technology	Competition	Economy
October 2015	Economic Analysis of the Introduction of a Telematics Platform in the Motor Vehicle Industry	KU Leuven	Access to telematics data must be open and standardized		Open access provides stronger incentives for innovation to OEMs and IO	OEMs as platform operator (e.g. BMW Car Data) in monopoly position leading to higher prices and less innovation	<ul style="list-style-type: none"> <li>• Increase of fixed infrastructure for closed access causes additional costs for all players</li> <li>• Efficiency gains for OEMs and captive dealers</li> <li>• Reduced consumer welfare</li> </ul>
2017	Access to In-Vehicle Data and Resources, Final Report	TRL	Conclusion about inadequacy of Extended Vehicle approach  “long-term: On board Application Platform is best solution to meet CITS principles			Competition argument is the major problem of „extended vehicle“ concept	
January 2018	The Effects of Extended Vehicle and onboard Telematics Platform on the automotive aftermarket, on mobility	Prof. Dr. Toni Viscido, Prof. Dr. Michael Maton	EU should regulate direct access to in-vehicle data (read and write), functions and resources	Disadvantage for European Authorities in case of Extended Vehicle  With OTP:	Open Telematics Platform superior to Extended Vehicle		

<sup>90</sup> AutomotivEIT. International., Interview with Rene Deiaist, CIO Faurecia, Summer 2018

Date	Title	Author/ Institute	Key finding	Legisla- tion	Techno- logy	Compe- tition	Economy
	services and on the wider European economy and society			<ul style="list-style-type: none"> <li>• 72'000 lives could be saved</li> <li>• 1000 billion tons of CO2</li> <li>• 500 billion € in fuel</li> <li>• 280billion € time savings</li> </ul>			
February 2018	In-vehicle data recording, storage and access management in autonomous vehicles	Viktoras Kabir Veitas, Simon Delaere, Vrije Universiteit Brussel	Request for collaboration between vehicle manufacturers and security researchers in order to bring state of the art security technologies to the industry	Considering "wait and see" policy of European Union, Extended Vehicle is the most probable approach	Clear and urgent need to develop secure architectures of CANs ready for C-ITS scenario		
February 2018	Vehicle Data, Digital Fuel for the Connected Car Economy, A Study on the Data Needs for Mobility Services	Dr. Jens Knodel, Caruso GmbH/Eduard C. Groen, Dr. Matthias Naab, Fraunhofer IESE in cooperation with CLEPA	Strong interest in in-vehicle data: Players in the mobility services market require at least 426 (at least 38 further data have been added since end of study) in-vehicle data items incl. Historic data to achieve their use cases, Caruso currently has 301 data in their standardized data catalog		<ul style="list-style-type: none"> <li>• Immense requirements were put on data update frequencies, which – given today's telecom networks – will require in-vehicle pre-processing</li> <li>• Extended Vehicle standards do not address latency and historic data</li> </ul>		Access to in-vehicle data benefits all players in the automotive domain
December 2018	OEM 3 <sup>rd</sup> Party Telematics	Knobloch & Groehn GbR for AFCAR	All OEM native Extended Vehicle solutions have limitations (e.g. no diagnostic trouble codes (DTCs) delivered to IAM)	Absence of legislation causes many OEMs not to offer any IAM access to data	Secure real time access to DTCs is already implemented for some OEMs, developed by Tier 1 suppliers	<ul style="list-style-type: none"> <li>• Significant disadvantage for IAM due to lack of real time access to data, deferred and limited direct driver contact options</li> <li>• OEM has privileged contact to driver and privileged access to vehicle data</li> </ul>	
September 2018	Access to digital car data and competition in aftersales services	Bertin Martens, Frank Mueller-Langer, Joint Research Centre of the European Commission		<ul style="list-style-type: none"> <li>• Competition should be promoted by opening more car data access channels (e.g. keeping OBD port open) and opening more services</li> </ul>	If digital players enter the car deeply: unless it is open source software, this additional layer would set a proprietary technology standard not	<ul style="list-style-type: none"> <li>• Markets for car data have monopolistic characteristics with Extended Vehicle where all car data are exclusively collected on a server operated by the OEM</li> </ul>	<ul style="list-style-type: none"> <li>• First, competition between manufacturers for a larger share in the car market may motivate them to lower the price of data and increase the</li> </ul>

Date	Title	Author/ Institute	Key finding	Legisla- tion	Techno- logy	Compe- tition	Economy
				delivery channels in the car (full portability of personal car data in line with Art 20 of the GDPR) <ul style="list-style-type: none"> <li>Legislation required to prevent OEMs abusing access to driver via HMI</li> </ul>	owned by the OEM and possibly a common standard that may be used across many car brands- clear rules needed to consider all stakeholders	<ul style="list-style-type: none"> <li>Monopolistic pricing of data access maximises OEM revenue and reduces consumer welfare, affects the welfare of (independent) aftermarket service providers whose profits may be reduced by high data costs</li> </ul>	variety of aftersales service providers who can access the car. <ul style="list-style-type: none"> <li>OEMs face competition from data marketplaces</li> <li>Well-known media platforms (digital players) may deliver services via alternative operating systems and services apps installed in the HMI</li> </ul>
November 2018	Data Governance in Connected Cars: The Problem of Access to In-vehicle Data	Prof. Wolfgang Kerber, Philips University of Marburg	Serious market failures possible in 3 areas, hence legislation is required for optimal governance of data in the ecosystem of connected and automated mobility	<ul style="list-style-type: none"> <li>Information and privacy problems ("notice and consent") can emerge requiring appropriate regulatory solutions.</li> <li>Possible solutions through data portability, data rights, competition, law, and recommends a sector-specific regulatory approach.</li> </ul>	Potential market failures in regard to technological choice (extended vehicle vs. interoperable on-board application platform) with serious standardization and interoperability issues	<ul style="list-style-type: none"> <li>Competition problems (esp. on markets for aftermarket and other services in the connected car)</li> <li>OEMs have de facto (but not legal) "ownership" of data and might there-fore be capable of appropriating the economic value of these data</li> </ul>	

Figure 32: Overview of recent studies dealing with Extended Vehicle.

#### 4.1.5.1 Open on-board platform superior choice

The study conducted by the TLR still forms a sound basis and the conclusion has not changed since it has been published in 2017.<sup>91</sup> Figure 33 summarizes the evaluation of different data access models.

Extended Vehicle	Neutral Server	Shared Server	Open on-board platform

<sup>91</sup> Access to In-Vehicle Data and Resources, Final Report, TLR, May 2017

<b>Technology</b>	Proprietary server	Data flow from proprietary server to neutral server	External server	Open
<b>Competition</b>	OEM monopoly	OEM monopoly	Level playing field	Level playing field
<b>Data Access</b>	Fully controlled by OEMs	OEMs control data flow to operators of neutral server and users	OEMs control access to car	Fair access to data

Figure 33: Comparison of server based and open on-board platform solutions. Source: TLR

#### 4.1.5.2 Data access aspects of Extended Vehicle insufficient and not a level playing field

In regard to the discussed policy conclusions, both the “shared server” (external server) and the open on-board application platform would better ensure for a level playing field for the access to in-vehicle data and can therefore contribute to the protection of competition on the markets for services within the ecosystem of connected and automated mobility.<sup>92</sup>

With regards to data access in general, there needs to be “an agreement ... between all relevant public and private stakeholders ... including business model-related question[s] of national or European data licenses, formats, interfaces and addressing privacy concerns.”<sup>93</sup>

The Extended Vehicle solution does not provide the required V2V access nor offline access via OBD. “In order to keep data integrity, all three access points to in-vehicle data – external server, ad hoc communication and OBD ports – will have to be integrated via [the] EDB/AD subsystem of [the] vehicular Controlled Area Network (CAN) bus. This is especially relevant to ad-hoc communications as it is the basis for Cooperative Intelligent transport Systems (C-ITS). Therefore, [the] Extended Vehicle concept and architecture does not cover all in-vehicle data access issues. Most importantly, it does not provide solutions to the data security and authenticity aspects of C-ITS.”<sup>94</sup>

The access of various players to different system levels is not a level playing field as can clearly be seen in Figure 34 summarizing the findings of the AFCAR study.

	OEM	Tier 1	IAM	Digital Players
<b>Level 1 (Device)</b>	✓	( ✓ )	-	-
<b>Level 2 (ECU)</b>	✓	✓	-	-

<sup>92</sup> Data Governance in Connected Cars, Access to In-Vehicle Data, Data rights, and Competition Law, Prof. Dr. Wolfgang Kerber, Philipps University Marburg, September 2018

<sup>93</sup> In-vehicle data recording, storage and access management in autonomous vehicles, Viktoras Kabir Veitas, Simon Delaere, Vrije Universiteit Brussel, February 2018

<sup>94</sup> Ibid

Level 3 (In-car app)	✓	✓	( ✓ ) today via OBD	✓
Level 4 (Backend)	✓	✓	( ✓ )	( ✓ )
Driver access	✓			✓

#### 4.1.5.3 Interoperability, standardization and licenses

In computer programming, an application programming interface (API) is a set of subroutine definitions,

*Figure 34: Overview of various players’ access to different vehicle system levels. Source: AFCAR.*

communication protocols, and tools for building software. In general terms, it is a set of clearly defined methods of communication among various components.

A good API makes it easier to develop a computer program by providing all the building blocks, which are then put together by the programmer.<sup>95</sup> E.g. the provision of API and development platforms that enable third party development of payment-capable in-vehicle apps is thus essential to the creation of new and innovative OEM services. The continuous technological development already envisions the use of digital voice assistants in the vehicle with forecasts predicting that over 370 million in-vehicle digital voice assistants will be accessed by 2023. These new assistants will also need to get access to vehicle data in order to continuously improve the customer experience and it is expected that OEMs will ultimately provide such access.<sup>96</sup>

Technical progress and consumer expectations will continue to grow and accelerate as shown in this example – another reason to refrain from the Extended Vehicle with its limitations and opt for an open platform better suited for interoperability and standardization.

In addition to standardization, the question of licenses from various patent owners to implement the 2G, 3G, 4G and 5G standards in a way reminiscent of the smartphone patent wars, closely follows. Also with licenses, standards need to be set and there is a growing need for standard essential patents (SEP) as well as fair and non-discriminatory licensing models. In this context, the European Patent Office (EPO) is increasingly being asked also by OEMs to play a more active role.<sup>97</sup>

#### 4.1.5.4 ISO standards

Notwithstanding all of the above listed shortcomings of the Extended Vehicle concept, OEMs have proceeded to develop ISO standards and norms, which define, for example, structures, processes, safety and security mechanisms and comprises of several series of standards. ISO 20077 describes methodological requirements for the use of vehicle data via the web interface as well as general terms. The ISO 20078 series defines the actual requirements for the web interface with regard to access, data content, security and access control. ISO 20080 defines a first Extended Vehicle application: the radio-based diagnostic access of workshop service providers. The way these standards have been put in place

<sup>95</sup> [https://en.wikipedia.org/wiki/Application\\_programming\\_interface](https://en.wikipedia.org/wiki/Application_programming_interface)

<sup>96</sup> Connected cars - how 5G, connected commerce & blockchain will disrupt the ecosystem, Juniper Research, November 2018

<sup>97</sup> The EPO should rule on SEPs, say top European auto patent players, <https://www.iam-media.com/frandseps/millien-epo-seps>

causes some observers to question the entire process of accepting proposals for ISO standards. In the meantime, first studies have shown that the above standards are still insufficient in covering crucial requirements such as data delivery with high update frequencies and the access to and availability of historical data.<sup>98</sup>

While it is understandable that OEMs try to secure their competitive advantage by setting standards like in this case the ISO standards, the process is very questionable when only part of the stakeholders are involved in this process. In the age of evolving ecosystems, any standardization process must be approached in a much more holistic and integrative way addressing the provision of APIs and development platforms that enable third party development of payment-capable in-vehicle apps.

#### 4.1.5.5 The safety argument

OEMs have based their defence of the Extended Vehicle strongly on the “safety and security” problem. An impressive number of studies - the latest one being “OEM 3rd Party Telematics”<sup>99</sup> confirm that this issue is not exclusive to the Extended Vehicle but also to the open platform, shared server and in fact any smartphone today as they also serve as control units connected to the dongle.

In addition, already existing (Seat/Apple Car Play, GM/NGI, Volvo/Google Android, Audi/Google Android) and planned (VIWI) on board telematics platforms prove that the safe and secure in-vehicle data access is already doable today and makes it even less plausible to invest in solutions like the Extended Vehicle which do not have this security feature. Increasingly, players of all kinds, i.e. OEMs, Tier1 suppliers, IO turn to use the cloud-based infrastructure services of Google (e.g. BigQuery), Amazon (AWS) or Microsoft (Azure).

Some even think that the Extended Vehicle approach would be more prone to security issues because “it is a 'black box' proprietary operating system that relies mainly on limiting access rather than different layers of protections (TRL, pp.137-138). If a malicious hacker gains access to the OEM's central server it could affect many vehicles and not just one. Multi-layered and decentralized security systems at the level of the car, with a hypervisor that prevents write access to critical components may be safer than a centralized system. Continuously tested open source software may also offer more security. The debate in the cybersecurity community on the relationship between open source and security is far from settled (Celasco et al., 2016; European Commission, 2016a; Pattemore, 2016).”<sup>100</sup>

“Results of state-of-the-art research in embedded and distributed systems security and privacy provide embedded protected module architectures with strong security guarantees having application potential for efficient message authentication in vehicular communication networks.”<sup>101</sup> Equally, in TRL's view and confirmed by a recent Security Concept elaborated by the European University of Flensburg, it is possible

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<sup>98</sup> Vehicle Data, Digital fuel for the Connected Car Economy, Fraunhofer IESE, Caruso Dataplace, February 2018

<sup>99</sup> OEM 3rd Party Telematics – General Analysis, Knobloch & Gröhn Gbr, December 2018

<sup>100</sup> Access to digital car data and competition in aftersales services, Bertin Martens, Frank Mueller-Langer, Joint Research Centre of the European Commission, September 2018

<sup>101</sup> In-vehicle data recording, storage and access management in autonomous vehicles, Viktoras Kabir Veitas, Simon Delaere, Vrije Universiteit Brussel, February 2018

to achieve safety and security for an OTP, as there are existing standards and technologies available that can be combined and implemented.<sup>102</sup>

The conclusions of all quoted studies are unanimous: safety and security concerns can be managed and should “not lead to a justification for the exclusive economic control of the in-vehicle data through the OEM.”<sup>103</sup>

“The basic assumption of the current policy discussion that there is a fundamental trade-off between the objectives of safety/security and fair and undistorted competition is deeply flawed. There is definitely no such trade-off in regard to the access to the in-vehicle data, and it is also very doubtful whether there is such a trade-off in regard to access to the connected car.”<sup>104</sup>

The safety argument cannot be countered much stronger than with all these objective analyses, statements and conclusions.

#### 4.1.5.6 Secure Vehicle Interface (SVI) standard

In order to respond to the cybersecurity concerns often raised in connection with vehicle data access, a 14 member group of international experts has developed the so called Secure Vehicle Interface (SVI) based on international standards of global standards organizations such as ISO, ETSI and IEEE. It is an “open, secure and standardized interface design that offers equitable access to in-vehicle networks for all authorized stakeholders (including potentially vehicle owners, C-ITS stations, maintenance and repair facilities, as well as OEMs).”<sup>105</sup> Although the SVI may provide secure access to the vehicle, it will require further development/legislative action to provide access to the data needed for a wide range of repair and maintenance/vehicle related services.

The SVI complements the Extended Vehicle ISO standard as well as other existing or proposed implementations of vehicle service interfaces such as embedded Android and could fulfil the needs of open communication, security and fair data access. Given the lack of cybersecurity experience of automotive OEMs, the SVI represents a potential option for a standard for a secure vehicle interface infrastructure and secure vehicle data access.

#### 4.1.6 Technical analysis of current OEM solutions

In February 2018 Caruso and the Fraunhofer Institute published a study commissioned by CLEPA to analyse the data needs of CLEPA members.<sup>106</sup> 12 responses to a questionnaire were analysed and the conclusions were that the demand for in-vehicle data is strong (426 data items needed, currently 301

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<sup>102</sup> Security Concept for an Interoperable Telematics Platform, Europe University Flensburg/ Dr.-Ing. Christian Knobloch, Knobloch & Gröhn GbR/ Dipl.-Ing. (FH) Neofitos Arathymos, German Federation of Motor Trades and Repairs checked by Proventa Security AG, September 2017

<sup>103</sup> Data Access in Connected Cars: The problem of access to In-vehicle Data, Prof. Wolfgang Kerber, Philips University Marburg, 14 November 2018

<sup>104</sup> Data Access in Connected Cars: The problem of access to In-vehicle Data, Prof. Wolfgang Kerber, Philips University Marburg, 14 November 2018

<sup>105</sup> A Balanced Approach on Access to In-Vehicle Data to protect Fair Competition and promote Innovation and Consumer Choice in the new Mobility Ecosystem, Enterprise Holdings, March 2018

<sup>106</sup> Vehicle Data, Digital fuel for the Connected Car Economy, Fraunhofer IESE, Caruso Dataplace, February 2018

available). However, high update frequencies within milliseconds as well as the availability of historic data in order to provide meaningful analyses, were requested by respondents with high priority. The study thus indirectly confirmed that the Extended Vehicle cannot be the optimal solution fulfilling the requirements of the respondents as it cannot process real-time data.

The most recent technical study<sup>107</sup> commissioned by AFCAR provides an interesting overview on the suitability of the individual OEM solutions for the IAM. The field study examined the various solutions for their ability to detect problems remotely, analyse problems and steer the driver. Most staggering is that the majority of the OEMs (i.e. Audi, Seat, Renault, Fiat, Chrysler, Toyota, Honda, Hyundai, Kia) currently does not have any Extended Vehicle based capability to offer access to in-vehicle data by the IAM. For the others, the result is sobering and summarized in this table of Figure 35.

Capability to	BMW		Mercedes		GM		PSA		VW		Ford	
	OEM	IAM	OEM	IAM	OEM	IAM	OEM	IAM	OEM	IAM	OEM	IAM
Offer a service to the customer	100%	0%	100%	20%	100%	100%	100%	33%	100%	(75%)	100%	100%
Conduct a service with the customer	100%	0%	100%	0%	100%	100%	100%	33%	100%	(75%)	100%	100%
Monitor need for service	100%	0%	100%	0%	100%	50%	100%	50%	100%	50%	100%	100%
Perform service on car	100%	0%	100%	0%	100%	0%	100%	N/A	100%	N/A	100%	N/A
Score			1/5		3/5				4/5		4/5	
Comments	Not rated in this study as BMW CarData was analysed in previous study				Open standards				ViWi (Volkswagen Infotainment Web Interface)		SDL (Smart Device Link)	

Figure 35: Comparison of OEM systems for customer dialog and performing/monitoring service. Source: Knobloch & Gröhn

As the existing solutions do not have write access nor data reset access, the functionalities of these Extended Vehicle solutions are even worse than those offered by OBD.

<sup>107</sup> OEM 3rd Party Telematics – General Analysis, Knobloch & Gröhn GbR, December 2018

#### 4.1.6.1 Enormous lack of data availability and arbitrary Extended Vehicle pricing

Caruso together with the Fraunhofer Institute has set up a standardized data catalogue based on the input of CLEPA members. At least 439 data are required for various use cases, they are all precisely described in the study (hard copy made available)<sup>108</sup> The below table (Figure 36) summarizes the availability of data in the OEM solutions investigated on behalf of AFCAR<sup>109</sup> – the tremendous gap is obvious.

Brand	Off-board			On-board			
	PSA	BMW	Mercedes	GM	SDL (Ford)	VW	Google, Apple, Mirrorlink
All data	89	75	23	400+	N/A	124	N/A
RMI data	18	10	-	140	N/A	Sufficient for fixed mileage/ fixed time maintenance	N/A

Figure 36: Data availability in current OEM solutions. Source: Knobloch & Gröhn

The commercial terms at which the Extended Vehicle solution is currently being offered by OEMs (e.g. 5 € per month per car flat rate for BMW Car Data) have been commented on in various studies. These as well as market participants confirm that these terms are beyond being reasonable and destroy any business case at which it would be worth buying data through the Extended Vehicle.

#### 4.1.7 Learning from developments in more mature IoT sectors

In conclusion, despite some similarities in approach between some manufacturers, in-vehicle data access means, their type, number and format are far away from any future proof standard. The Extended Vehicle is technically inferior to the Open Telematics Platforms (OTP) and there is a clear trend of OEMs to turn their focus towards OTP, be it their proprietary platforms or cooperation with digital players such as Apple or Google. In some cases, the access of DP is already very deep. The battle for a European OTP platform has thus begun between OEMs and DPs without the IO playing any role in it at this stage. Therefore, legislation is required to ensure C-ITS principles are being adhered to and that IO can continue to make their contribution to an innovative and consumer friendly automotive business environment.

Increasing complexity driven by technology developments requires a more inclusive and less exclusive approach. This applies to business models, interfaces, customer relationships etc. As the extended vehicle provides OEMs with de facto control over data in their proprietary servers and as such is a closed system, it has limitations with regards to interoperability and standardization.

<sup>108</sup> Vehicle Data, Digital fuel for the Connected Car Economy, Fraunhofer IESE, Caruso Dataplace, February 2018

<sup>109</sup> OEM 3rd Party Telematics – General Analysis, Knobloch & Gröhn GbR, December 2018

Clearer guidelines on the question of open vs. closed systems resulting in common standards and coordinated license handling are required in order to bring the entire industry with all its various stakeholders forward. Multiple lessons from other industries and the multitude of players in the automotive primary and aftermarket as well as the mobility sphere make this space suitable for an open approach as the positive impacts of data applications can only be realized by following an open data approach.

## 4.2 Legal framework

Since the turn of the century, the EU Commission has consistently pursued a policy of ensuring a level playing field for authorized and independent aftermarket service providers (e.g. EU regulations no. 1400/2002, 715/2007, 692/2008, 595/2009, 461/2010, 64/2012, 758/2015). Given the relatively stable market shares – a sign for a market equilibrium - between OEMs and independent aftermarket players over the past decade, it appears, that the efforts of the European Commission have borne fruit. With the advent of connected and autonomous vehicles, the legal framework to be applied is expanding and getting more complex. It is therefore crucial, that similar efforts of the European Commission in other areas such as data protection, data privacy and competition law are combined with those in the automotive sector.

In relation to vehicle data access, the eCall that has been introduced as a mandatory system in April 2018, lays the groundwork for an interoperable, standardised and secure open access platform to which all stakeholders have fair access.<sup>110</sup> It thus sets a very important precedent for the European approach to access to vehicle data. As far as IO are concerned, Euro 5 and Euro 6 legislation regulates “easy and clear access to information on vehicle repair and maintenance” for IO.<sup>111</sup> This access must be “without discrimination in favour of dealerships and official repair workshops”, at reasonable prices and at the same terms for franchised and independent workshops.

The Motor Vehicle Block Exemption Regulation (MVBBER) regulates that IO have “unrestricted access to essential inputs”<sup>112</sup> with the question remaining unanswered, how to define essential inputs. As the current MVBBER will expire on 31<sup>st</sup> May 2023, it is an obvious conclusion to consider the update of this regulation the appropriate format for providing a clear definition of the inputs which are predominantly consisting of data from various connected sources under the assumption and with the recommendation that the sector specific competition regulation continues to be applied in addition to the general European competition law. The continuous forward integration of OEMs along the automotive value chain, the accelerating connectivity of vehicles and the speed at which DPs occupy new territories are important reasons to conduct a thorough modernization of the MVBBER.

It is therefore not comprehensible at all that in a recent qualitative survey of the EU Commission<sup>113</sup> no recommendation for legislative action on vehicle data access was given despite the survey results

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<sup>110</sup> Regulation (EU) 2015/758 of the European Parliament and of the Council of 29 April 2015 concerning type-approval requirements for the deployment of the eCall in-vehicle system based on the 112 service and amending Directive 2007/46/EC

<sup>111</sup> For light-duty vehicles, RMI provisions were introduced by Regulation (EC) No 715/2007 (Euro 5/6) and its implementing Regulations 692/2008 and 566/2011

<sup>112</sup> Commission Regulation (EU) No 461/2010 of 27 May 2010 on the application of Article 101(3) of the Treaty on the Functioning of the European Union to categories of vertical agreements and concerted practices in the motor vehicle sector

<sup>113</sup> Scenarios and conditions for the implementation of CAD and proactive mapping of policy measures, Final Report, A study prepared for the European Commission, DG Communications Networks, Content & Technology by VVA, Sant’Anna, TNO, August 2018

speaking a different language (60% prefer in-vehicle data access and request adequate legislation while only 19% prefer the Extended Vehicle/Neutral Server). On top of that, the survey revealed that the second most important issue for the EU's uptake of a Cooperative, connected and automated mobility (CCAM) is to update the data sharing framework, i.e. provide new rules on data access and usage. Notwithstanding these clear results, the study recommends to wait and see for another two years before considering any legislative measures on data access. It is impossible to quantify the magnitude of mobility stakeholders that are being ignored here as there was no quantitative measure (like number of employees, annual revenues etc.) used.

For the EU Commission, to follow such a far-reaching recommendation without any quantitative measurements and to ignore the voice of the vast majority of mobility stakeholders in such a way appears not to be in line with its political mandate. Therefore, we strongly urge policy makers to review other inputs into their decision making like this comprehensive and quantitative study.

#### 4.2.1 Relevant legislative domains and political activities

Figure 37 provides an historical overview.

Date	Body/ Organisa- tion	Policy/Study	Type	Relevance for direct in-vehicle data access	Relevance for IAM	Relevance for consumers	Legally binding
<b>June 2007</b>		Regulation 2007/715 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles ( <b>Euro 5 and Euro 6</b> ) and on access to vehicle repair and maintenance information	Legisla- tion	<ul style="list-style-type: none"> <li>Unrestricted access to essential inputs such as spare parts and technical information for IO</li> <li>Common technical requirements for the type approval of motor vehicles and replacement parts with regard to their emission and lays down rules for in-service conformity, durability of pollution control devices, on-board diagnostics (OBD) systems, measurement of fuel consumption and accessibility of vehicles repair and maintenance information</li> </ul>	Easy and clear access to information on vehicle repair and maintenance for IO	Indirect, as charges to IO for accessing such information are permitted if they are reasonable and proportionate	Yes (to be replaced by a Regulation which will be applicable as from 1 September 2020)
<b>May 2010</b>	EUC DG COMP	MVBER Commission Regulation (EU) 461/2010	Regula- tion	MVBER applies to vertical agreements relating to the motor vehicle aftermarket, which includes the purchase, sale or resale of spare parts or provision of repair and maintenance services	High, ensures that independent repairers have access to the brand-specific repair tools on the same terms as members of the authorized network	High	Yes
<b>June 2011</b>	EUC DG COMP	Commission Regulation (EU) No 566/2011	Regula- tion	Access to vehicle repair and maintenance information	High	High	Yes
<b>October 2014</b>	EUC DG GROW	RICARDO Report	External study	Demonstrated that IO are hampered in their competitiveness due to a series of obstacles and refusals to grant access to Repair and Maintenance Information (RMI)	Detailed focus on Repair and Maintenance aspects that need improvement	Indirect strengthening of competition and market quality	No
<b>April 2015</b>	EUC and EUP on eCall	Regulation (EU) 2015/758 concerning type-approval requirements for the deployment of	Regula- tion	Precedent for interoperable, standardised, secure and open-access platform for possible future in-vehicle applications or services	High	High	Yes

		the eCall in - vehicle system					
<b>January 2016</b>	EUC DG MOVE	C-ITS (Cooperative Intelligent Transport Systems)	Recommendation	All stakeholders agreed on 5 principles for access to „in-vehicle data“ (a) Data provision conditions: Consent (of car drivers) (b) Fair and undistorted competition (c) Data privacy and data protection (d) Tamper-proof access and liability (e) Data economy	Provides principles for vehicle data access	Security and interoperability are adequate to key consumer requirements	No
<b>October 2017</b>	EUC DG GROW	GEAR 2030	Recommendation	<ul style="list-style-type: none"> <li>Connected and automated driving (CAD) acknowledged as one of two key development routes for EU automotive industry</li> <li>Report identifies opportunities for the Commission and EU countries to support the sector in this transition</li> </ul>	Services perspective must be represented	Consumers perspective must be represented	No
<b>2017</b>	EUC DG CONNECT	Building the European Digital Single Market	Public consultation	<ul style="list-style-type: none"> <li>Commission intends to support the creation of a common European data space — a seamless digital area with the scale to enable the development of new products and services based on data</li> <li>Data should be available for re-use as much as possible, as a key source of innovation and growth</li> </ul>	Indirect	Indirect	No
<b>2017</b>	Free Flow of Data	Proposal for a Regulation on a framework for the free flow of non-personal data in the European Union (COM(2017)495)	Proposal for a Regulation	This Regulation introduces the principle of the free flow of non-personal data across borders into EU law thereby establishing the free movement of non-personal data	Indirect	Indirect	TBD
<b>May 2018</b>	EUP and EUC	General Data Protection Regulation 2016/679 (GDPR)	Regulation	Rules concerning the protection of personal data. As most driver and vehicle data are considered personal data, these rules are relevant	Indirect	High, e.g. right to data portability	Yes
<b>April 2018</b>	EUP	OBDII port to stay open and be included in new Type Approval		Provisions for onboard diagnostics, including the OBD port have to be included in the new regulation	High	High	TBD
<b>November 2018</b>	EUP	Own Initiative Report	TRAN Committee of the EUP	EUP's Committee on Transport called on the European Commission for a second time in the same year to come forward with binding legislation on how vehicle data is accessed	High	High	No

Figure 37: Overview of relevant legislative domains and political activities

Currently, the policy question of fair and equal access to (in-)vehicle data is not solved. The European Commission's Communication on automated and connected cars COM (2018)/283 has failed to provide a clear answer on a binding legislative solution on open-access, secure and transparent networks for connected cars, as well as in-vehicle data access. However, there is sound reason to believe that the absence of a clear data governance could lead to a market failure based on the exclusive data control of one stakeholder group and the maximization of individual profit maximization decisions by them.<sup>114</sup> In addition, legal aspects such as the treatment of personal and non-personal data need to be clarified.

The numerous activities, legislations and governing bodies listed in this very limited overview show that the topic of access to in-vehicle data requires a broad forum in context of the general EU Data Economy and competition law. In particular, new features and implications of connectivity and data enabled activities in the automotive industry like for example remote diagnostics – a prerequisite for contemporary aftermarket services - need to be well explained and integrated.

<sup>114</sup> Data Access in Connected Cars: The problem of access to In-vehicle Data, Prof. Wolfgang Kerber, Philips University Marburg, November 2018

Based on the interviews with stakeholders, the majority is of the opinion that in the short term of all available legislations *Type Approval* is the best way to address and ensure fair access to in-vehicle data. The latest Type Approval legislation<sup>115</sup> has been published in June 2018 and will come into effect as of September 2020. It is of particular relevance to the IO that the access to basic vehicle data like RMI and spare parts identification information by the OEM in form of machine readable and electronically processable data sets has now been clearly integrated in the regulation.

In the midterm, the adequate amendment of the MVBBER is also considered an effective approach by stakeholders as the competition issues need to be more clearly addressed.

#### 4.2.2 Right to repair

The “Right to Repair” movement originating from the US where it has become part of the legislation, has meanwhile become a global movement and with the increasing popularity of personal and mobile devices has spread from vehicles to consumer goods, such as smartphones where there are similar complaints of consumer groups about the limitations of consumers to be able to repair their electronic devices.

Manufacturers of devices such as smart phones or tablet computers, use digital protection measures to safeguard their intellectual property. However, in the US, consumer activists have been defending the position that these protection measures make it impossible for consumers to repair their own personal devices and expose users and repair professionals to the risk of violating copyright law simply by amending the software of the devices.

Since October 2018, there is a new exemption<sup>116</sup> in place in the US according to which consumers have a legal right to repair a device they own and that such repair does not infringe upon the copyright protection afforded to the manufacturer.<sup>117</sup> Also in Europe, initiatives such as the Open Repair Alliance, restart or iFixit gain traction and will continue to pursue consumers’ freedom to repair their own devices and push for legislation within the EU.<sup>118</sup>

#### 4.2.3 Competition

It has been concluded and confirmed by many studies that the Extended Vehicle approach is unfair as it enables OEMs to control in-vehicle data.

Fair access to in-vehicle data compares to fair access to technical information, an aspect that has extensively been dealt with in the BER (2010), its Supplementary Guidelines (2010) and the FAQ (2012), which have all been formulated with the *aim to prevent vehicle manufacturers from discriminating*

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<sup>115</sup> Regulation (EU) 2018/858 of the European Parliament and of the Council of 30 May 2018 on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles, amending Regulations (EC) No 715/2007 and (EC) No 595/2009 and repealing Directive 2007/46/EC

<sup>116</sup> Exemption to Prohibition on Circumvention of Copyright Protection Systems for Access Control Technologies, Library Of Congress, U.S. Copyright Office, 37 CFR Part 201 [Docket No. 2017–10]

<sup>117</sup> ‘Right-to-repair’ advocates claim major victory in new smartphone copyright exemption, The Washington Post, 26 October 2018

<sup>118</sup> E.g. Motion for A European Parliament Resolution on a longer lifetime for products: benefits for consumers and companies, (2016/2272(INI))

between their authorised repairers and independent repairers as regards the provision of essential inputs that are entirely under the vehicle manufacturer's control and that are not available from other sources.

From interviews, we conclude that there is a lot of strong news distributed that OEMs wish to close the OBD access, which of course disturbs IAM investors and creates market uncertainty. But that is rather to be seen as a strategy, as in reality many refrain from it, since closure would be in conflict with certain parts of regulation.

#### 4.2.3.1 Monitoring competitors' activities

There is one competition aspect that has to date insufficiently been analysed and reviewed in studies dealing with the Extended Vehicle, which is the fact that under Extended Vehicle scenario OEMs have the opportunity to monitor the activities of their direct competitors, in this case the activity of IO who are competing with the services arms, leasing subsidiaries or captive workshops of forward integrated OEMs.

Similar to DPs like Google, Amazon or Apple, OEMs would be in the position to exclusively access and amass enormous data not only of their customers but also – and this would be the disturbing part - of their competitors.

Concerned stakeholders expect significant damages from this aspect and therefore it has been included in modelling the economic impact of the Extended Vehicle on the IAM. This aspect needs to be clearly defined in any upcoming revision of the MVBBER or Type Approval. Considering all the technical options reviewed, legislation must ensure that rather than OEM's or DP's proprietary operating systems, truly independent and standardized operating systems will be applied as indicated in below overview in Figure 38.

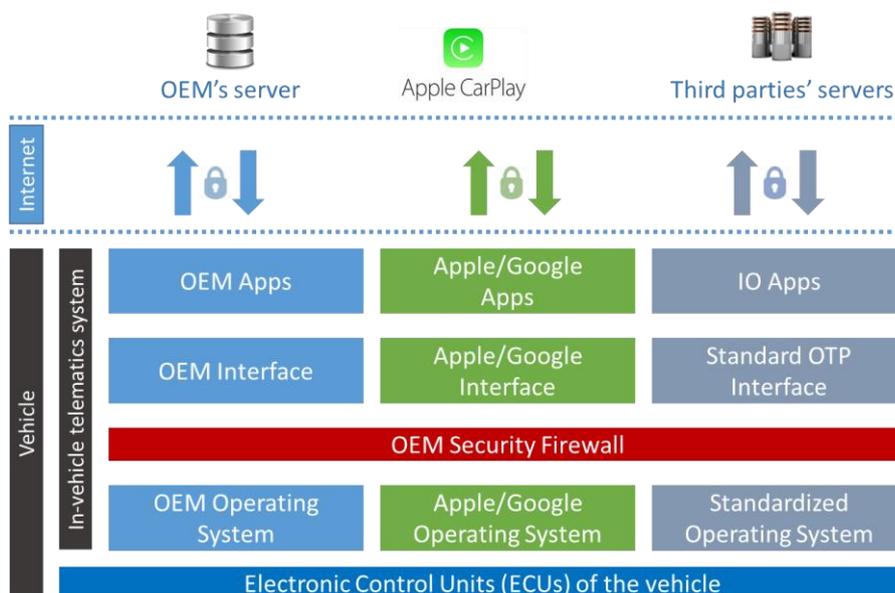


Figure 38: Access to vehicle ECU by different operating systems (illustrative). Source: TH Köln.

#### 4.2.3.2 Effects on vehicle distribution chain

It is widely recognized that the progress of OEMs on implementing the connected transformation is varying. This can very well be monitored when looking at the status of rolling out new agreements between dealers and OEMs where these new agreements would address a new way of cooperating in the digital data driven era.

As one of the first OEMs in Europe, VW has started to restructure and digitalize the distribution of its vehicles. As of 2020 it will be possible to order vehicles online. VW is currently renegotiating the agreements with its franchised dealer network. The agreements foresee, amongst others, increased direct sales by the OEM and new reward schemes for dealers.

Instead of earning a margin on physical services performed in the garage, dealers will receive payments for OTA (over the air) upgrades even though these will be performed centrally by the OEM and not by the dealer. This is meant as a compensation for expected lower dealer revenues due to a lower intensity of maintenance services by allowing these “preferred service partners” in the customer cloud to access revenue streams from OTA features chosen by drivers to upgrade their vehicle.

The basis for this will be a system of unique Volkswagen customer IDs, enabling more precise targeting of products and services to individuals – and the firm aims to gain five million new customers worldwide for its mobility services each year.<sup>119</sup> A joint platform is being developed in a digital partnership with dealers to handle each aspect of a purchase from start to finish, including financing, payment and vehicle trade-ins (see Figure 39).

It is still unclear how independent dealers or garages will be able to offer any similar services and this is already an early indication on the arising complexity from a competition law perspective and it confirms that the MVBBER will be a good place to address such aspects.

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<sup>119</sup> <https://www.volkswagen-newsroom.com/en/press-releases/volkswagen-digitalizes-sales-new-era-of-car-buying-to-start-in-2020-4257>

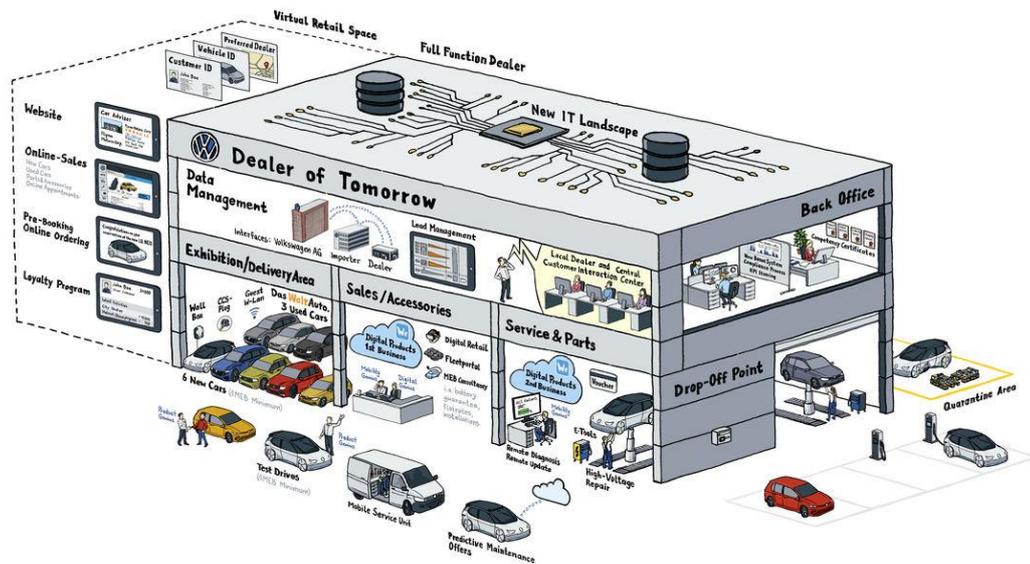


Figure 39: Dealer of tomorrow according to Volkswagen. Source: Volkswagen.

#### 4.2.3.3 Digital pricing discriminatory behaviour needs clear definition beyond the automotive sector

Using proprietary distribution channels for discriminatory pricing and yield management has been present in the travel industry since the advent of on-line booking portals. As increasingly user data are being used for pricing algorithms, there is a growing need to clarify what is discriminatory behaviour. As dynamic pricing practices have rapidly evolved beyond the travel industry it is only a matter of time until they will arrive in the automotive industry once connected data will become more widely available. This foreseeable trend adds to the reasons why an ex ante legislation makes sense.

In addition to the view of interviewed stakeholders about referring to the BER for legislation on access to in-vehicle data, latest research confirms that “the instrument of a block exemption regulation according to Art. 101 (3) Treaty on the Functioning of the European Union (TFEU), in which problems of data access, e.g. in regard to complex multi-stakeholder situations of IoT applications, might be addressed, either more generally or in a more sector-specific way”<sup>120</sup> is a recommended approach in order to achieve a level playing field over access to in-vehicle data.

#### 4.2.4 Other regulations, developments and movements concerning data

While there is a strong consensus about the suitability of Type Approval and Block Exemption Regulation to address the access to in-vehicle data, there are two regulations that are frequently mentioned in this context and therefore we would like to briefly comment on them, PSD2 and GDPR.

<sup>120</sup> Data Access in Connected Cars: The problem of access to In-vehicle Data, Prof. Wolfgang Kerber, Philips University Marburg, November 2018

#### 4.2.4.1 PSD2

Since January 2018, bank customers have the right to use third party payment providers or access their bank account information through them.

This is based on the revised Payment Services Directive PSD2 that was put in force with the aim to drive competition and foster innovation by reducing entry barriers for new entrants to payment services thus challenging incumbent banking institutions to open up and share data. It had been revised as the original PSD had led to impaired consumer protection and competitive distortions in a number of areas.

Updated definitions now ensure a level playing field between different providers and address in a more efficient way the consumer protection needed in the context of payments. A common, freely available, high quality and resilient open application programming interface (API) platform provides the basis for all participants. It also ensures security as it regulates that FinTech companies have to have adequate cyber risk insurance.

While it is still relatively early to comment on the experiences with PSD2, according to industry insiders the lack of standards-based APIs has led to complexity creeping back in, which leads to increased costs.

From a customer perspective, under PSD2 it is easier to have a consolidated view and they benefit from sharing access to their financial data with non-bank third parties. Already today there is a number of different business models and this is expected to further increase. PSD2 enables third parties, amongst them an impressive number of FinTech start-ups, to integrate their services with those of a bank for a better consumer experience which is increasingly seen as a key success factor for growing businesses. Consumers are thus positioned at the centre of their services ecosystem.

When raising the question, whether or not a sector specific regulation similar to PSD2 should govern the in-vehicle data access, many believe that this is a worthwhile approach as it could address the mobility data needs of a wider stakeholder group in the light of evolving V2X and V2I questions (e.g. municipalities, cities, infrastructure providers). If this is path would be chosen, it is highly recommended to learn from the PSD2 where almost a year after it coming into force, first lessons can be learnt, such as

- API use must be made mandatory and the use of alternative APIs should be penalized
- API should be extended beyond current accounts to all accounts and depots
- Customers should be able to opt out from their data being accessible via API
- No free of charge use of banking infrastructure by direct or indirect competitors, charge based rules of use similar to the telephone network
- Option to vary the authentication depending on type of service or transfer authentication from bank to TTP for the stationary point of sales to benefit as well

Having its origins in Open Banking initiatives, PSD2 is inspiring various open data initiatives worldwide in other data driven industries like telecom, utilities with the aim to provide consumers with choice, innovation and security. Apparently, PSD2 is not yet inspiring the legislative specialists in the automotive sector.

Many PSD2 arguments, principles and concerns addressed that led to the EU regulatory intervention in finance are equivalent or equally applicable in the automotive case, however no intervention seems to occur here. To our best knowledge to date, explicit parallels between the automotive and the banking sector from the viewpoint of PSD2, are not drawn yet: it is a wide open gap in literature at this moment.

The PSD2 concepts, stripped from their banking specificity, are yet to be analysed in the automotive data access debate.

#### 4.2.4.2 GDPR

The General Data Protection Regulation (GDPR) has been introduced in 2018 with the objective to give control to individuals over their personal data and to simplify the regulatory environment for international business by unifying the regulation within the EU.

It significantly increases the penalties for companies that fail to protect the data they hold. Article 20 of the EU GDPR makes personal data portability mandatory. However, it does not provide any further details on whether or not this needs to happen in real-time and how often. It stipulates only that the data should be provided "in a structured, commonly used and machine-readable format" and "the right to have the personal data transmitted directly from one controller to another". Theoretically, this clause provides the ground for consumers to freely move their (vehicle) data from one service provider to another. However, even if this would be technically possible, the fact that only OEMs have control over the in-car interface with the driver, any other service provider would still suffer from significant disadvantages in providing in-vehicle services.<sup>121</sup>

As a side note and following up on important remarks during an interview with a start-up company active in the vehicle mobility sphere, there is a noteworthy issue that needs to be ensured by any car rental, leasing or sharing company. As every driver needs to give his or her consent to the collection of personal data during the use of the vehicle, it must also be ensured that these data remain private, i.e. are deleted from the vehicle upon return to the vehicle and cannot be tracked back and that the driver may request portability of his or her data.<sup>122</sup>

As awareness for such issues amongst drivers grows, we expect the pressure for stricter compliance and transparency about it to increase.

#### 4.2.4.3 Progressing EU harmonization in IAM relevant fields – Repair Clause

While in most EU countries the “right to repair” is a legislative reality, there are still a handful countries without so called “repair clauses”, i.e. laws that prohibit the use of visible non-OEM spare parts in the interest of design protection.

In the past, in many European countries like Germany, the courts would have permitted the design holder to use their registered designs to prevent sale of non-OEM spare parts. Most recently, however, the European Court of Justice has ruled differently with a new “freedom of free repair” approach<sup>123</sup> that is in line with previously mentioned consumer movements’ objectives. In addition, the new German government examines the introduction of a repair clause, which would further strengthen independent repairers and lead to further harmonization on this topic in Europe.

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<sup>121</sup> Access to digital car data and competition in aftersales services, Bertin Martens, Frank Mueller-Langer, Joint Research Centre of the European Commission, September 2018

<sup>122</sup> [https://www.theregister.co.uk/2018/09/07/connected\\_cars\\_privacy/](https://www.theregister.co.uk/2018/09/07/connected_cars_privacy/)

<sup>123</sup> <http://www.osborneclarke.com/insights/ecj-widens-the-notion-of-spare-parts-falling-under-the-repair-clause/>

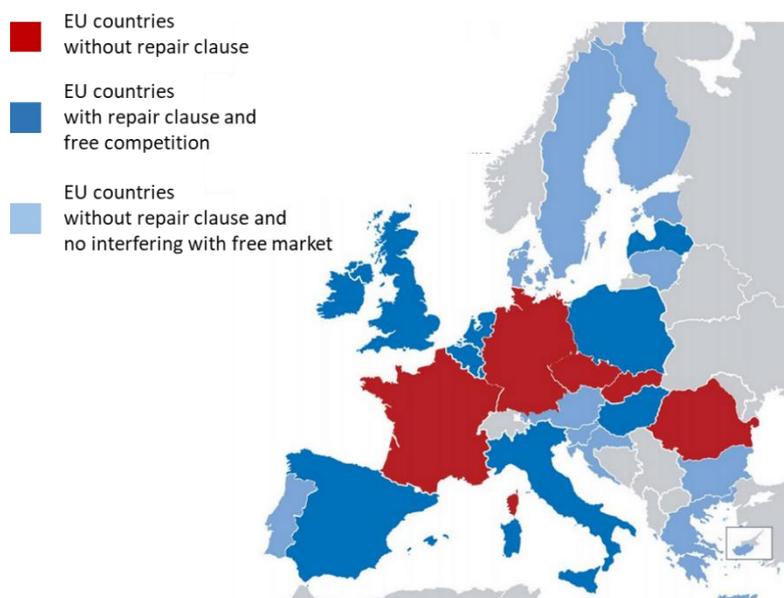


Figure 40: Repair Clause status in Europe. Source: GVA

The example of the Repair Clause shows that if no harmonization of legislation is being put in place across the EU, consumers will continue to demand equal treatment across the EU territory with much more efforts and costs and over a long period of time

#### 4.2.4.4 Promoting innovation

The European Commission has clear priorities for innovation and launched numerous initiatives to support it. In this context, the Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs supports innovation development in priority areas and in SMEs, mainly through Horizon 2020.

It aims to improve regulatory conditions for innovation with measures for start-ups, entrepreneurship, access to finance, digital transformation, Single Market, intellectual property and standards and develops sector policies to modernise the EU's industrial base and accelerate the market uptake of Key Enabling Technologies<sup>124</sup>.

In addition, the European Commission has made 450 million EUR available under the Connecting Europe Facility in order to support digitization in transport and support to automation.<sup>125</sup>

It would be contrary to the European Commission's own goals to limit innovation in the IAM as this sector has recently seen new opportunities to innovate and has embraced this opportunity. For example, the

<sup>124</sup> [https://ec.europa.eu/growth/industry/innovation\\_en](https://ec.europa.eu/growth/industry/innovation_en)

<sup>125</sup> Communication from The Commission to The European Parliament, The Council, The European Economic and Social Committee, The Committee of the Regions, On the road to automated mobility: An EU strategy for mobility of the future, COM(2018) 283, European Commission, 17.May 2018

OBD port and the decision of the European Parliament to maintain access to it beyond 2020<sup>126</sup> has given start-ups in all European countries a cause to pursue fresh business ideas.<sup>127</sup> To now cut it off from this opportunity would be counterproductive to the longstanding efforts.

#### 4.2.4.5 Screen or web scraping

In the context of PSD2, a very intensive discussion about screen or web scraping has been led. This method has been the basis for hundreds of FinTech start-ups as it enabled them access to data, which they could not get from established banks due to the lack of well-defined APIs. The controversy was that while screen scraping has markedly contributed to the development new applications and businesses to the advantage of the consumer, it would also limit the extent to which incumbent banks would be willing to invest in new and more modern data sharing methods. Start-ups even claim that screen scraping is safer than banks' API, as the security assurance and accreditation processes by professional cloud hosting providers such as Amazon Web Services AWS or Microsoft Azure.

PSD2 does not ban screen scraping as it would hinder competition and harm consumers as there are not yet sufficiently well accessible APIs in place. As it is the key intention of the PSD2 to have them in place, screen scraping will become obsolete if the PSD2 will be successful.

Screen scraping is also the basis for many start-ups in the automotive scene such as comparison portals and there is a clear analogy to the legislative requirements. The phenomenon is to date less known and less obvious than in the travel or finance industry but will also need to be taken into consideration of any legislation as only a clear legislation of non-discriminatory access to in-vehicle data will lead to higher standards and a fair treatment of all players.

On top of all reviewed legal frameworks, OEMs themselves do not perceive the current legislation to support their objectives as 87% of surveyed senior executives think that data sharing regulations constrain effective cross-industry partnerships.<sup>128</sup> Still, it is unlikely that there will be a voluntary move of all stakeholders towards a common ground and open standards as can be learnt from the example of mobile phone chargers where the EU Commission has been pushing for a common charger for nearly a decade. However, apart from a Memorandum of Understanding (MoU) and Letters of Intent (LoI) by 14 charger manufacturers, little progress has happened.<sup>129</sup>

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<sup>126</sup> '[the European Parliament] recommends that the Commission rapidly establishes an adequate legal framework to achieve EU-wide cross-border interoperability, as well as a framework laying down rules on liability for the use of the various forms of connected transport; calls on the Commission to publish a legislative proposal on access to in-vehicle data and resources by the end of the year; recommends that this proposal should allow the entire automotive value chain and users to benefit from digitalization and guarantee a level playing field and maximum security with regard to access and storage of in-vehicle data for third parties, which should be fair, timely and unrestricted in order to protect consumer rights, promote innovation and ensure fair, non-discriminatory competition on this market in respect of the principle of technological neutrality'. If approved by the European Parliament, the new regulation will come into play from 1 September 2020.

<sup>127</sup> While this statement cannot be supported by statistics, it is derived from the author having had multiple insights in start-ups basing their idea on the free access to the OBD port.

<sup>128</sup> Ready for Inspection – The Automotive Aftermarket in 2030, McKinsey & Company, June 2018

<sup>129</sup> <https://www.reuters.com/article/us-eu-telecoms-charger/eu-regulators-to-study-need-for-action-on-common-mobile-phone-charger-idUSKBN1KR1WE>

#### 4.2.5 Ex-ante legislative response needed to prevent market failure

In addition to the vital voice of the customer, the arguments described in this study strongly support an ex-ante legislative response of the European Commission in the context of Cooperative, connected and automated mobility (CCAM) as a failure to act will foreclose access to in-vehicle data for some IO and the IAM in general. In summary the key points supporting the argument comprise of the following points

- Result of formal interviews with AFCAR members with a unanimous request for a legislation
- Result of informal interviews with market players expressing the need for fair and relevant standards across all vehicle brands and types
- Result of informal interviews with start-ups relying on a fair data access
- Lessons from other industries indicating the superiority of open systems
- Lessons from US where even tech giants have started to request more regulation
- Lessons from EU history and OEM behaviour repeatedly requiring regulation adjustment to ensure a level playing field
- Conclusions of renown research institutions supporting the need for legislation and standardization
- Growing activism for open data, right to repair and data self-sovereignty
- Growing consumer awareness about data economy

While all mentioned reasons have been reviewed in this study at the minimum extent possible, it is obvious that the need for ex-ante legislation is imminent in order to prevent undue behaviour of OEMs when it comes to driver interaction.

The consequences for not issuing ex-ante legislation as requested by various stakeholders as well as neutral research institutions are likely to be looming market failures, which are

- **Competition imbalances between OEM and IAM** in the area of aftermarket and related automotive services
- **Potential choice of wrong technology by OEMs** as Extended Vehicle or Neutral Server solution proclaimed by ACEA is inferior to OTP solution in terms of standardization and interoperability
- **Privacy and personal use of data of consumers** - difficult if not impossible to deal with in the Extended Vehicle set up in terms of transparency allowing consumers to make informed decisions about the use of personal data<sup>130</sup>

We strongly recommend that any future legislative approach would consider amending the Type Approval legislation to provide a framework on fair and non-discriminatory access to in-vehicle data in alignment with GDPR and PSD2 and for all digital competition aspects to be fully addressed in sector specific BER in alignment with general BER, GDPR and PSD2. Such legislation should ensure open and fair access closely aligned with global standards for interfaces and data to ensure a coordinated approach. Any such approach should be technology agnostic and thus allow for the best possible technological solution.

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<sup>130</sup> Data Access in Connected Cars: The problem of access to In-vehicle Data, Prof. Wolfgang Kerber, Philips University Marburg, November 2018

## 5 Consumer preferences

The consumer perspective is often being underrepresented in the discussions about technical developments in the automotive sector such as the access to in-vehicle data. As the topic of data access and commercialization of data in connection with digital devices and consumer awareness about the implications is rising, one may expect growing consumer attention/sensitivity. In this section we elaborate on some consumer views that are relevant for the automotive aftermarket, through the presentation of results from a consumer survey conducted in 2018 in major European markets, as part of this study.

### 5.1 User control

As described in Section 3, data access is a very hot topic, but dominated by the professionally involved stakeholders in the automotive sector. As a representation body of motorists, FIA wants to ensure that the voice of consumers is **also** being heard in this debate about data access, similar to the “My Car My Data” campaign in connection with data privacy and ownership.

For example, while consumers back then showed a relative openness to data sharing, that openness tends to reduce when it concerns more personal data<sup>131</sup>. Figure 41 indicates that the consumer makes a clear distinction between data types and that consent can be situation dependent.

Driver consent is at the moment left very open in the ExVe model. No security principles or standards are enforced, nor ease of use or details about granularity or timing or opt-out possibilities (all or nothing). Each OEM can organize this as they wish. Failure to standardize and overly cumbersome multi step procedures for all stakeholders can result possibly in high outage. The user permission protocol is an often overlooked item in the telematics platform evaluation.

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<sup>131</sup> What Europeans think about connected cars, *My Car My Data*, FIA Region I, Research Now, January 2016

## Consumer attitude towards data sharing

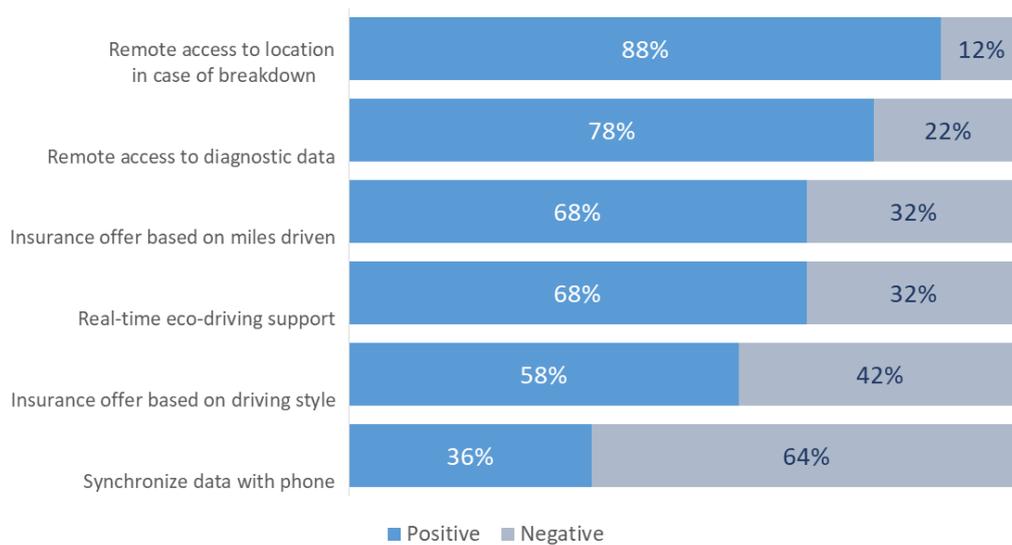


Figure 41: Consumer attitude towards data sharing. Source: FIA.

Most data relating to a vehicle that is connected to other systems via retrofit or embedded solutions, are personal data. Personal data are subject to GDPR, these requirements are an important basis as the discussion about mobility data in the widest sense needs to take into consideration the evolvement of various ecosystems

Consumers in the EU have strong privacy rights at their disposal while the changing regulatory and technological environment can create a lack of transparency and makes it harder to make informed choices. The processing of their data will make any consent or authorization processes very complex in systems with multiple stakeholders.

It needs to be ensured that consumers have at all times all required information at their fingertips and an ease of use in making an educated choice that can be amended at any time. The freedom (and the right) to opt out from data aggregation, communication or connection must be given like the airplane mode button on a smartphone. It is another crucial aspect in the data access debate with deep consequences.

Consumers must also be able to decide which actors are allowed to use their personal data. Ultimately, consumers must be able to switch not only between hardware and software options, between OEMs or IAM providers, but between entire ecosystems. Any lock-in for services because of clauses in contracts in connection with the sale of a new car or unclear consent to data use must become a matter of the past. These prerequisites are important irrespective of the technical choice for in-vehicle data access.

The use of the non-personal data of their cars might become a more important question as consumer awareness about data monetization practices will grow and so will the appetite to get a share of the digital pot of gold. As of today, consumers do not participate in the monetization streams for anonymized data as processed by data platforms of OEMs or neutral providers. However, from an economic standpoint it

can be argued that – as the car owner also owns the data of the car<sup>132</sup> that produces the data, this exchange of value between OEMs and car owner should be reflected in added value for the consumer such as lower new vehicle prices or additional services. And last but not least, as far as the freedom of choice is concerned, it should be up to the car owner to decide who is allowed to monetize the data. Many of these aspects have as of yet not been sufficiently analysed and need to be taken into consideration.<sup>133</sup>

Furthermore, it is also important to not only focus on the rising share of millennials, their digital preferences and habits and increasing buying power in a digital world, but also consider less digitized and less privileged consumer groups that rely on affordable telematics solutions.

With the purpose of providing a consumer perspective to the debate, a survey was performed to characterize the relation of consumers with the aftermarket and how data access plays a role in that.

## 5.2 Survey coverage

The RN-SSI survey<sup>134</sup> that was carried out from the 7th to the 16th of November 2018 as part of this study, is based on an online questionnaire.

The target group consists of people (male/female), aged 18-70 years, who own or lease a car and personally– or someone in their household- pay for the aftercare of their car. The sample comprised four countries (Germany, Italy, France, Spain) and counted about 1000 interviewees per country (see Figure 42). Uniform sampling over these sociodemographics (gender, age, region) ensures that a statistical sufficiently representative inference from the total EU population was reached.

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<sup>132</sup> What Europeans think about data, [http://mycarmydata.eu/docs/FIA\\_survey\\_2016.pdf](http://mycarmydata.eu/docs/FIA_survey_2016.pdf)

<sup>133</sup> Data Access in Connected Cars: The problem of access to In-vehicle Data, Prof. Wolfgang Kerber, Philips University Marburg, Nov. 2018

<sup>134</sup> Assessment of the potential consumer response to the Extended Vehicle approach, Global report I Research Now SSI, December 2018

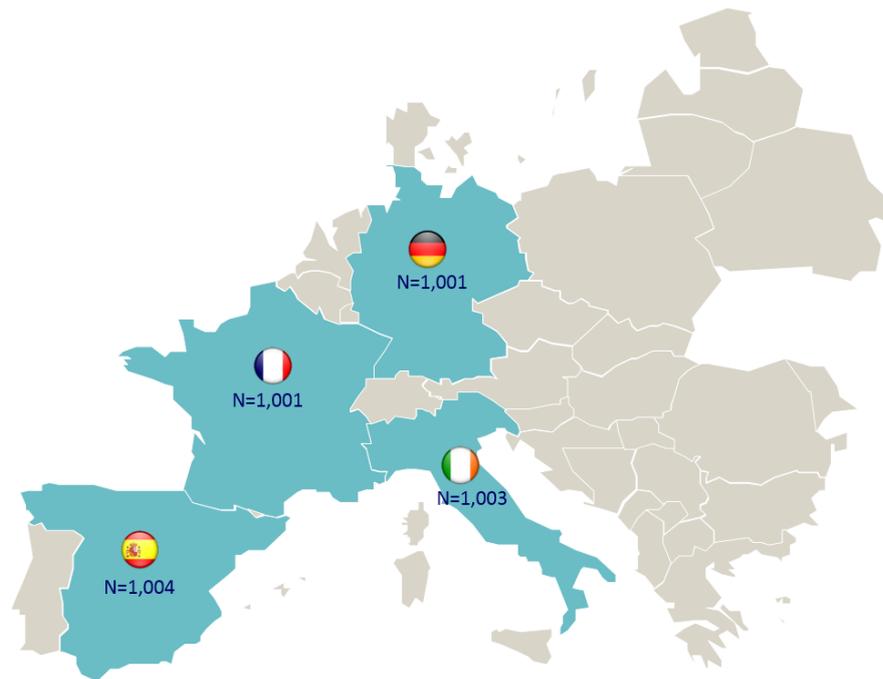


Figure 42: Sample size and geographic scope of survey. Source: Research Now SSI

### 5.3 Pricing difference

The fact of a substantial pricing difference between IAM and OEM in the automotive aftermarket is evidently confirmed in the survey by about 89% of consumers. Despite the claim of better quality being the reason that justifies that difference, 87% perceive the competences of IAM equal to those of OEM. Figure 43 provides the breakdown of these figures in the 4 major countries of the EU.





Figure 43: Consumer opinion on IAM workshops, with breakdown of responses per country. The question was: "For car repair/maintenance, to what extent would you say you agree or not with each of the following statements". It appears independents are found to be cheaper, but also equally competent. Source: Research Now SSI

From the consumer's viewpoint, the independent aftermarket is thus a quintessential catalyst for cost savings. The 213 million IAM clients would be financially much worse off if they would only have the OEM channel operating. A quick back-of-the-envelope estimate for the impact of the increase in customer spending if IAM operators would be 100% eliminated overnight, would be in the order of +125 billion € (an increase of circa 50% in total European aftermarket volume).

On its turn, this consumer gain is entirely conditional on the existence of EU automotive regulations. Several studies confirm the benefits of regulation, and quantify the increased competitiveness in the automobile sector<sup>135</sup>. It is understandable that OEMs see the regulation rather as cause of missed revenue.

#### 5.4 Aftermarket Drivers

One of the drivers that influence the choice between IAM vs OEM workshops is the price, as can be expected. According to the survey, consumers are less likely to use the services of IAM garages if OEM garages are more competitive on price with a drop from 56% to 32% of consumers preferring the IAM if the OEM channel is cheaper.

Surprisingly, waiting time is a more considerable factor and makes even more consumers choose for the OEM channel (only 21% remain). And moreover, the capability to intervene from a distance (e.g. remote resetting, software update, or diagnosing) even reduces it to 17%. Figure 44 illustrates the outcomes from the survey.

<sup>135</sup> The European Automotive Aftermarket Landscape - Customer Perspective, Market Dynamics and the Outlook to 2020, Boston Consulting Group, 2014; <https://www.bcg.com/documents/file111373.pdf>

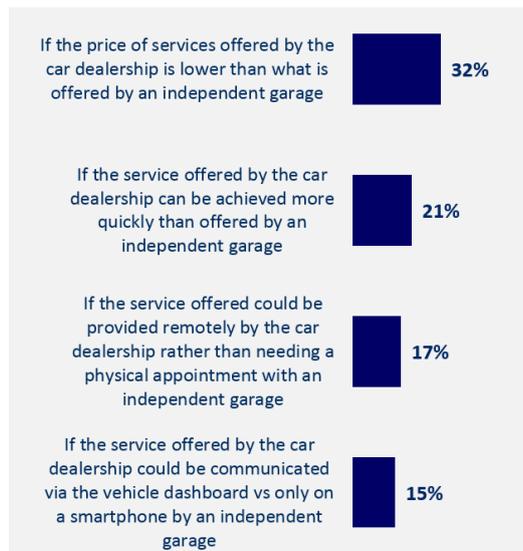


Figure 44: Consumer decision criteria for workshop preference. The question asked was: "Would you be more or less likely to use the services of an independent garage in the following situation". The outcome of the survey indicates likeliness to use services of an independent garage, depending on 4 different conditionals [in % Very Likely]. Source: Research Now SSI

Thus service speed or telematics capacity appear to be (slightly) stronger drivers than price. This is a remarkable outcome, but an important one for the debate because it involves not only the financial aspect, but also the time and communication dimensions of (in-vehicle) access. In other words, the question is, if the consumer will have in reality the actual choice between a faster or a slower service at the moment of deciding, which assumes in-vehicle human interface access for IAM, on an equal basis as the OEM.

Next to data access, the findings suggest there is (i) the timeliness and (ii) capacity of remoteness of service, that must be included in the open data model debate.

## 5.5 Interoperability

Another requirement is the interoperability for the vehicle platform. On the level of services, there should be a presence of a multitude of stakeholders from which the consumer can make his choice. According to the survey, for instance in case of an accident, the majority of drivers would prefer to use the assistance of their insurance, while other assistance providers also find a significant user base. Figure 45 illustrates the outcomes of the survey.

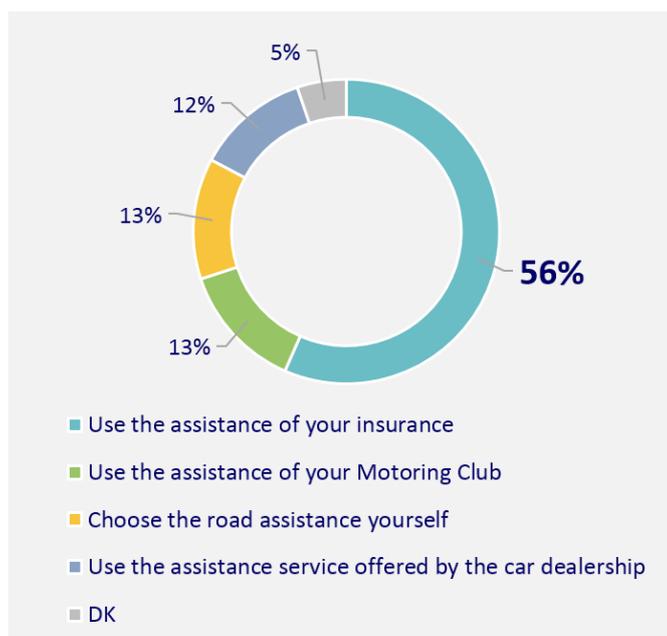


Figure 45: Consumer provider preferences in case of required road assistance (DK=Don't know). The question asked was: "If you need to use the assistance, in case of an accident for instance, would you prefer to:". More than half prefers the insurers'.

Source: Research Now SSI.

Giving this user perspective some deeper thought, the results suggest that strictly confining the user to the OEM solution for services would alienate them (in this case more than half of the customers).

Moreover, the consumer would not benefit from the variation, innovation and the competition between the providers to offer the best user experience and assistance. And despite the hassle and inconveniences, it is likely that determined customers will try to find the access to the provider of their choice through the internet browser platform of the connected vehicle. If it depends on the customer, in-vehicle access to multiple service providers is something that OEM interface builders would anticipate by design.

On the lower level of the operating system (between OEM brands or consortia) the following research findings (outside the consumer survey) supports this finding: the interoperability between Apple and Android mobile devices has been growing over the years driven by Google Play offering iOS apps. We believe that consumers want to have the freedom of choice between operating systems and that it should be easy to switch between them. It was only in 2018 that Apple's Car Play allowed non-Apple navigation apps like Google Maps or Waze to be installed and run on its operating system. Still, many of the inbuilt features are not available when using Google Maps via Car Play like for example using Siri's voice control or tap buttons for frequent locations. It is such small features that decide about consumer preferences and tech giants are fully aware about that and can thus influence consumer behaviour.<sup>136</sup>

An example for the likely superiority of tech players in the eyes of the consumer is the widely accepted opinion that the navigation apps of tech players (e.g. Google Maps, Waze) are superior to those embedded in common vehicle models and thus the preferred choice of consumers. This is being confirmed by

<sup>136</sup> Hell Freezes Over: Apple Allows Waze, Other Grown-Up Navigation Apps in CarPlay, Extreme Tech, June 2018

survey<sup>137</sup> results that show the preference of consumers to choose their own in-vehicle entertainment apps over those offered by OEMs.

It is thus more than worthwhile to listen to the consumer *in the first place*.

### Preference for stream entertainment services in their vehicle

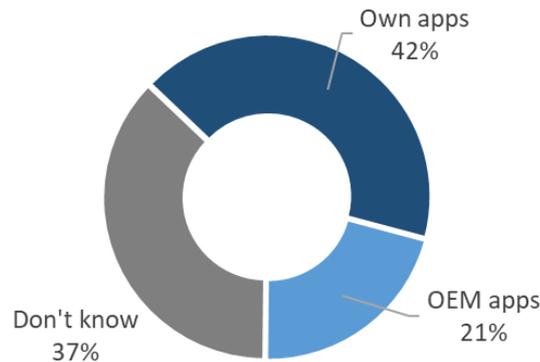


Figure 46: Consumer preference for stream entertainment services in their vehicle. The question asked was: "If your car could stream entertainment services (i.e. films, games) and show them on screens in the car for passengers, would you prefer?" It indicates many remain with their own apps, although one third is undecided. Source: Research Now SSI

## 5.6 Data access bill

According to the survey result, it is for 70% of the vehicle owners not acceptable that the independent garage charges them extra for accessing the computer data of their own car (see Figure 47). Additional charges by independents to the customer are difficult to sell, as can be expected.

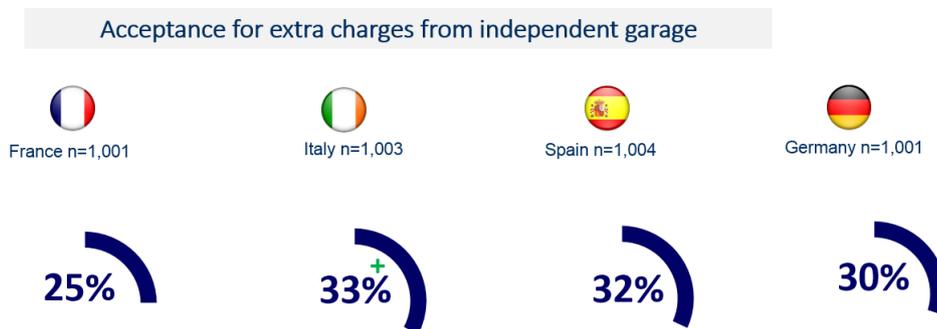


Figure 47: Consumer acceptance of additional charges. Question: "Would you accept that the independent garage charges you extra for accessing the computer data of your car?" 70% would not accept it. Source: Research Now SSI.

<sup>137</sup> Assessment of the potential consumer response to the Extended Vehicle approach, Global report | Research Now SSI, December 2018

This drops only slightly to 60% if drivers are not impacted themselves, and it is going to be a bill for the independent garage to pay extra to a car manufacturer to access data of the vehicle.

If the consumer has to pay for data from his own vehicle, that is a matter of data ownership. The question whether the IAM subsegment should pay for it, is rather a matter of competitive power.

### 5.7 Remote maintenance

About 2/3 of drivers would be open to receive a remote maintenance service rather than taking the vehicle to a garage for physical inspection<sup>138</sup>. Price and transparency are the most important criteria for remote maintenance (see Figure 48).

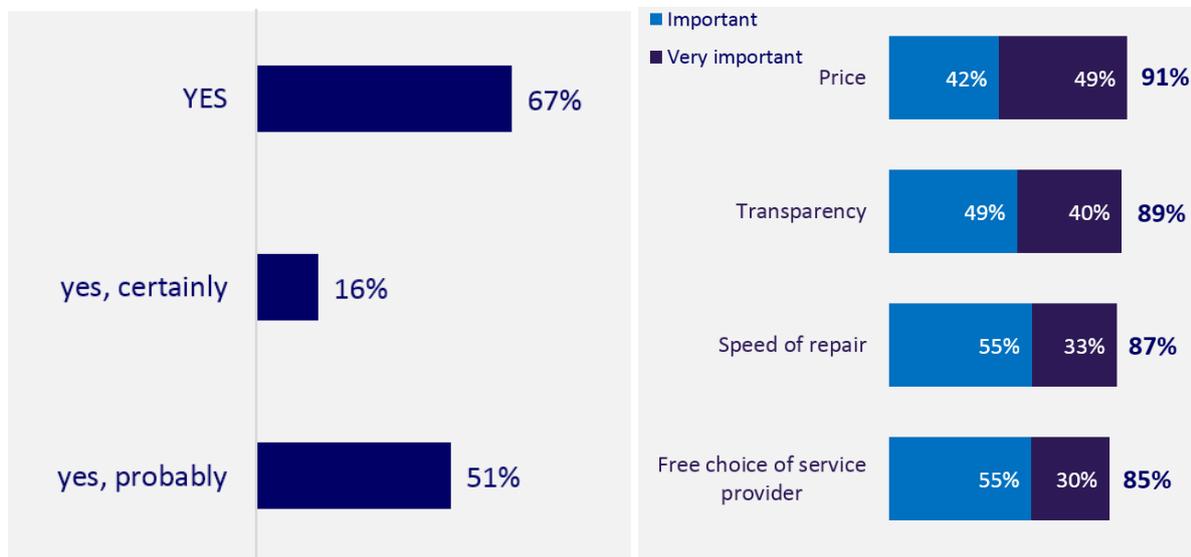


Figure 48: Consumer criteria for remote maintenance. Question: "If problems with your car could be fixed remotely, please assess the importance of each of these criteria?" Two third of drivers is open to that, with price as primal driver, but also transparency. Source: Research Now SSI.

It is clear that vehicle owners appreciate any remote fixing, but that it depends on 'how much' and 'what for', 'how fast', and 'by whom'. If the offer is one-sided, the customer will likely postpone and look for second opinions, in order to compensate for the lack of market forces in the offering. Besides on-board presence, one may guess that a second question shall be reaction-time: 'who gets first to the customer' (latency).

<sup>138</sup> Assessment of the potential consumer response to the Extended Vehicle approach, Global report | Research Now SSI, December 2018

## 5.8 Independent Telematics

The Extended Vehicle seems to suggest that every OEM is to become the only provider of (true) telematics. But this picture would be a setback compared to the current situation, since in reality this whole function (transmission, storage, monitoring, interfacing, security, etc) can and is today already delivered by specialist IAM companies (notably by OBD dongle, external devices or smartphone apps producers) as described in Section 4.1. The various telematics players offer various unique selling points today to attract customers with different needs (some focus on realtime reporting, ease of use, high security, or simply entertainment).

For most fleet owners interviewed (with mixed vehicles), this independence of the brand is a *conditio sine qua non*. For the individual consumer, it allows the market forces to be maximally at play, because he can choose his telematics provider, just like with energy or telecom. Figure 49 from the survey<sup>139</sup> results indicate that individuals are aware and strongly value this freedom of choice.

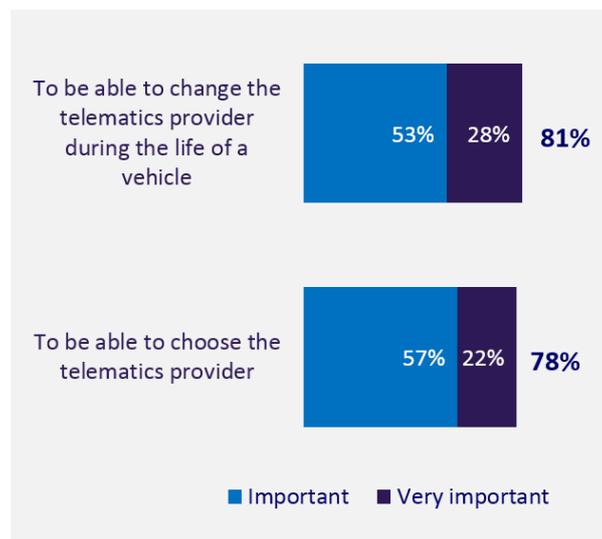


Figure 49: Relevance of freedom of choice to consumers. Question: "Today, every new car comes equipped with a telematics system from the manufacturer that is - if accepted by the consumer - linked to the vehicle for its entire life. How important is it for you?" Freedom of choice appears to be key. Source: Research Now SSI.

It is understandable that OEMs claim the sole right to telematics on their product sold, but the fundamental question is if they really align themselves then with the interests of their customers. Given the current possibilities and advanced practices nowadays on other domains, consumers likely will look through the Extended Vehicle concept, which starts by design from the premise that a monopoly is better than a free market.

<sup>139</sup> Assessment of the potential consumer response to the Extended Vehicle approach, Global report | Research Now SSI, December 2018

## 5.9 Clear Consumer perspective on freedom of choice

The limitations of the Extended Vehicle concept will prevent OEMs from meeting key customer demands such as freedom of choice, price competitiveness and transparency.

The consumer survey conducted as part of this study represents the voice of the customer that tends to be missing in most of the reviewed material and in ongoing investigations. The aftermarket consumer clearly wants to maintain and further improve freedom of choice, transparency, service levels and price competition. The overwhelming majority is open for innovative services such as remote maintenance or usage-based insurance.

Knowing how much the customer perspective needs to be protected in the digital era, it is important for EU policy makers to pay thorough attention to it and act accordingly.

## 6 Economic impacts

In this section, a quantitative view is provided on some consequences of data access control, or the lack thereof.

### 6.1 Remote Diagnostics/Prognostics

One of the contentious points of discussion between OEM and IAM is the repair and maintenance arena at the workshops of resp. dealerships and independent garages.

#### 6.1.1 Workshops

Workshops or garages make up the majority of typical aftermarket intermediaries: they repair, replace parts, and perform the maintenance of the vehicles.

According to studies of that aftermarket subsegment, there were in Europe a total of about 455,000 garages in 2014<sup>140</sup>. Taking into account almost 2% growth, one can estimate for 2017 about 480,000 workshops in Europe. If we exclude Russia, Turkey, Ukraine, then about 16% (ie the proportion in vehicle count) must be reduced from that count, and we obtain:

*Total number of aftermarket workshops in Europe  $\approx$  400,000.*

Regarding the partitioning in number of physical outlets, there are on average about 18% OEM affiliated vs 82% IAM in Europe<sup>141</sup>. Figure 50 illustrates that market share contrast.

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<sup>140</sup> <https://www.tyrepress.com/2015/04/european-aftermarket-still-growing-despite-a-small-drop-in-2014/>

<sup>141</sup> Databook, *Garage Structure in the European Car Aftermarket 2017*, Wolk-aftersales research, january 2018

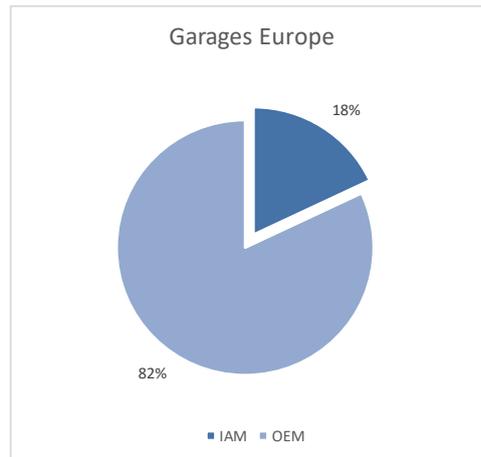


Figure 50: Share of OEM and IAM in number of garages in Europe. Source: Walk after-sales research.

Knowing the approximate count of garages, and the percentage share, (rounded) absolute figures for Europe come down to following division in 2017:

$$\begin{cases} G_{IAM} \approx 328\,000 \text{ garages} \\ G_{OEM} \approx 72\,000 \text{ garages} \end{cases}$$

where we denote

- $G_{IAM}$  as the number of garages served exclusively by IAM,
- $G_{OEM}$  as the number of garages served exclusively by OEM.

Combining this result with the number of vehicles served in the IAM and OEM segment, one obtains an estimation of car park size (densities  $D$ ) for the segments

$$\begin{cases} D_{IAM} \approx 650 \text{ vehicles per garage} \\ D_{OEM} \approx 1\,500 \text{ vehicles per garage} \end{cases}$$

It implies that IAM garages have on average 3 visits per working day (counting circa 210 d/y), while OEM garages have about 7 vehicles per day (assuming only one visit per year).

### 6.1.2 Workshop expenditure

The actual annual expenditure per vehicle in a workshop depends on many factors (e.g. age, mileage, driving style, use, location, power). Figure 51 gives an example<sup>142</sup> for German vehicles of the variation over time.

<sup>142</sup> Online automotive parts sales: The RISE of a NEW CHANNEL, Roland Berger, 2016; [https://www.rolandberger.com/publications/publication\\_pdf/roland\\_berger\\_study\\_online\\_automotive\\_parts\\_sales.pdf](https://www.rolandberger.com/publications/publication_pdf/roland_berger_study_online_automotive_parts_sales.pdf)

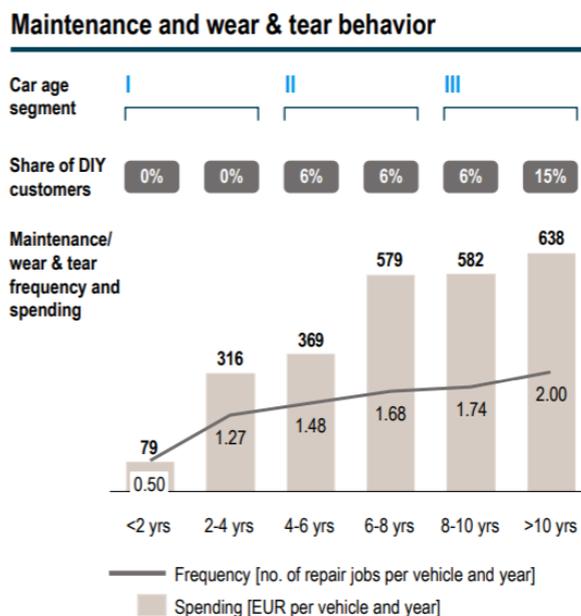


Figure 51: example of wear and tear spending in Germany over the vehicle lifetime. Source: Roland Berger.

However, for our purposes we focus in first order just on averages. According to ACEA<sup>143</sup>, a vehicle drives on average 14 000 km per year. Combining that fact with a typical wear-and-tear maintenance<sup>144</sup> (W&TM) cost of roughly 3 €cent/km according to an EU study<sup>145</sup>, we may obtain:

*Average annual workshop wear-and-tear maintenance expenditure per vehicle in Europe ≈ 400€*

Given that there are about 320 million vehicles, this yields a total revenue generated in workshops of

$$320 M * 400€ = 128 B€$$

Wear and tear maintenance in workshops accounts thus for about half of the total aftermarket value (250 B€) or half of the total annual 750€ spending per vehicle.

One may notice that this estimate of particular repair and maintenance expenditure is only half of the one in the USA, where it amounts to 745 € (\$848 - according to the US bureau of Labor Statistics<sup>146</sup>). On the other hand, the annual average distance (mileage) is also about half (14 000 km/y as compared to 22 000 km/y), according to the US Federal Highway Administration<sup>147</sup>. Thus it confirms the order of magnitude of workshop expenditure per vehicle per year.

<sup>143</sup> [https://www.acea.be/uploads/statistic\\_documents/ACEA\\_Report\\_Vehicles\\_in\\_use-Europe\\_2018.pdf](https://www.acea.be/uploads/statistic_documents/ACEA_Report_Vehicles_in_use-Europe_2018.pdf)

<sup>144</sup> Remark that we consider only the wear-and-tear maintenance, repairs, replacing of parts, which are requirement to keep a vehicle operational, but it excludes optional (tyres, engine enhancements) or random costs (road assistance, collision or crash related services or parts).

<sup>145</sup> [http://ec.europa.eu/ten/transport/studies/doc/compete/compete\\_annex\\_01\\_en.pdf](http://ec.europa.eu/ten/transport/studies/doc/compete/compete_annex_01_en.pdf)

<sup>146</sup> <https://www.bls.gov/opub/ted/2017/consumer-spending-on-vehicles-averaged-8427-in-2016.htm>

<sup>147</sup> <https://www.fhwa.dot.gov/ohim/onh00/bar8.htm>

To obtain the differentiated spending at the workshop per IAM/OEM segment, we take into account (i) the average price discount of 50% of section 2.4.4 in terms of spending, and (ii) the average spending per garage, so that we have a set of constraints:

$$\begin{cases} S \approx 400 \text{ €} \\ S_{IAM} \approx 50\% * S_{OEM} \end{cases}$$

Where we denote

- $S_{IAM}$  as the average spending per vehicle in the IAM workshop, and
- $S_{OEM}$  as the average spending per vehicle in the OEM garage.

Since there is one fundamental unknown to solve, we have to link the constraints through one additional equation, in order to solve. For example, the expression for the average revenue per workshop for a vehicle is a weighted sum of the spending over each segment (proportional to the number of vehicles):

$$S = 34\% * S_{OEM} + 66\% * S_{IAM}$$

Using the constraints above, we obtain the average spending per vehicle, for each network:

$$\begin{cases} S_{IAM} = 300 \text{ €} \\ S_{OEM} = 600 \text{ €} \end{cases}$$

We may check that the annual total volume in each workshop type indeed adds up to the total of 128 B€:

$$128 \text{ B€} = 64 \text{ B€} + 64 \text{ B€} = (213 \text{ M} * 300 \text{ €}) + (107 \text{ M} * 600 \text{ €})$$

Consequently, the average revenue per garage type is

$$\begin{cases} \frac{64 \text{ B€}}{328 \text{ 000}} \approx 200 \text{ 000 € per IAM garage} \\ \frac{64 \text{ B€}}{72 \text{ 000}} \approx 889 \text{ 000 € per OEM garage} \end{cases}$$

Thanks to -both- larger car park size and higher pricing of OEMs, they are able to generate half of the revenue of workshops, by means of only one fifth of the workshops.

### 6.1.3 High Client Conversion capacity

According to Section 6.1.1, there are in Europe a total of about 400,000 garages, with about 18% OEM affiliated vs 82% IAM. The annual average is circa 400€ revenue per vehicle. It is a situation in equilibrium for already quite some time, which implies that the number of OEM garages is pretty saturated. New entry is difficult and the pricing handicap of OEMs can likely explain the current market equilibrium.

Furthermore the revenue per car that each network type realizes also remains constant for the subsegment.

Because OEMs can capture the client relationship through their monopoly on communication and data access, they are able to increase the productivity of their workshops, as they can lead them to theirs. That this privilege is of great importance, shows the survey that a high level (70%) of interest in receiving financial offers for maintenance services for vehicle data via the interface screen. Even 41% would immediately drive to the dealership upon a message for maintenance/repair. Combined with the fact that Tesla states that "90 percent of issues with its cars can be identified and diagnosed remotely, before taking it to a service center"<sup>148</sup>, the diagnostic and prognostics feature is one of the most valuable advantages in client conversion.

Our survey demonstrates the strong gravitational pull that the remote diagnostics exerts, as it demonstrates that this feature of preventive maintenance is overwhelmingly appreciated by about 92% of those who experienced it (40%), as was found in the survey<sup>149</sup>. Figure 52 illustrates the proportion who already received such a message.

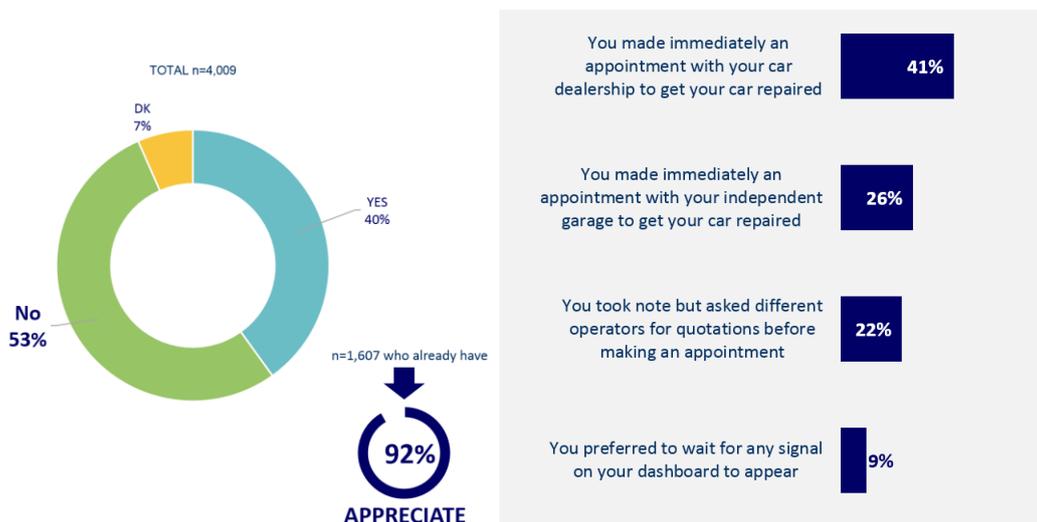


Figure 52: **Left:** The question was: "Have you ever received messages (on the dashboard, on the smartphone, by letter, by phone, given in person etc....) for preventive maintenance, i.e. before a part is worn or broken? Did you appreciate to receive this kind of message?" Consumer appreciation is very high (92%) of text messages with service/repair notice (DK= Don't know) for those who already experienced receiving a message (40%). **Right:** the first reaction of motorists when they receive a message from the vehicle system. The question was: "How have you reacted when receiving this message?" Most followed instructions. Source: Research Now SSI

For a long time there was no need for profit seeking on, or investment in telematics, as a large portion of profit for OEMs and their dealerships remained with aftermarket repair and maintenance services. However, increased electrification of the vehicle park is expected to eventually lead to a reduction in repair and maintenance operations as full electric vehicles have significantly fewer moving parts that are less prone to wear and tear. This realisation will in part be driving the increased OEM focus on in-vehicle

<sup>148</sup> <https://www.washingtonpost.com/technology/2018/08/02/behind-wheel-tesla-model-its-giant-iphone-better-worse>

<sup>149</sup> Assessment of the potential consumer response to the Extended Vehicle approach, Global report | Research Now SSI, December 2018

data access, as monetizing data will provide the opportunity to substitute reduced income for standard RMI services and spare parts sales. In light of these developments, it is unsurprising the OEMs have chosen to pursue a more monopolistic view in this respect.

#### 6.1.4 Productivity gains

To estimate the impact of a data access monopoly, we turn to the most flexible parameter for growth: the productivity of the workshop. While the number of workshops is constant, they can grow the capacity by hiring more technicians. Today, on average 1 500 vehicles are serviced per OEM garage, which is circa 7/day. This is a core customer base in equilibrium of about 107 million vehicles.

By attracting for example 1 additional vehicle per day (from 7 to 8), each OEM workshop will increase its park size with 210 vehicles, and all 72 000 OEM workshops together gain about 15 000 new clients in total.

Just attracting one vehicle per day more, allows OEMs to increase their market share from 50% to 55% in terms of workshop revenue. The annual loss for the IAM amounts in that case to about 4.5B€. The same amount of 4 B€ is lost for the consumer, as they will pay -on average- double at OEM workshops. Figure 53 illustrates the IAM loss in revenue for different churning rates of customers.

vehicles per day	vehicles per year per OEM garage	OEM avg. vehicle park size	OEM revenue [€]	IAM revenue [€]	IAM loss [€]	OEM market share	delta nr vehicles
7	1470	105,840,000	63,504,000,000	64,248,000,000	<b>equilibrium</b>	<b>50%</b>	-
8	1680	120,960,000	72,576,000,000	59,712,000,000	-4,536,000,000	<b>55%</b>	15,120,000
9	1890	136,080,000	81,648,000,000	55,176,000,000	-9,072,000,000	<b>60%</b>	30,240,000
10	2100	151,200,000	90,720,000,000	50,640,000,000	-13,608,000,000	<b>64%</b>	45,360,000
11	2310	166,320,000	99,792,000,000	46,104,000,000	-18,144,000,000	<b>68%</b>	60,480,000
12	2520	181,440,000	108,864,000,000	41,568,000,000	-22,680,000,000	<b>72%</b>	75,600,000
13	2730	196,560,000	117,936,000,000	37,032,000,000	-27,216,000,000	<b>76%</b>	90,720,000
14	2940	211,680,000	127,008,000,000	32,496,000,000	-31,752,000,000	<b>80%</b>	105,840,000
15	3150	226,800,000	136,080,000,000	27,960,000,000	-36,288,000,000	<b>83%</b>	120,960,000

Figure 53: different churning rates of market share between OEM and IAM workshops, the blue scenario is the most likely. OEM workshops can likely attract 2 more vehicles per day if they can be the first to communicate with diagnostics messaging. Own Estimations.

For the estimation of the most likely churning amount that shall realize, we just use the result of the survey: 42% from the survey indicated to respond immediately to such a message by going to the OEM; so about 60% of the 320 million clients seems to react (irrespective if they are OEM or IAM clients). By offering the vehicle remote diagnostics and communication feature to the IAM population, OEMs could thus most likely expect to increase their current customer base with about 30 million additional clients.

The potential for OEMs to obtain 60% of the workshop market share is a realistic possibility if they have sovereignty over the interface in the car and allow no third parties. If they will appear first in the listing, this may decline to 55%, but still the OEM will gain market share.

Irrespective of any regulation or status quo, OEM garages will have a strong advantage in attracting customers through advanced data-driven remote diagnostics/prognostics capabilities to their dealership

network. The associated potential annual loss<sup>150</sup> for the **IAM segment is of the order 9B€, and 9B€ for consumers.**

Since there are about 10% vehicles connected today, and it will take until 2032 until 100% of the car park is connected<sup>151</sup>, one may expect that the churning of 10% will equally gradually take effect until then. Being prudent, we assume only about half of the potential of connected vehicles will be realized (50% instead of 70% in 2025, rather linear instead of exponential), so only an additional 5% market share will be reached in 2025, with a loss impact of 4B€ for IAM and 4 B€ for consumers. After ten years another 5% loss on top of that will be expected to be realized if this situation of unfair competition is not going to be regulated.

## 6.2 Churning sensitivity

In this section we estimate the link between price and market share.

### 6.2.1 Market share observations

Today, the aftermarket is more or less in equilibrium with regards to the market shares of OEM vs IAM. As in most commodity businesses, price is the single most important driver, although other ones, like quality or location also determine choice of the customer between IAM and OEM.

According to a recent survey<sup>152</sup>, about 69% of consumers declare to compare prices before choosing the workshop (dealer or independent). Therefore, we focus on price sensitivity. Figure 54 shows some key findings of the survey.



Figure 54: Consumer preferences for workshop selection. Question: "For car repair/maintenance, to what extent would you agree or not with each of the following statements." Source: Research Now SSI.

<sup>150</sup> Remark that in this study we do not adjust estimates for their future value, a loss of 100 € today is rather a loss of circa 106€ in some years into the future, given the time value of money. This is part of the choice to be conservative in the estimates.

<sup>151</sup> Connected Car Report 2016; Opportunities, risk, and turmoil on the road to autonomous vehicles, PWC, Strategy&, 2016

<sup>152</sup> Assessment of the potential consumer response to the Extended Vehicle approach, Global report I Research Now SSI, December 2018

Regarding price, as shown in the above section 2.4.4, the current market share of circa 50% corresponds to a 50% price discount compared to the OEM (service or part). It is a market equilibrium point that is observable today.

If you ask consumers what they prefer in the hypothetical situation that the OEM dealership is not more expensive any more, then about 32% would still stay loyal to the independent operator, according to the survey in Section 5.4.

According to another survey<sup>153</sup>, regardless of price, IAM after-sales are also regarded as safe (good quality in specialist expertise, or the rights tools) by about 26% of consumers. In that study, other positive labels have been associated with a population of about 20%. Being prudent, we adopt the indicator of about 20% market share as a lower limit of market share level when the price discount is not a factor any more.

For an upper limit, we find some indication in the survey<sup>154</sup>, where about 87% has ever used IAM providers, but about 30% was not sensitive to the price nor quality, and returned to the OEM network for repairs/maintenance/parts (see Figure 55). Therefore, we -again prudently- extrapolate that circa 30% won't churn away from OEM garages, even if price differences increased ever more beyond the existing discount point of today.



Figure 55: Consumer usage of IAM aftermarket channels. Question: "Have you ever made use of services of independent garages other than car dealerships? If yes, which ones have you ever used?" Many do, for repairs and tyres. Source: Research Now SSI.

These upper and lower limits of market share are sufficient to approximate the market share sensitivity with regards to pricing discount differences. It is in practice difficult to estimate the real market share in

<sup>153</sup> UK, National Franchised Dealers Association Consumer Attitude Survey Autumn 2018; <https://www.nfda-uk.co.uk/reports/consumer-attitude-survey>

<sup>154</sup> Assessment of the potential consumer response to the Extended Vehicle approach, Global report | Research Now SSI, December 2018

other conditions than today's equilibrium pricing, because it is always hypothetical (since it is not a true state of the economy). However, surveys provide a fair indicator, and that suffices for first-order calculations.

### 6.2.2 Sensitivity curve

In Figure 56 we can draw upon above findings to mark the lower, middle point and upper bound of market share versus price discount level on a graph. By connecting the dots, we obtain an estimate of a sensitivity curve for the dependency of price difference for the market share of IAM vs OEM.

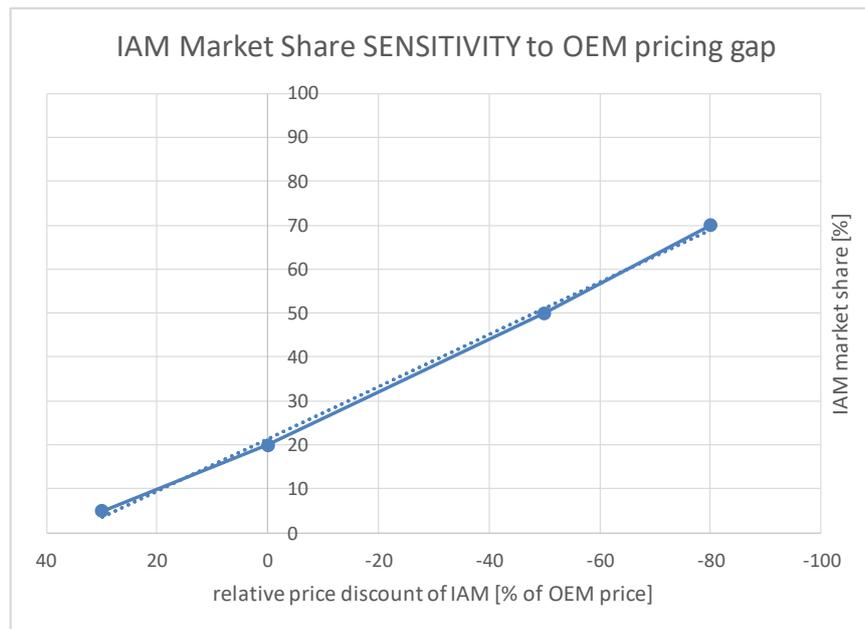


Figure 56: IAM market share sensitivity to OEM pricing gap.

The curve is highly intuitive: when the price gap between IAM and OEM widens, IAM will gain market share (and vice versa). We obtain the relationship that:

*for every -1% of relative discount increase, IAM can gain +0.6% of market share.*

Such a simple curve usually captures already quite well the basic market dynamics. For example, if the OEM garages lower their price with 2%, then IAM will lose  $2\% \times 0.6 = 1.2\%$  market share, and since the share of 100% corresponds to a value of 250 B€, the IAM revenue pool will decline with  $1.2\% \times 250 \text{ B€} = 3 \text{ B€}$ .

One may notice the behavioral paradox that the churning customers will have to pay more than at the IAM, even much more beyond the 2%, but that is explained by to the (psychological) tension between price and other drivers.

This churning coefficient around 1 reflects in general a tendency to stay loyal to the chosen party, which is aligned with the above-mentioned consumer survey result, where more than half (even 84%) remains loyal to their workshop (whether dealership or independent). Compared to other products/services, such low churning sensitivity means there are to a large extent more underlying factors involved than only price.

Based on available evidence, we also decided on a pricing point at the maximum quartile around -80% discount because this discount level amount can be observed (or at least in subsegments). Moreover, we drew a pricing point at 5% for e.g. specialist IAM shops that cater a specific audience (as the survey indicates, some 3% is willing to pay up to +20% more and remain loyal to IAM).

In reality the curve has more curvature, and beyond some point, say between -100% and -200% discount, there shall be a 'tipping point' where consumers will turn away from an IAM shop because of the psychological perception that price is 'too good to be true', so that the customer believes there must be something wrong with the offering.

### 6.3 Data access tariffs

In this section we aim to estimate an average annual cost for data access per vehicle.

#### 6.3.1 Monetizing data

Currently OEMs are claiming the full ownership of the vehicle (and driver) data. This monopolistic position allows them to monetize to a maximum extent, as noted in a recent publication<sup>155</sup>.

For example, on the mobile phone platform, navigation system services are typically offered to consumers free of charge, in exchange for their coordinates, while the developer earns by offering advertisements in their application. However, in case of a vehicle, the monopolistic position claimed by the OEMs will allow revenue generation at many more levels, for example: (i) to charge the consumer to pay for the navigation service, (ii) to receive the consumers' coordinates for free (iii) to charge third parties for access to data as to use the location coordinates, and (iv) to charge third parties access to the on-board platform and (v) to charge third parties for advertisements in applications. This list of revenue sources is not exhaustive.

The data sovereignty allows OEMs to establish a monopoly to monetize vehicle/driver data to the full extent: not only in magnitude, but also *in time* via e.g. renewal periods. The continuous-time subscription-based nature of the cash-flow is the most attractive aspect of the quest for vehicle data monetization. One of the first and obvious sources of revenue is simply directly selling the data to third parties. Other (indirect) OEM cash-flows (advertisement, customer charging etc) we do not cover, because of a lack of tariffs. Omitting these cash-flows does not mean that they are negligible, but we do consider them to be

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<sup>155</sup> Bertin Martens and Frank Mueller-Langer; Access to digital car data and competition in aftersales services, Digital Economy Working Paper 2018-06; JRC Technical Reports. <https://ec.europa.eu/jrc/sites/jrcsh/files/jrc112634.pdf>

of second order in magnitude, since the incentive is much smaller for OEMs to create comparison or allow competitors' content.

On the one hand, the OEMs justify such a data charge by enumerating costs of data hardware, transmission, infrastructure, storage, huge terabyte figures, etc. But such setup and maintenance costs are only a one-time investment, while they charge that *full* amount, and moreover *recurrently* (instead of the marginal cost of use, which is lower). Therefore, the profit margin on data access tariffs are considered large, compared to the actual cost.

On the other hand, these investment costs are included in the list price of a new vehicle and indirectly paid by the consumer, so the consumer would **pay twice** when visiting IAM (if data access cost is passed on). If not included in list price, then consumers that visit IAM garages are subsidizing the OEM clients that don't have to pay the extra charge. Even if formally (by regulation indeed) also the authorized dealerships are required to pay for access, one may speculate there shall be given compensations to the OEM dealerships via other mechanisms by the OEMs. Thus, we assume that OEM dealerships will ultimately not carry this cost, while the IAM are subject to it. According to our interviews, this assumption is not a naive speculation.

At the time of writing, there are not many rates publicly offered on the market, and most are still in a testing stage. To date, Daimler and BMW are actively open to the public, while other OEMs are likely making car data available to aftersales service providers, but there is no publicly available information on exact access conditions.

The offering is very recent and the statistics about the typical cost levels, user experiences and literature on the pricing has yet to emerge. It is quantitatively still unspecified what is exactly meant with 'data set' or 'codes', the length of time series, the sampling intervals, and the quality or timeliness has not yet been evaluated in the literature. From these few examples we shall nonetheless extract an estimate, with prudent assumptions, to arrive at least at a reasonable ballpark estimate.

Because the data cost per vehicle appears to be limited in time, technically, one must take into account the use frequency. To keep things simple, we assume only two types: on the one hand 'occasional' use for e.g. a workshop visit for repair or maintenance, and on the other hand 'intensive' use, e.g. a telematics application with vehicle tracking, which requires continuous real-time polling of the server to evaluate the status of certain data items (e.g. location).

### 6.3.2 Case 1: Daimler

Daimler offers currently a data set<sup>156</sup> of diagnostic Electronic Control Units (ECUs) and Diagnostic Trouble Codes (DTCs). A remote single retrieval costs €6. There are small discounts for larger amounts (quasi linear tariff structure): €55 for 10 accesses, and 100 retrievals at circa €544. The credit of the user is valid for 90 days and is prolonged again when a new purchase is made. Figure 57 contains a snapshot.

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<sup>156</sup> <https://xentry-shop.mercedes-benz.com/daimlerDiagnosisShop/category?0&pk=8796551807118>

	Name	Quantity
	<b>Remote Diagnostic Support Small</b> 1 Retrieval - valid for 90 days Item number: 6523235199 Additional information: Order type Specified payment method: Purchase	Price 5.99 €
	<b>Remote Diagnostic Support Medium</b> 10 Retrieval - valid for 90 days Item number: 6523235299 Additional information: Order type Specified payment method: Purchase	Price 54.99 €
	<b>Remote Diagnostic Support Large</b> 100 Retrieval - valid for 90 days Item number: 6523235399 Additional information: Order type Specified payment method: Purchase	Price 544.99 €

Figure 57: Remote diagnostics offers by Daimler, "exclusively for independent operators". Source: Daimler.

The Daimler data content is limited to specifications of ISO/DIS 20080, which is only a fraction of the diagnostic content that third parties usually require to repair and maintain vehicles efficiently and effectively.

This data set reduction is roughly only representing a third of what is usually required. So, often more data will be needed, and this tariff represents rather a *minimum* than an average: we assume three retrievals will be on average required to properly address vehicle issues at one workshop visit: 18 € (= 3 \* €6) is most common then.

Over the lifetime, the average number of visits to a workshop is circa 1.5 per year<sup>157</sup> per vehicle, and usually there is more than 3 months in between consecutive visits if a second one occurs. Therefore the tariff is more likely of the order  $1.5 * €18 \approx €27$ .

Our interpretation of "one retrieval" is conservative and it could imply that our average impacts calculated further on are underestimated with a factor 10. Presumably, many more retrievals are required, between 3 and 100, as the tariff structure seems to suggest. But given the results of the consumer survey on willingness to spend, and the fact of low profit margins of IAM, such high costs would appear to be extremely excessive and prohibitively expensive.

### 6.3.3 Case 2: BMW

BMW offers a different tariff structure, which it makes publicly<sup>158</sup> available. A single data entry costs 0.29€, and the maximum cost is €5 per vehicle, regardless of how many data points (i.e. beyond 10 data points), with a validity of 30 days. Figure 58 contains a snapshot.

<sup>157</sup> Online automotive parts sales: The RISE of a NEW CHANNEL, Roland Berger, 2016

<sup>158</sup> <https://bmwcardata.bmwgroup.com/pricing/en/BMWCarDataPriceList.pdf>

### Price overview

The following prices apply to the use of BMW CarData:

	Price
Individual data keys per retrieval <sup>1)</sup>	€0.29*
Individual event keys per retrieval <sup>1)</sup>	€0.09*

<sup>1)</sup> You only pay for the provision of the keys that you have actually requested and received.

### Maximum amount per vehicle and container

BMW CarData will only charge you for data transfers per vehicle and container up to a maximum monthly limit. This means that even very data-intensive services can be provided at fair conditions.

	Price
Maximum monthly amount per vehicle and container	€5.00*

Figure 58: BMW CarData offer. Source: BMW.

In one single movement, BMW achieves a considerable reduction of data (currently less than hundred), as compared to the OBD II port data scope today. One may value the 'hypothetical worth' of the current OBD dataset with this tariff. Given that there are about 3,500 generic, and OEM-defined 50,000 DTC codes accessible on the current OBD ports, the total OBD dataset worth by BMW standards of €cent29 per code would be in the range [€1,000; €15,000]. By the vagueness of the term "container", any value within this range is in theory at will attainable for BMW. But for typical maintenance, we assume –optimistically- that just one container will suffice.

The short validity in time is a constraint that harms the IAM relatively more than the OEM channel, since IAM workshops serve the older vehicles, which have more visits (around 2) per year: so the tariff counts statistically more often double for them. If we apply again the 1.5 average frequency of workshop visits per vehicle per year, then the tariff shall be circa €8 (=1.5 \*€5)<sup>159</sup>.

#### 6.3.4 No overhead costs

Besides the basic cost of the data, there are (overhead) costs to enable the retrieval. For example:

- It requires that every third party develops or buys an application to online interface with the API server and obtain it in human readable format.
- Also, the consent from the driver requires the logon of the driver to another website for car owners.
- Only when these authentication steps are done, retrievals are possible.
- Likely there is a support line which is likely paying as well.

<sup>159</sup> For older vehicles it will be more expensive, but we use simple averaging, due to the lack of statistics on tariff data and use cases.

- Training of staff to use the application.
- Several other aspects, like maintenance, extensions, changes over time, etc.

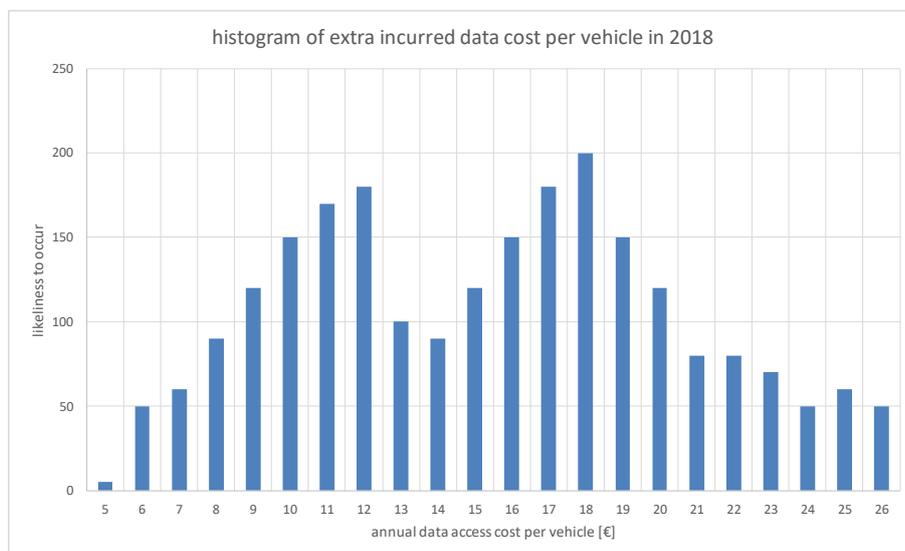
However, given that intermediary software industry will provide scalable solutions to solve the multibrand platform API/interface issues, and, since OBD port access similarly already bear costs, we shall rather refrain from adding the overhead costs, as they (partially) already exist today. Being prudent, we thus ignore such additional costs.

### 6.3.5 Data cost in case of Occasional data access

Given that we have on average 1.5 visits to a workshop per year, one may assume an annual cost in the range €8-€27, and applying a simple average we obtain as cost estimate:

*The average annual data cost for occasional data access  $\approx$  €18*

For the IAM repair industry this additional cost will be appearing on the bill of the IAM customer, or it will erode the IAM profit margin, since the IAM will pursue likely the customer retention. Figure 59 is an illustration (just an example) of a possible cost distribution that may develop in the coming years.



*Figure 59: An example (for illustrative purpose only) of extra incurred data costs per vehicle in 2018, based on just 2 OEM data tariff points.*

### 6.3.6 Data cost in case of intensive data access

When telematics applications require continuous access throughout the year, the annual cost range is rather €24-€60, when applying the standard validity terms of the above two cases (4\* €6 quarterly in the Daimler case, or 12 \* €5 monthly in the BMW case).

*The average annual data cost for an application with intensive data access ≈ €40*

This OEM cost is in strong contrast, against the present-day one-time cost of circa 5€-10€ for OBD II port diagnostics smartphone applications (like Torque or Dashcommand). Such apps bear perhaps a one-time cost of a Bluetooth tether (ranging €50-€60 like OBDLink), but it offers the full broad access to all official OBD port codes: in real-time and perpetually after purchase.

Compared to that open market benchmark, it is clear that the OEMs behave currently as price setters that wish to lock in a recurrent cash-flow. On average, smartphone telematics applications with intensive data use, can be expected to increase in price by a factor of 4 (from €10 to €40 on average) if this level in pricing sustains. Because of this relatively high nominal amount for data access compared to the actual cost of, we believe that the cost will be always passed on to the consumer.

In the years to come, the tariff distribution and hence the severity of the impact will become more accurate when more and more OEMs will implement the Extended Vehicle model or other detrimental paradigms/standards for data access that bear a negative impact for the IAM.

## 6.4 Data charge impact

The most direct (and very measurable) impact will be the data charge that the Extended Vehicle model will impose on the independent operators in the repair/maintenance sector and service industry. From the previous section we recall the following data cost estimates, as shown in Figure 60.

	Occasional data use	Intensive data use
<b>Daimler</b>	€27	€24
<b>BMW</b>	€8	€60
<b>Average cost</b>	<b>€18</b>	<b>€40</b>

*Figure 60: Estimates of the data charges for the most prevalent cases: for occasional use (eg workshop visits) and intensive use (e.g. a telematics app). Own estimations based on published Daimler and BMW tariffs.*

### 6.4.1 Impact in the case of occasional data use

Each of the two players have two options: either pass on the data access bill, or absorb it into the profit margin. In reality they will likely apply a mix, but it is difficult to predict this. However, we can approximate

the mix by first considering four distinct situations (namely the four possible combinations where IAM or OEM absorb or not), and then extrapolating these impacts to the average situation.

#### 6.4.1.1 IAM absorbs, OEM absorbs

They will both ultimately absorb this cost in their profit margin, then the market remains in equilibrium, but remains the fact that OEM has been financed.

The OEM will receive potentially from the whole car park today an amount of € 18 per vehicle. Since there are 320 million units, the OEMs receive financing of the data access at €5.76 billion annually.

An amount of €3.8 billion (=66% of €5.76 billion) will come from IAM own pockets, while 34% from OEM dealerships own pockets. Both would not transfer the extra cost for data to their customer.

However, the OEM channel has double the profit margin, and will thus relatively be in the advantage. IAM workshops will lose 50% of their profit margin ( $=€18/(12\% \text{ of } €300)$ ), while IAM only 12.5% ( $=€18/(24\% \text{ of } €600)$ ).

It becomes clear that absorbing the cost will be difficult for the IAM channel, given their already low profit margin.

#### 6.4.1.2 IAM passes on, OEM passes on

They will both pass on the cost 100% to the consumer: the workshop spending of the motorist increases in this case with 4.5%. Then strictly OEM dealers will gain relatively a 1.5% discount difference ( $=1-€318/€618$ ), and grow their market share with €2.3 billion ( $=1.5\%*0.6*€250 \text{ billion}$ ).

Also in this case the IAM channel is disadvantaged.

#### 6.4.1.3 IAM passes on, OEM absorbs

To size up the impact, one considers the basic market behavior dynamics of section 6.2.2.:

- Given that the average of €18 amounts to an increase of circa +6% of annual workshop spending bill of €300 for customers in the IAM segment, one computes that the churning rate of circa -3.6% market share (using the -0.6 coefficient) will imply circa €9 billion loss for the IAM segment. That revenue lost corresponded to 30 million vehicles (14% of clients shall churn).
- Paradoxically, the 30 million churned clients will pay double (i.e. pay the average OEM workshop price of €600), so consumers are losing the 300 € discount, which amounts to €9 billion lost.

- The remaining 183 million (=213 million-30 million) IAM customers, just remain and pay the additional €18, which amounts to €3.3 billion.

This is the most likely scenario.

#### 6.4.1.4 IAM absorbs, OEM passes on

To size up the impact, one takes into account the basic market behavior dynamics of section 6.2.2.:

- Given that the average of €18 amounts to an increase of circa +3% of annual workshop spending bill of €600 for customers in the OEM segment, one computes that the churning rate of circa -1.8% market share (using the -0.6 coefficient) will imply circa €4.5 billion loss for the OEM segment. That revenue lost corresponded to 7.5 million vehicles (7% of clients shall churn to IAM).
- The 7.5 million churned clients will pay half (i.e. pay the average IAM workshop price of €300), so consumers are gaining each €300 discount, which amounts to €2.3 billion gained by consumers.
- The remaining 100 million (=107 million- 7.5 million) OEM customers, just remain and pay the additional €18, which amounts to €1.8 billion.

It is again that absorbing the cost will be difficult for the IAM channel, given the already low profit margin. OEM garages also receive the incentive to absorb when market share comes under pressure.

#### 6.4.1.5 Overview

In reality there will be a mix of absorbing and passing of the data cost. It is difficult to say how often this cost will be passed on to the consumer: according to the survey in part 2, only 30% of consumers are willing to accept an extra data charge bill from IAM workshops. Figure 61 summarizes the impact computations of the cases above, shows the estimated likeliness of the cases and averages by weighing.

scenario	IAM	OEM	IAM [B€]	Consumer [B€]	likeliness	IAM [B€]	Consumer [B€]
1	absorb	Absorb	-3.8	0	0.2	-0.76	0
2	Pass	pass	-2.3	-5.7	0.3	-0.69	-1.71
3	Pass	absorb	-9	-12.3	0.4	-3.6	-4.92
4	absorb	pass	4.5	0.5	0.1	0.45	0.05
						-4.6	-6.58
						weighted by likeliness	

Figure 61: Impacts of data charge in 4 distinct cases which allow analysis. Combined with likeliness (by expert judgement) we obtain an expectation of the loss level for IAM and consumers.

It is believed by experts that many IAM operators will take this loss by eroding their own profit margin, just to safeguard customer retention. Even if this hurts: with a typical 10% to 15% profit margin, on a spending of €300, this means that OEM garages already claim 50% of their net income.

Even if formally also the authorized dealerships are required to pay for access, one may speculate there shall be given compensations to the customer via other mechanisms by the OEM. Thus, we assume that it is most likely that OEM dealerships will ultimately not carry this cost, while the IAM are subject to it.

Moreover, given that OEMs shall have an oligopoly if no regulation intervenes, they likely shall increase the data cost so that IAM will be obliged to pass it on to their customers, until ultimately the price difference gap with IAM would be closed. It is a typical strategy of oligopolists to gain quickly customization to a new system with inexpensive tariffs to induce a high acceptance rate, and once established dependency, control the market at will with a few peers.

We have given the 4 cases probabilities to indicate the likeliness of their realization, based on expert judgement. Weighing the cases gives then a mix that may be expected. Thus, on average, the **consumer likely would bear €6 billion loss** and **IAM business circa €4 billion loss** due to the OEM data charge.

Comparison of data charge bills in the IAM and OEM segments will provide in the future the empirical data to verify the effective realized impact against the theoretically predicted one.

Presumably these losses will take time to realize until 2030, when the total vehicle park is expected to be 100% connected under regulatory status quo, and we estimate that half of that will likely be reached by 2025 (although one predicts that 70% will be connected in 2025, we remain conservative and assume only 50%).

#### 6.4.2 Impact in the case of intensive use of data

Aside from the occasional data charge that will be applicable to every IAM user, there is the segment of customers that will purchase optional automotive aftermarket services or packs, which require intensive vehicle data use (for example, an app to find a parking spot).

From the survey<sup>160</sup>, one may conclude that about 21% of the population is willing to pay around between 6% and 20% extra of the price in the garage, for the data. Figure 62 provides more detail about the level of deemed acceptable amounts.

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<sup>160</sup> Assessment of the potential consumer response to the Extended Vehicle approach, Global report | Research Now SSI, December 2018

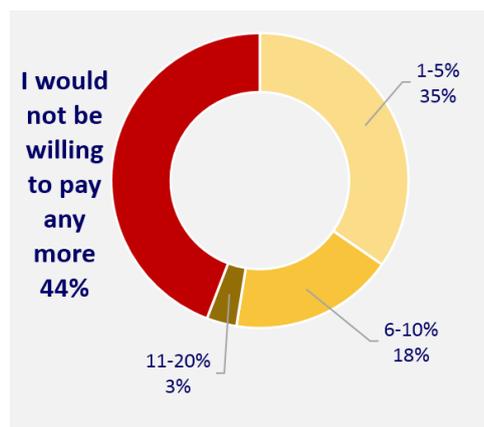


Figure 62: Consumer willingness to pay extra for data. Question: "If the cost of accessing the data in your vehicle by an independent garage led to the cost of their services increasing, how much extra would you be willing to pay?" Source: Research Now SSI.

With these indicators, we can now estimate, per segment (IAM and OEM), the population size and budget that consumers are willing to spend on data intensive applications.

#### 6.4.2.1 Budget available in IAM segment

Given the 590€ IAM expenditure from section 2.4.5, we can obtain the budget that consumers are willing to spend on a data intensive application:

- 6% of €590 yields €35
- 10% of €590 yields €59

The annual OEM data charge lies between €24 and €60, so OEMs will be able to find an audience with room to claim between €24 and €59. The 45 million (thus 45 million of 213 million IAM served vehicles) customers pay then a potential **annual gain for OEM between €1 billion and €2.7 billion** received from business generated by applications of third parties making intensive use of the vehicle data. We assume (for lack of objective data on the dynamic in the automotive applications field) that such additional cost is passed on, independent of the developer (either by IAM, either by OEM), to the consumer almost all the time.

#### 6.4.2.2 Budget available in OEM segment

Given the €1,180 OEM expenditure from section 2.4.5, we can obtain the budget that they are willing to spend on a data intensive application:

- 6% of €1,180 yields €70
- 10% of €1,180 yields €118

The annual OEM data charge lies under the lower bound of €70, so OEMs will be able to find an audience room to claim between up to €118. The 20 million (thus 20 million of 107 million OEM served vehicles) customers pay then a potential **annual gain for OEM between €1.4 billion and €2.4 billion**

### 6.4.2.3 Overview

For the total population, these amounts for data intensive applications can be considered as direct revenue for the OEM, where the data charge is unlikely to be absorbed by the IAM. We assume an (averaged) prudent estimate of circa **€3 billion for the consumer, and zero for the IAM.**

## 6.5 Leasing

### 6.5.1 Relevance

According to Frost and Sullivan<sup>161</sup>, a considerable amount of the car park in Europe are company cars and company fleets: about 46 million vehicles, representing circa 13% of the passenger and LCV in operation. Only the operational lease and the hire purchase, which include contractual service agreements are considered in scope of the aftermarket (thus e.g. purely financial leasing types are excluded).

Assuming that about 53% of leasing is of the 'operational' type or a variation thereof, and that road transport segment contains about 75% of LCVs, the lifetime business volume for the leasing market is about €134 billion for passenger vehicles and circa €30 billion LCV. Figure 63 summarizes the overview of figures<sup>162</sup> used to estimate the (relevant) market volume.

136,000,000,000€	Value leasing motorcars
58,000,000,000€	Value leasing road transport
62,000,000,000€	Value hire purchase motorcars
10,000,000,000€	Value hire purchase road transport
53%	operational lease share
75%	Share LCV of road transport total
134,080,000,000€	Value Passenger cars in aftermarket
30,555,000,000	Value LCV in aftermarket

Figure 63: Overview of European leasing figures in the PV+LCV vehicle scope. Source: Leaseurope.

Assuming that lifetime business volume covers on average about 4 years of service, the total *annual* value generated is circa **€41 billion**, with about 8 million vehicles (6.5 million passenger vehicles and 1.5 million LCV). The European leasing market contributes therefore circa 16% to the €250 billion aftermarket, with on average an annual spending of circa €5,200 per vehicle (a typical payoff scheme of €433/month).

<sup>161</sup> "Leasing is a predominant financing method used by company car fleets in the European market (EU 26), which has an estimated market size of 13.3 million units for the year ending 2017. This accounts for 28.5% of the total fleet's vehicle in operation. Of various leasing products, operational leasing or full-service leasing is the most popular option, as it provides utmost flexibility in vehicle usage. Operational leasing accounts for 18.5% of the total fleet vehicle parc, while financial leasing takes 9.9%. Highly developed markets (EU Big 5) comprise 66.6% of the total leasing market in EU 26 countries." <https://ww2.frost.com/frost-perspectives/transformation-mobility-service-ecosystem-embrace-or-exit/>

<sup>162</sup> Leaseurope, Annual Survey, 2017; <http://www.leaseurope.org/uploads/documents/stats/European%20Leasing%20Market%202017.pdf>

Leasing business<sup>163</sup> is growing fast with CAGR of about 8%: today one leases at a proportion of 40% of new vehicles, one may expect that about half of the new vehicles will be operational lease in the near future.

The leasing market players are divided over three types: OEM captives 30%, Banks 40%, and Fleet Management Companies (FMC) 30%, according to a Berger study<sup>164</sup>. Banks and FMCs together are considered as IAM segment. Figure 64 gives a general illustration of the market player types.

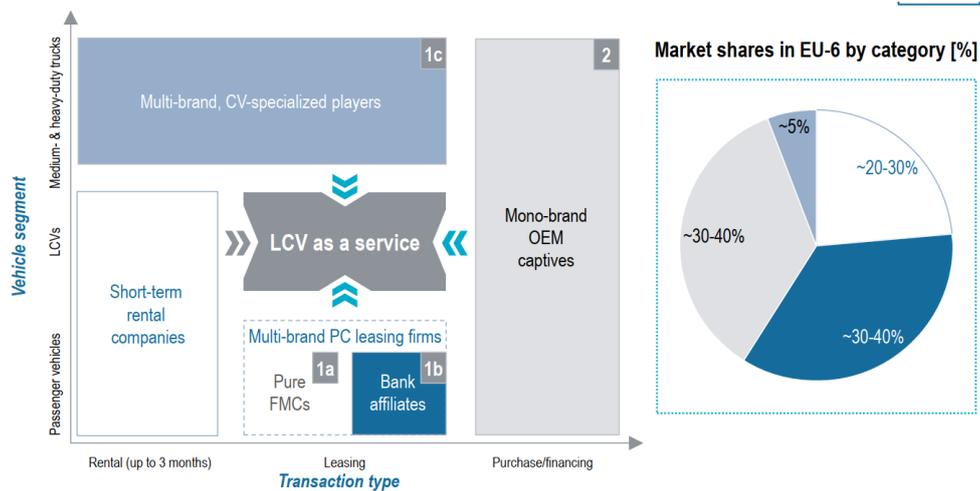


Figure 64: Market shares and types of leasing players. Source: Roland Berger.

### 6.5.2 Fleet Cost saving aspects

Fleet management requires close follow-up on all vehicles. This subsegment has therefore already -for decades- the most experience with telematics. They are one of the key aftermarket benefactors of telematics innovations.

One of the reasons is that enormous savings can be realized with data access to the fleet vehicles. Several studies showcase the benefits. By sheer measurement and comparing with benchmarks, fleet managers can identify cost sinks and setup programs to remedy on the level of driving behavior to save fuel, avoiding accidents, limiting speeding, stricter maintenance follow-up, remote diagnostics, prognostics, route optimization, reduction of blameworthy collision claims, combat vehicle crime, optimize fleet size, composition and allocation, reduce idling, etc.

For example the US Marine corps NREL<sup>165</sup> study concludes that for the government fleet of light- and medium-duty vehicles the savings amounted up to €2,000/year. Figure 65 provides a breakdown of their components.

<sup>163</sup> Leaseurope, Annual Survey, 2017; <http://www.leaseurope.org/uploads/documents/stats/European%20Leasing%20Market%202017.pdf>

<sup>164</sup> Embracing the Car-as-a-Service model – The European leasing and fleet management market, Market Report, 2018.

<sup>165</sup> Telematics Framework for Federal Agencies: Lessons from the Marine Corps Fleet, Cabell Hodge and Mark Singer, National Renewable Energy Laboratory, 2017; <https://www.nrel.gov/docs/fy18osti/70223.pdf>

**Table 12. Potential Per-Vehicle Cost Savings from Telematics**

Measure	Annual Cost Savings
Safety	\$553
Idling	\$143
Aggressive driving	\$112
Reduced VMT	\$123
Maintenance	\$99
Reporting	\$312
Inventory optimization	\$695
<b>Total</b>	<b>\$2,037</b>

Figure 65: Breakdown of the annual cost savings with telematics for US mixed fleets, totaling about 8000 vehicles. Source: NREL.

The findings from such independent studies are found to be aligned with figures from telematics software companies that promote the use of vehicle data for realizing savings, and report anonymized over their client database of millions of vehicle averages to demonstrate the savings obtained. In Figure 66 the known Geotab company reports<sup>166</sup> the savings for light-duty vehicles of about €170/month, close to circa €2,000/year, which scales up with the size of the vehicle.

Estimated Potential Monthly Telematics Savings Per Vehicle (USD):

Potential Monthly Telematics Savings	HD Vehicle Annual Mileage (80,000 miles)	MD Vehicle Annual Mileage (24,000 miles)	LD Vehicle Annual Mileage (24,000 miles)
Safety	\$410	\$78	\$70
Fuel	\$410	\$54	\$33
Maintenance	\$290	\$24	\$20
Productivity	\$360	\$48	\$48
<b>Total Potential Monthly Savings Per Vehicle</b>	<b>\$1,470</b>	<b>\$204</b>	<b>\$171</b>

Figure 66: Statistics on the monthly savings per vehicle type. Source: Geotab.

These figures only take into account today's effective benefits. But when telematics adoption rates become high (say 40% to 80% of total car park), then peer-to-peer (or M2M) vehicle communication could improve road congestion and accident prevention, with even larger benefits for the fleets.

<sup>166</sup> <https://www.geotab.com/blog/show-money-fleet-management-roi-vs-coi/>

### 6.5.3 Effective Impact

Fleet managers in the corporate or SME subsegment of course can impose strict rules on their employees and apply high productivity countermeasures to realize the gains. However, in the case of individual leases or company cars, the company (lessee) nor the fleet management company (lessor) will be able to exert as much control over all the fleet parameters. For passenger vehicles approximately 15% is eligible for such large savings, and in LCVs about 50% is eligible, based on figures from the Berger study<sup>167</sup>. Figure 67 illustrates the proportions of the customer type.

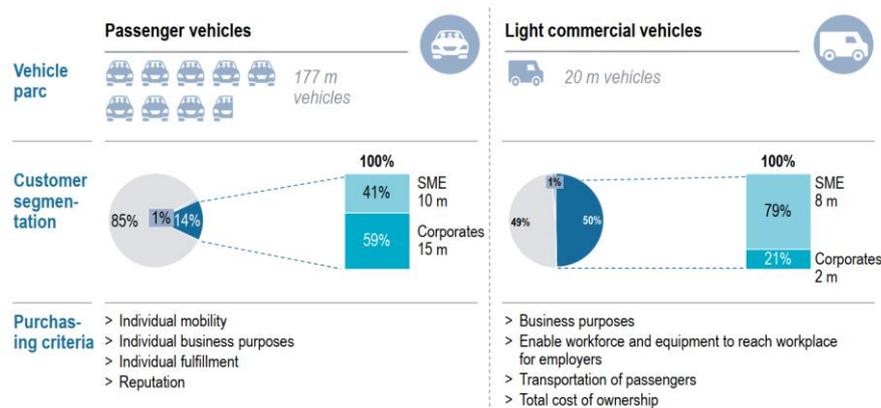


Figure 67: Customer segmentation for PV and LCV in terms of controlling savings. Source: Roland Berger.

For that subsegment of vehicles in 'non-commercial' (or individual) use, we retain only the two 'control' items of fuel and maintenance savings through driver feedback communication. We estimate conservatively that this can realize annually circa €500 in savings.

Applying the above cost savings potential to the current fleet park, it means that annually roughly €6.5 billion can be saved in this industry if in-vehicle data access was "a common good" in the aftermarket.

But, if for example OEMs would someday close the OBD port or restrict its use exclusively for standing vehicles or lock out third parties from highly granular and real-time data, then the fleet managers are obliged to use the best alternative dongle solution. We identify two factors to account for this OBD closure scenario.

- Firstly, there is the expense: a high quality telematics solution with a lot of parameters and features, including placement, maintenance, analytics and updates costs about €150/year. This cost is an additional disadvantage for the IAM players, since the OEMs already have this solution built-in and financed through the list price by their buyers. As can be expected, OEM telematics are reportedly more expensive than the IAM solutions (although OEM telematics can then read OEM proprietary codes), so this fixed cost itself cannot be ignored.

<sup>167</sup> Embracing the Car-as-a-Service model – The European leasing and fleet management market, Market Report, 2018.

- Secondly, the data of such external dongles would provide only a subset of the OEM's in-vehicle data that is available (assuming the dataflow has been limited to EURO 5 and 6 mandated data only) and moreover the accuracy is lower (for example cross correction control variables like wheel turns are not readable). In order to quantify the all-round loss of completeness and loss in accuracy, we have not found to date a study that reports on that aspect, and we make an educational guess: namely that 80% of the effects can be approximated, as 20% of the data only matters (according to the Pareto principle from statistics that governs so many domains). Thus we assume that about 20% of effects cannot be realized due to the inferior data quality of the dongle as a substitute for in-vehicle data. We assume: due to limitations the dongle performs only 80% as good as any telematics solution with full access to the in-vehicle data.

Applying the fixed cost and only realizing 80% of the potential for the IAM segment equals approximately a loss of potential savings today for the IAM fleets of almost **€2 billion annually** (in a static approach with 100% of the fleet optimizing). Since usually the IAM market shares discounts with the customer, one could say that IAM segment loses €1 billion and the consumer also loses 1B€ annually due to the lack of a level playing field for in-vehicle data access.

To put this into a time perspective of growing connected vehicles, where the full vehicle park is only expected to be connected fully by 2030, we expect approximately 50% of that loss to realize by 2025 if regulatory status quo is going to be maintained. Remark that is an annual financial loss, and that we even did not account for the environmental and societal losses involved. We only provide first-order estimates.

#### 6.5.4 Driving factors

The obtained potential impact is likely to grow strongly in the coming years, as the commercial segment is growing at high rates because of shift in the automotive leasing market from personal lines to commercial lines (from a 80/20 personal vs. commercial in 2015 to 50/50 by 2030, and 30/70 by 2040) according to Morgan Stanley research<sup>168</sup>.

Another bump up is coming from the car sharing segment (MaaS, mobility as a service, mobility on demand or hail-riding), which is typically run by fleet managers with vehicles under heavy duty (with on average a 1 year write-off period). Such car sharing fleets are expected<sup>169</sup> to grow in Europe (including Russia/Turkey) from circa 2.1 million users in 2016 to 14 million users in 2021. Yet, as about 1 car is necessary for about 70 users, it adds to the current 31,000 only 200,000 vehicles in 2021, which is circa 2% of the leasing fleet, and therefore in this study ignored regarding impact. Note that the lack of regulatory intervention to create open data access stands orthogonal to the EU funding program (Horizon 2020<sup>170</sup>) "*to remove the barriers and enable a cooperative and interconnected EU single transport market for the mobility as a service (Maas)*".

If we take into account market dynamics, then there is again a churning of customers to be expected from the IAM to the OEM segment. The leasing market is highly competitive: pricing between IAM and OEM is

<sup>168</sup> Motor Insurance 2.0, Morgan Stanley, Boston Consulting Group, 2016;

<https://www.the-digital-insurer.com/wp-content/uploads/2016/10/844-MS-BCG-Motor-2.0-blue-paper-exec-summary-1.pdf>

<sup>169</sup> What's Ahead for Car Sharing? The New Mobility and Its Impact on Vehicle Sales, BCG, 2016;

[https://circabc.europa.eu/sd/a/d06aca03-fcdc-4e08-b753-316f1f7db80e/%20www.bcg%20perspectives.com\\_content\\_articles\\_automotive-wha.pdf](https://circabc.europa.eu/sd/a/d06aca03-fcdc-4e08-b753-316f1f7db80e/%20www.bcg%20perspectives.com_content_articles_automotive-wha.pdf)

<sup>170</sup> <https://ec.europa.eu/inea/en/horizon-2020/projects/h2020-transport/intelligent-transport-systems/maas4eu>

very similar, so price sensitivity is very high (an 'elastic' market): only a little bit of price delta will induce a large transfer of customers. If only OEM fleets will realize the full 100% savings and bear no cost for dongles, they are able to offer a better fleet price as well. Unfortunately, by lack of elasticity data in the public leasing literature, an improved estimate of the above estimated data impact cannot be provided here.

Apart from the loss in savings, also other efficiency issues are overcome if there was a regulatory incentive to create an open and uniform data platform between makes. Just to name a few:

- Many fleets have mixed makes (multibrand) in the IAM segment and require e.g. *interoperability* regarding telematics analytics between makes, which requires today expensive reverse engineering/bridging and maintenance costs.
- The IAM market requires often tailored solutions, which OEMs cannot or do not want to offer. Moreover, IAM fleet managers must *optimize efficiencies across makes* or OEM parts to remain competitive while OEMs are reluctant to offer that insight.
- And finally OEMs offer solutions that are highly integrated with their own in-vehicle systems, which makes them *more vulnerable to cyberattacks* (compared to a standardized peer-reviewed open platform standard solution).

## 6.6 Insurance

### 6.6.1 Relevance

The insurance market is an entire industry on its own, but it has an overlap with the aftermarket on the segment of motor vehicle insurance. For both the obligatory third party liability cover and additional damages cover, consumers pay annual premiums, which cover the claims in vehicle collisions or due to external forces.

The motor insurance market is approximately divided<sup>171 172</sup> over three types:

- OEM (captives for a single brand name) 30%,
- IAM financials (e.g. banks, insurers) 40%, and
- IAM specialized firms (e.g. mobility players, telematics manufacturers and telcos) 30%.

The fact that IAM has the major 70% market share is also aligned with the strong preference of the consumer: in the survey<sup>173</sup> about 70% indicates to prefer a dedicated insurance party (see Figure 68).

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<sup>171</sup> Innovating for future growth, automotive assurance products' strategy, PWC, 2013;  
<https://www.pwc.com/gx/en/automotive/industry-publications-and-thought-leadership/assets/pwc-revamping-auto-assurance-product-strategy-for-future-growth.pdf>

<sup>172</sup> Automotive Finance Study 2016, The European Market And Its Future Challenges, Nextcontinent;  
<http://www.nextcontinent.net/publications/automotive-finance-study-2016/download>

<sup>173</sup> Assessment of the potential consumer response to the Extended Vehicle approach, Global report I Research Now SSI, December 2018

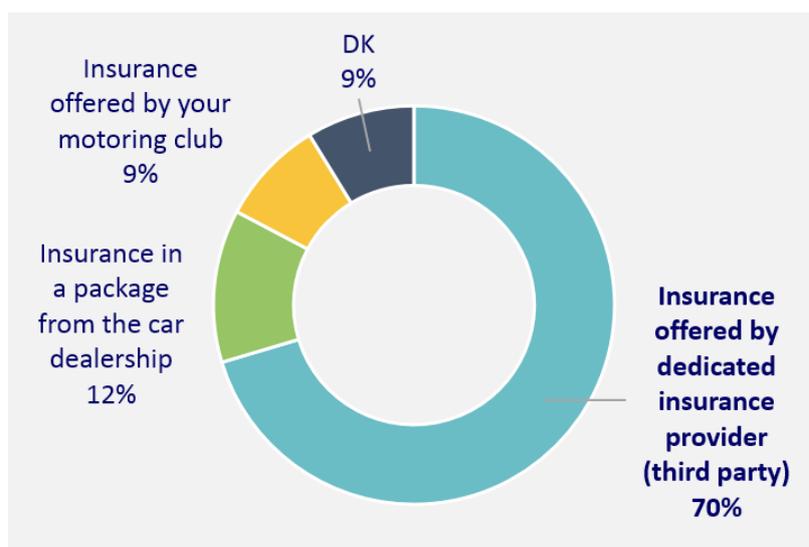


Figure 68: Consumer provider preferences for vehicle insurance. Question: "What type of motor insurance do you prefer?" Many prefer third parties. Source: Research Now SSI.

Regarding the contribution to the aftermarket in revenue terms, we look into the European total of motor premium<sup>174</sup>, which amounts in 2017 to €138 billion market volume, according to Insurance Europe.

We shall not count the costs and taxes of the insurance industry (to avoid double counting- it is another industry), but only consider the naked Technical Provisions for motor claims<sup>175</sup>, which amounts to €102 billion. To narrow it further down, consider only the part for passenger cars and LCVs in the aftermarket scope (about 85% of the car park), which yields €82 billion.

Furthermore, we exclude about 15% of those claims due to 'total loss' vehicle direct reimbursements (since it are euros not necessarily spent in the aftermarket), which yields finally an estimated volume of €70 billion contribution to the aftermarket automotive value chain by claims handling after accident (including labour –about 25% of the claim amount- for repair and replacement of parts). That is roughly €218 per vehicle on average annually.

Although consumers ultimately pay the claims via the premium and franchising costs, insurance companies are the intermediaries who can have impact on the repair decisions. This calculation demonstrates that all in all, the insurance scheme drives almost one third of the total aftermarket volume.

<sup>174</sup> European Insurance — Key Facts, 2018, Insurance Europe;

<https://www.insuranceeurope.eu/sites/default/files/attachments/European%20insurance%20-%20Key%20facts%20-%20October%202018.pdf>

<sup>175</sup> Notice that we do not include the roadside assistance claims (eg towing, roadside tyre repairs), although this is actually aftermarket revenue. In general, assistance insurances are very thinly reported about, those for motor roadside are estimated circa 5 B€ gross written premium (Finaccord prospectus Europe 2017). Breakdowns excluding hotel stays, rental vehicle replacement, and other compensation schemes are seldom in the public domain. And moreover the size of the contribution is rather of the order of the standard deviation on our figures.

## 6.6.2 Usage based insurance

Insurance based on telematics data is on the rise<sup>176</sup> and covers about 5% of total policies in the West (US and EU) today, with strong CAGR of about 37%. Figure 69 illustrates the increase of the market share with slight exponential growth, accelerated likely due to introduction of connected cars (as compared to tethered solutions which are expected to flatten since the connected car data is superior).

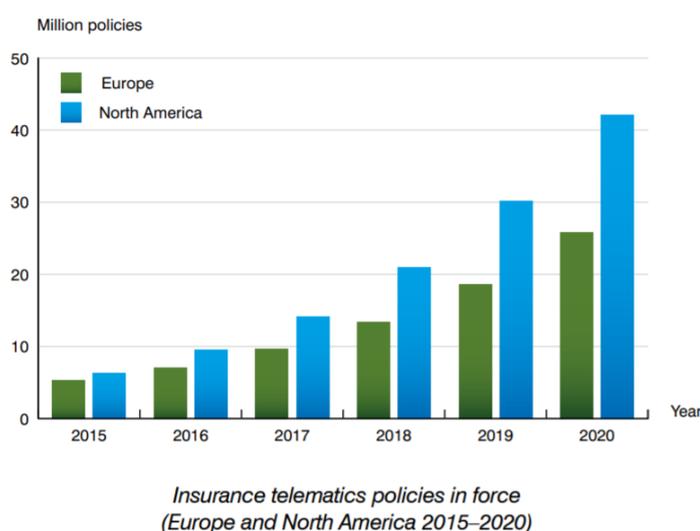


Figure 69: Insurance telematics policies in force in Europe and North America, 2015-20. Source: Berg.

Usage based insurance (UBI) allows to estimate<sup>177</sup> the risk individually on behavior (speeding, accelerating) instead of over pools of static customer characteristics (e.g. age, location). For insurers, a more accurate customer risk profile allows to correct risk misclassifications, attract more favorable risks, fight fraud, enhance customer retention, reduce claims...and ultimately result in superior pricing.

As OEMs claim ownership of the data, and have the most granular and real time data, they will also be able to estimate the risk profile more accurately than any competitor. Aside from better risk, the second component is the channel benefit in the pricing. And of course, there is the data cost handicap for IAM. The other cost components are considered equal.

- Firstly, there is for competitors the cost of the dongle (or the cost of the OEM data access) that forms a handicap in pricing. On the other hand, OEM garages will use OEM parts and labor rates, which are more expensive, and likely they will keep that business intact. We assume cost of data and OEM parts/labor will offset each other, so there is no discount for the customer due to different costs structure.

<sup>176</sup> Insurance Telematics in Europe and North America, M2M Research Series, Berg Insight, 2016; <http://www.berginsight.com/ReportPDF/ProductSheet/bi-insurancetelematics2-ps.pdf>

<sup>177</sup> Unraveling the predictive power of telematics data in car insurance pricing, Verbelen R, Antonio K, Claeskens G, Kuleuven, 2017; [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2872112](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2872112)

- Secondly, the on average 15% commission/acquisition cost can be relatively lowered to circa 12%. The dealership commissions are lower than the agents of the commercial insurers. We assume the OEM segment can keep about 50% and shared thus with the consumer a discount of 1.5% of the OEM insurance premium.
- Thirdly, we assume OEM services can be better priced in only 20% of cases due to 80% efficiency of dongles, as pointed out in previous section on leasing. A typical commercial discount minimum of around 5% in 20% of cases is provided because the risk profile is superior (resulting in lower claims), which yields a global discount of 1.5% on the OEM insurance premium.

On average, a price difference of 3% is a conservative estimate of the capabilities of OEM captives to beat the claims component compared to the IAM peers. Combining this premium delta with a general sensitivity coefficient<sup>178</sup> of 4 in the motor insurance field (this is a UK based extrapolation<sup>179</sup> to the whole EU), a 3% discount will sort a churning effect of circa 12% of customers from IAM to OEM captives.

If we apply this, in an immediate fashion, on today's IAM market volume (70% of €70 billion), it yields a **potential loss of almost €6 billion annually for IAM**. Experts believe that not yet all of the OEMs have an appetite for overtaking the whole operational insurance chain (underwriting, claims handling, regulation, etc.) and might use their pricing insight to negotiate individually determined, but large, commissions instead and require OEM parts coverage in the subcontract with third parties. So it is possible that a considerable fraction of that IAM loss would be transferred to the consumer after all.

Yet, for the customer, there is a lower premium, so he seems to gain at first sight, but if we count the part of available profits not shared due to the oligopoly position (like the commission, or the profit in unrealized claims) that discount is offset. Gains up to 33% of premium<sup>180</sup> could be shared with the consumer, but we assumed in our conservative calculation only 4% shared due to the opportunity to maximize the profit margin that the data sovereignty provides (33% of 30% of 85% of €138 bn premium is circa €10 bn potential lost for the consumer). We choose however not to count with virtual amounts, and ignore such impacts, as we intend making conservative estimates.

Then remains still the unnecessary use of more expensive OEM parts, which represents a **potential consumer loss of almost €3 bn annually** for about 29 million vehicles (counted at €100 more- 50% of the 200€ claim budget per vehicle).

We point out that this global potential €9 billion impact is still small today (only at say 5% level thereof), but that the unregulated situation of injection of asymmetry of information in the market is ongoing. As telematics penetration reaches half of the car park in 2025, impact shall become much more sensible and

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<sup>178</sup> Car Insurance Renewal Price Rises Double, Consumer Intelligence, 2016;

<https://www.consumerintelligence.com/articles/car-insurance-renewal-price-rises-double>

<sup>179</sup> "Average price rises for drivers renewing their car insurance have doubled in the past year as shopping around hits a three-year high, exclusive independent data from insurance market research experts Consumer Intelligence shows. Its independent data — used by the Government's Office of National Statistics to calculate official inflation statistics — shows average renewal quotes have increased £22 on average compared to an £11 increase last year. The price rises — driven by Insurance Premium Tax rises and wider market movements — have boosted shopping around to a three-year high with up to 11 million drivers expected to move insurer this year. Consumer Intelligence's data shows around 40% of motorists will switch and it advises all motorists to shop around at renewal to try to secure a more competitive deal."

<sup>180</sup> The chaotic middle, The autonomous vehicle and disruption in automobile insurance, white paper, KPMG, June 2017 ;

<https://assets.kpmg/content/dam/kpmg/us/pdf/2017/06/chaotic-middle-autonomous-vehicle-paper.pdf>

acute (around 4.5 B€ annually). And if regulation remains status quo that potential loss will be fully realized by 2030 when all vehicles will be connected.

The autonomous car is touted to be highly disruptive for the insurance industry. Studies<sup>181</sup> predict several evolutions: for example a decline of 90% of accidents by 2050, which will shrink the insurance industry market volume to 40%; There will be a shift of liability from driver to OEM; and in-vehicle data and connection will become the new fuel of the car-as-a service. However, because autonomous vehicles (i.e. with level 5 capacity) are assumed not significantly present on the short/medium term until 2030, they are not considered any further, although their economic impact on the aftermarket is presumably very significant as well.

## 6.7 Monitoring

In the Extended Vehicle model, as described in section 4.1.3, data servers are explicitly under control of OEMs. As a consequence, the activity of the competition can be highly analyzed in detail. Because this data is not in the public domain, nor it is shared amongst the participants in the server setup, one may perceive that the line is crossed from competitive intelligence towards industrial espionage.

Competitive intelligence is the result of a company's efforts to gather and analyze information about its industry, business environment, competitors, and competitive products and services. The information-gathering and analysis process can help a company develop its strategy or identify competitive gaps. As such, the company is making those data part of its control processes.

PWC<sup>182</sup> observes that such monitoring firms increase Gross margins:

*"42 percent have increased their margins over the past year, while 25 percent decreased them--for a net of 17 percent increasing. For all other businesses, 34 percent increased their margins; 26 percent decreased them--for a net of only eight percent increasing."*

Thus relatively 9% extra profit becomes for OEMs available to make better investments (e.g. Mergers and Acquisitions, strategic decisions).

We approximate the monetary benefit by assuming that OEMs could -hypothetically- offer this full potential 9% discount to consumers.

According to the IAM market share sensitivity relation (applying the coefficient of 0.6) this reduction of the pricing gap will cause a churning of 5.4% market share from IAM to OEM. **The impact for the IAM segment is a potential loss of circa €13 billion**, for about 22 million customers (=€13 billion IAM revenue where each vehicle yielded €590). These 22 million consumers can profit from the OEM discount, but will still end up paying 41% (=50%-9%) more, **about €10 billion annually for consumers**.

One may quite safely consider this loss as a minimum loss estimate (lower limit). Real-world impact is likely a factor 2 to 3 larger (€39 billion for IAM, €30 billion for consumers), given that this OEM monitoring data is believed to breach competition law. It likely offers larger leverage and exploit of the competitors

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<sup>181</sup> The chaotic middle, The autonomous vehicle and disruption in automobile insurance, white paper, KPMG, June 2017; <https://assets.kpmg/content/dam/kpmg/us/pdf/2017/06/chaotic-middle-autonomous-vehicle-paper.pdf>

<sup>182</sup> <http://www.barometersurveys.com/vwAllNewsByDocID/03295DF410AE990A85256BA6000013AC/index.html>

than the estimated advantage already can yield by means of normal market practices (i.e. competitive intelligence efforts).

## 6.8 Overview

In this part, we assessed the potential impact of the Extended Vehicle model on the IAM. In such a model, the data is controlled by the OEM and only partially open against a cost, furthermore write access to on-board functions and communication with the driver through the HMI is denied.

We looked at the possible impacts if the status quo remains and no regulatory framework shall be applied. The impacts are estimated on a first order basis with the use of basic inputs to demonstrate the order of magnitude of potential effects for the IAM segment and consumers in Europe.

We identified five more or less disjoint domains of impact, without being exhaustive:

- A net cash-flow from IAM to the OEM to use the in-vehicle data (section 6.4)
- The use of diagnostics and prognostics (section 6.1)
- The savings potential of operational leasing fleets (section 6.5)
- The insurance pricing effects of the connected vehicle (section 6.6)
- The competitive advantages due to one-sided monitoring of IAM data traffic (section 6.7).

The breakdown of the averaged losses over different identified impacted areas are as follows:

LOSS [in bn €]	2025 (Car park 50% connected)		2030 (Car park 100% connected)	
	IAM	Consumer	IAM	Consumer
Data charge	2	4.5	4	9
Prognostics	4	4	9	9
Leasing	0.5	0.5	1	1
Insurance	3	1	6	3
Monitoring IAM	6	5	13	10
<b>Total</b>	<b>15.5</b>	<b>15</b>	<b>33</b>	<b>32</b>

Figure 70: Estimated potential impacts for IAM and consumers when status quo remains and OEM shall implement the ExVe.

Overall results indicate that on a first-order basis one may expect significant effects:

- In 2025, the loss in annual market volume of the IAM segment amounts to circa €15 bn (=12% of their current annual market volume), increasing to €33 bn by 2030 when all vehicles will be connected.
- In 2025, the loss in terms of annual spending for the IAM affiliated vehicles in operation of consumers amounts to €15 billion (= €70 additional annual spending per vehicle; or an average increase of 9% compared to today), increasing to €32 billion by 2030 when all vehicles will be connected.

Figure 71 visualizes the projected market shares over time, to depict the loss of market share for the IAM.

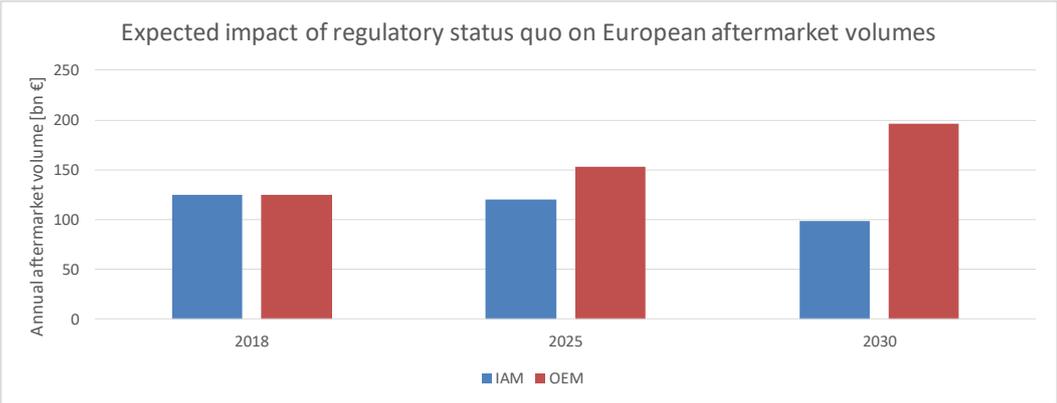


Figure 71: the various impacts of the exVe model together are expected to have a substantial churning of market share from IAM towards OEM over the next decade when no regulatory measures are taken. Source: own calculations.

## 7 Annex I

In this section, additional information is provided on recent political developments and the view of AFCAR stakeholders.

### 7.1 Increased activism for fair access to data

We expect activism for fair and open access to data to continue to rise. Already in 2006, the Software Freedom Conservancy (SFC), a not-for-profit organization was established in New York, US, with the objective to support free/open software projects which started to rise based on the success of the open Linux operating system. SFC made the headlines in May 2018 when it finally made Tesla start to open its code.

Another international movement is the open data initiative which also started in the US but has in the meantime arrived in the EU with the Dutch Transit Authority being an example with their open data portal. Data which for many decades were not accessible to the public, i.e. end consumers but also business wanting to develop value adding services, will sooner or later be made publicly available such as [opendata.rdw.nl](https://opendata.rdw.nl) in The Netherlands where the Dutch RDW (Rijksdienst Wegverkeer), the governmental organisation for mobility regulation, openly shares raw vehicle registration and other mobility related data.

Open Data is even considered central to evolving Mobility as a Service ecosystems for the future of city transportation like for example in London. The basic Open Data concept is that city performance data is openly released for consumption by the public and private bodies. Data available from Transport for London includes air quality, tube statistics, bus, coach and road data available via open APIs. It is considered a great success with significant economic benefits and has inspired similar initiatives in other cities worldwide.

Also in the EU, privacy group [noyb.eu](https://www.noyb.eu) (Not your business) has filed complaints against Google, Facebook, WhatsApp and Instagram over “forced consent” only one day after the GDPR came into force in May 2018, which adds to the increasing resistance against overmighty control of tech giants that can generally be observed, see the call of European tech companies call on EU to toughen regulations setting a precedence that applies also to car data platforms/OEMs.

### 7.2 EU wide smart cities initiatives

In order to meet the climate objectives set at EU level, most urban areas and municipalities have started to implement digital transformation programs and smart cities initiatives. There is a number of projects and research studies to prove the benefits of secured third party access to vehicle data. The expected benefits are for example monitoring road conditions and traffic flows, notifying dangerous road conditions in near real-time, locating charging stations for electric vehicles or allowing for improved capacity utilization in the electric grid.

Given the role that vehicles already play today and will in the future, also considering changing technologies and functionalities of vehicles, secure, open and fair access to in-vehicle data is expected to play an increasing role in this context and the according framework should be defined with smart city visions in mind.

### 7.3 US perspective

While Europe tends to be considered by automotive IT insiders more advanced when it comes to using data to improve fleet management of electric vehicles, the US are considered a bit further with regards to understanding how to activate some of the data from multiple business systems and bring them together. Therefore, it is worth looking at some aspects as raised in the US in connection with the rise of connected vehicles, like these policy principles<sup>183</sup>

- Support vehicle-to-everything (V2X) infrastructure
- Promote national cooperation and interoperability for V2X
- Incentivize companies to protect consumers
- Ensure regulations are technology neutral
- Rely on transparent industry-led standards for data protection
- Restrict scope creep for regulators overseeing connected vehicle privacy
- Allow vehicle owners to access and use their own data
- Permit after-market modifications and repairs while protecting copyright holders' rights

A thorough analysis of the developments in the US with regards to the topic of in-vehicle data access has not been in the scope of this study but is highly recommended in order to align legislation in this global data economy.

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<sup>183</sup> A Policymaker's Guide to Connected Cars, Alan McQuinn, Daniel Castro, Information Technology and Innovation Foundation, January 2018

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