



The Connected Vehicle in Catalonia

May 2019

Technology Snapshot

The Connected Vehicle in Catalonia: Technology Snapshot

ACCIÓ
Government of Catalonia



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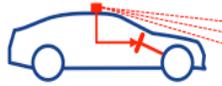
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1. Definition of Connected Vehicle and its importance to industry



The vehicle of the future: main trends of change in the automotive sector

The mobility and the automotive industries are evolving following four main trends that will define how the vehicle of the future will be:



The vehicle is undertaking tasks of driving and the driver is becoming an observer and, at higher levels of automation, a passenger.

Automated



Fossil fuel-based propulsion is being replaced by electrical components.

Electric



The vehicle exchanges data with the infrastructure and other vehicles.

Connected



Mobility and car sharing services offer new solutions, changing vehicle ownership patterns.

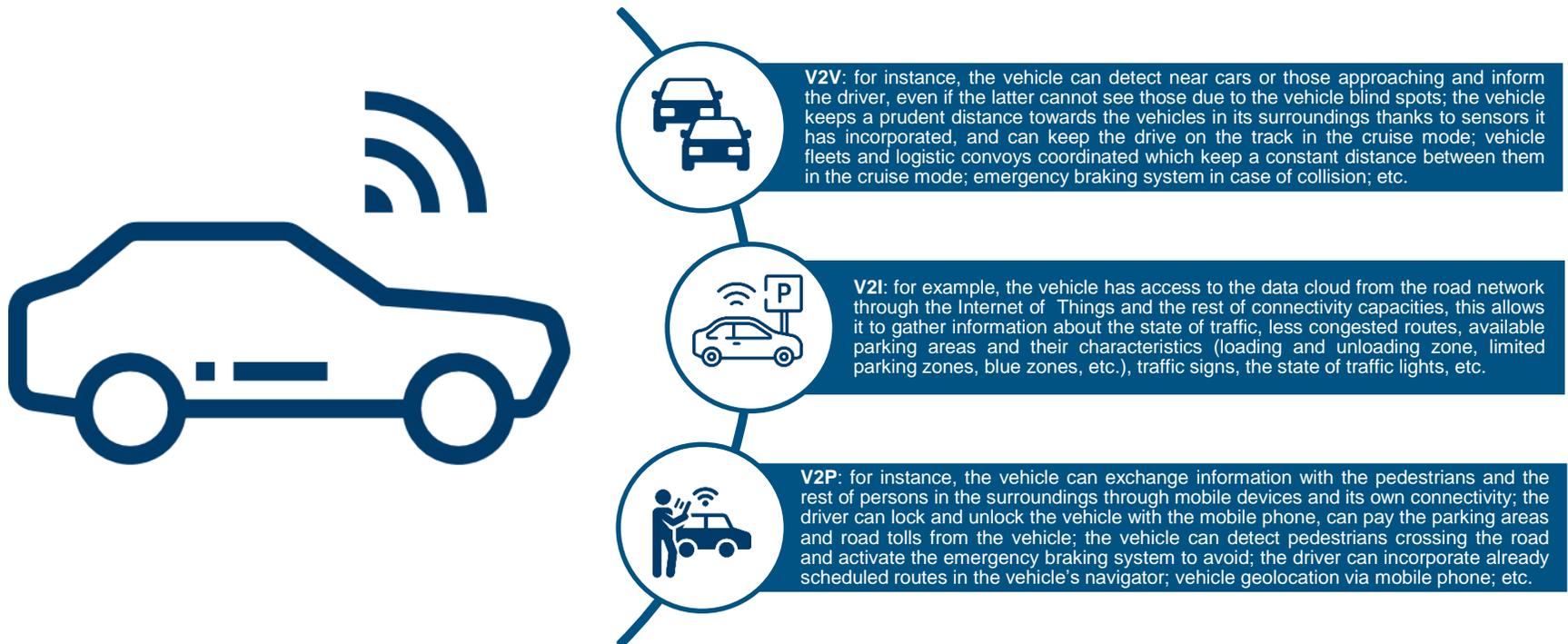
Mobility as a Service

This report focuses on the **connected** vehicle.

Source: Dr. Sven Beiker, Silicon Valley Mobility, LLC.

Interaction with the environment

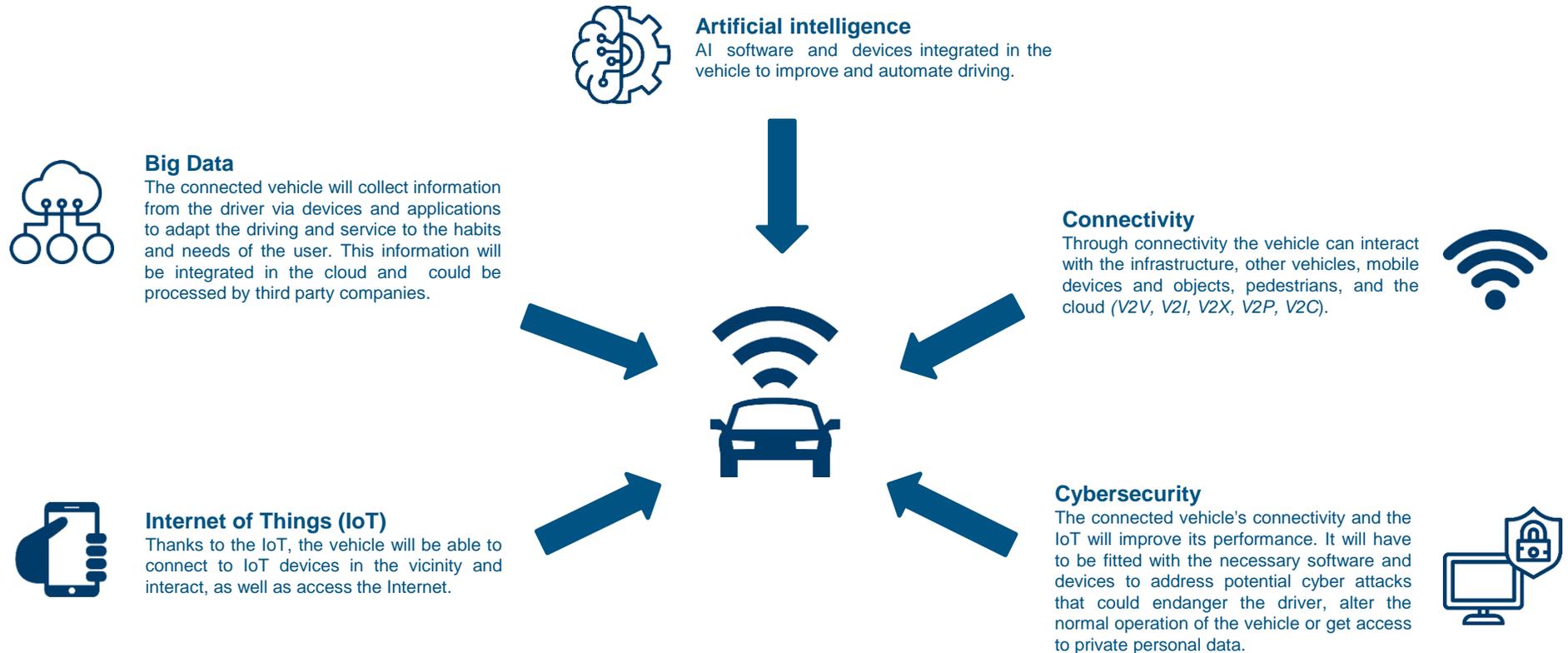
The connectivity of the vehicle will allow it to interact in three different ways: with other vehicles in its surroundings (*vehicle to vehicle; V2V*), with the infrastructure (*vehicle to infrastructure; V2I*), and with persons (*vehicle to persons; V2P*).



Source: EIC (DGI-ACCIÓ) based on Everis and *The Internet of Things and Connected cars*, Hewlett Packard Enterprise.

The Connected Vehicle is an hybridization of technologies:

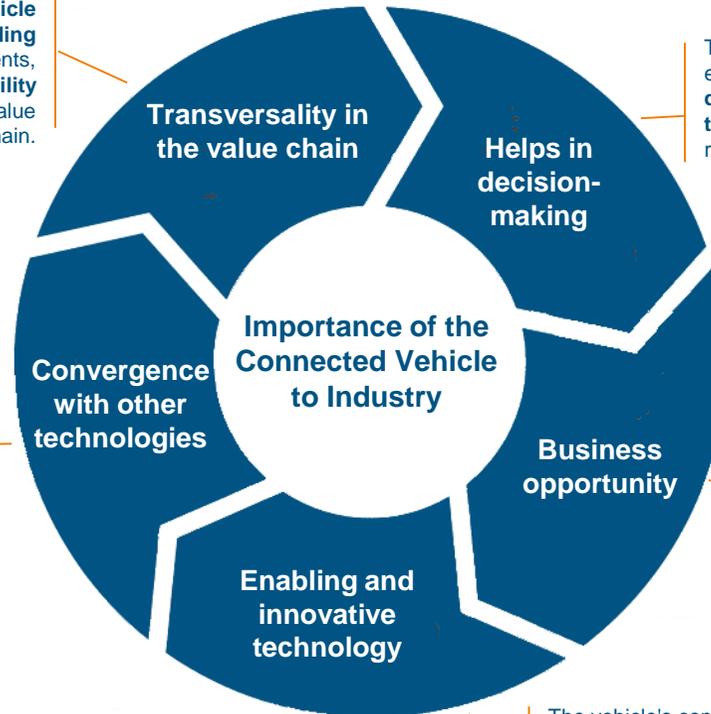
The connected vehicle includes mainly the following technologies:



Source: EIC (DGI-ACCIÓ) based on media, technology forums and the ACCIÓ technological trend dashboard.

Importance to industry

It is **cross-cutting market** segment which directly and indirectly involves **vehicle manufacturers**, companies **providing technology**, **mobile devices**, components, **applications** for the vehicle, **mobility enterprises**, etc. This leads to high added value in the value chain.



The vehicle's **connectivity** with the environment allows **access to real-time data** on the variables of the environment, **thus facilitating decision-making** based on real knowledge.

The connected vehicle will incorporate a **hybridization of cutting-edge technologies** such as **artificial intelligence**, the **Internet of Things**, **Big Data**, **connectivity** and cybersecurity, as reflected in the ACCIÓ technological trend dashboard.

The connected vehicle has a prospective sales growth of **200% in 5 years**. In an **environment** that is increasingly interconnected through **mobile devices** and the **IoT**, it will **create jobs** and business opportunities for start-ups, telecommunications companies, in addition to vehicle manufacturers.

The vehicle's connectivity will enable a wider **range of new features** that will provide it with **greater autonomy**, facilitating driving and increasing safety.

Source: EIC (DGI-ACCIÓ).

2. Main world magnitudes



World leading companies in Connected Vehicles

World leading companies according to whether they are **manufacturers of connected vehicles, suppliers of components or connectivity providers:**

1. Connected vehicle manufacturers:





Audi





Mercedes-Benz

2. Suppliers of automotive components:



BOSCH



Autoliv



DENSO



DELPHI
• APTIV •



ZF



Continental
The Future of Motion

3. IT and Connectivity providers:



AT&T



Airbiquity



bright box



Qualcomm



CISCO Jasper



Google



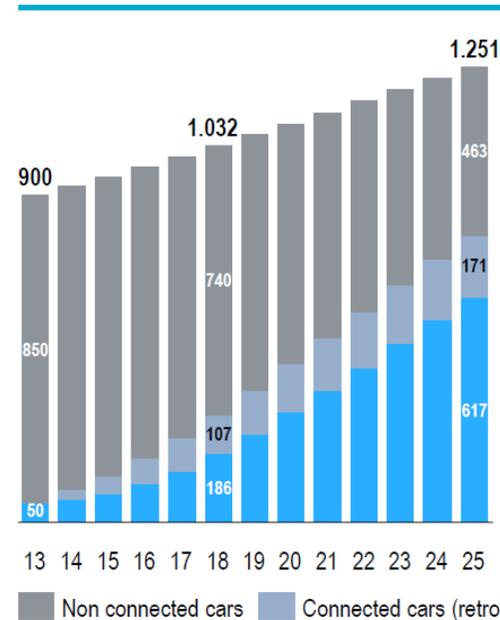
OnStar

Source: EIC (DGI-ACCIÓ) based on the official websites of the manufacturers, suppliers and providers.

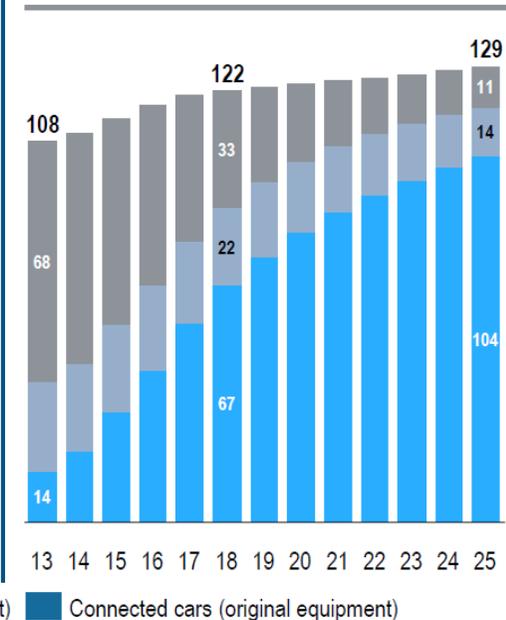
World market of the Connected Vehicle: forward-looking data and sectors

- According to studies conducted by Roland Berger, it is believed that by 2025, 60% of the passenger vehicles in circulation all over the world will be connected, that is to say, they will be factory-fitted with devices that enable connectivity (**Connected cars original equipment**) or will have been re-conditioned and re-equipped with connectivity devices (**Retrofit**) despite being older models. Re-equipping takes into account at least some type of connectivity, such as *e-Call* or vehicle geolocation devices.
- Re-equipping or reconditioning older unconnected models of vehicles will allow the development of the market for re-conditioning and the sourcing of connectivity devices for models of older vehicles. In particular, **the number of passenger vehicles factory fitted with connectivity, and passenger vehicles re-equipped with connectivity devices, will reach 171 million units by 2025**, as shown in the graph on the right. The **growth in the sector is expected to be led by traditional telecommunications markets (United States, Western Europe, etc.) and the new emerging markets (China, India, etc.)**.

Number of passenger cars in circulation on a global scale (in Million units)



Number of passenger cars sold globally between 2013 and 2025 (in Million units)



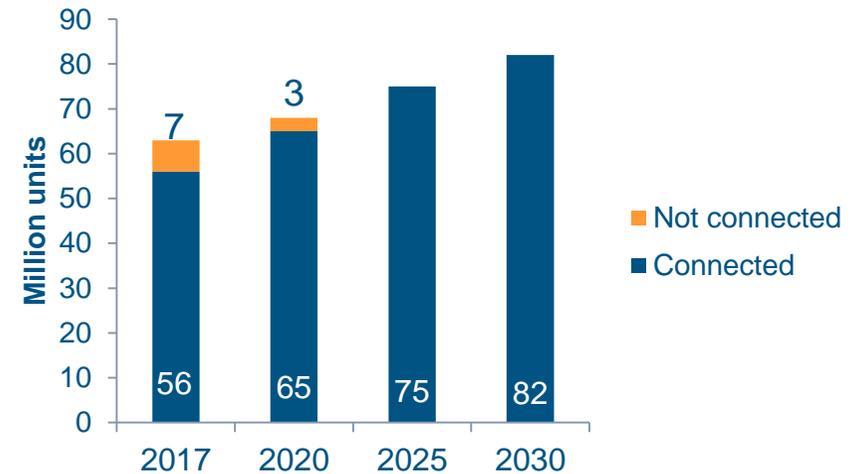
Source: IHS, Roland Berger Analysis

Source: Roland Berger & Confederation of Indian Industry. Report on Automotive Industry 4.0 Summit.

World market of the Connected Vehicle: forward-looking data and sectors

- Among the main trends influencing the automotive industry, **connectivity is the most advanced in terms of devices on the market and the availability of technology** (compared, for example, with electric or automated vehicles).
- Already in **2017 the number of new vehicles** sold in the main markets, (China, Europe and the United States) **with connectivity services was significant**, as can be seen in the graph on the right. This is due to the availability of the technology but also to the growing regulatory momentum, such as for example in the case of the emergency call (e-Call) in case of accident.
- The complementarity of connectivity services with automated vehicle technologies along with the emergence of new business models that require vehicle connectivity, will mean that by **2022, all vehicles sold in Europe, the USA and China will have some form of connectivity**. This connectivity can be: **integrated, cooperative or compatible** and market growth largely depends on the development of these three solutions.

Forecast sales of new vehicles in China, the USA and Europe

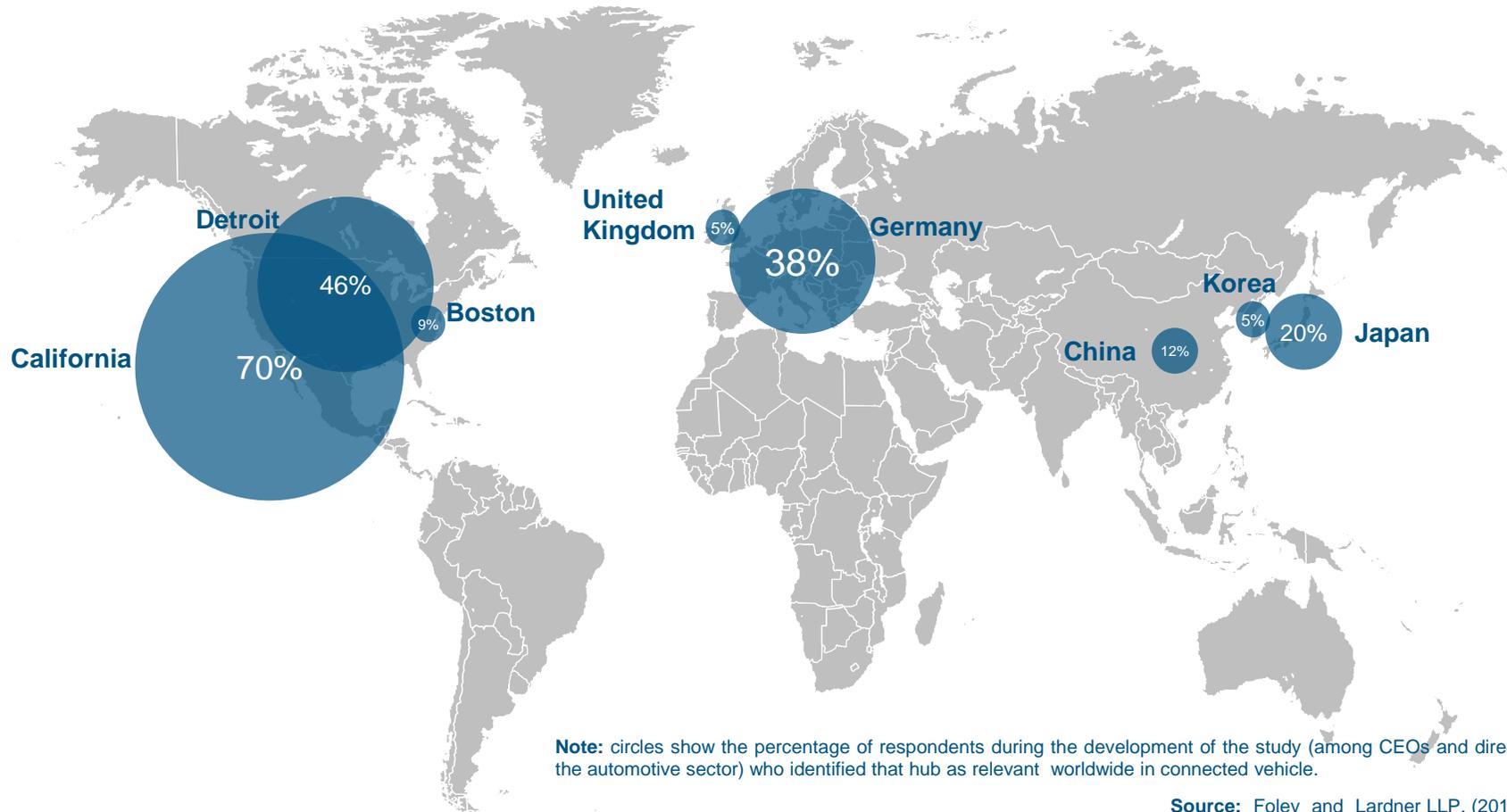


In 2022, 100% of the vehicles sold in China, Europe and the United States will have at least some element of integrated connectivity (e.g., an e-Call system)

Source: PwC Strategy & report, Connected car report 2016. Opportunities, risk, and turmoil on the road to autonomous vehicles.

Main regions and important hubs in the world

The study conducted by Foley and Lardner LLP (2017) identifies the main hubs in the world for the development of connected vehicle technologies:



Note: circles show the percentage of respondents during the development of the study (among CEOs and directors of the automotive sector) who identified that hub as relevant worldwide in connected vehicle.

Source: Foley and Lardner LLP. (2017).

3. Main conclusions of mapping

71 companies* have been detected in Catalonia working in Connected Vehicle

4,1 billion euros of turnover and 9.720 employees** related to connected vehicle.

Number of companies according to segment:

1. Connected Vehicle Manufacturers (6)
2. Suppliers of Automotive Components (9)
3. Suppliers of Engineering (12)
4. IT and Connectivity providers (16)
5. Consultancy and Services (28)

The Connected Vehicle in Catalonia



It is a mature sector:
62% of companies are more than 10 years of age

70% of companies are SMEs

High level of internationalization:

20% of companies have subsidiaries abroad.

48% of companies export.

The sector is composed by a combination of mature companies which dedicate part of their business to the Connected Vehicle together with a group of entrepreneurial companies: 29% of companies are start-ups

Source: EIC (DGI-ACCIÓ) according to Orbis, ACCIÓ's directories and Barcelona&Catalonia Start-up hub. Data on turnover and workers related to connected vehicle have been estimated based on the companies' business lines.

*Note: apart from these, there have been detected around twenty companies in Catalonia which do not work in Connected vehicle yet, but that could do so in future.

**Note: estimation made by ACCIÓ.

3. Ecosystem companies and agents

Partial illustrational table



Source: EIC (DGI-ACCIÓ).

Note: These brands are used for information purposes only. The brands mentioned in this report belong to their respective owners. None of them is owned by ACCIÓ. This is a diagram of the main companies that form part of the connected vehicle ecosystem in Catalonia; there may be other companies in the sector that were not included in the study.

4. Macrotrends, trends and applications by demand sector



The connected vehicle will respond to the macro trends of the future

In a world whose energy resources are increasingly under pressure, with increased demand and consumption, there is a need for savings, and so devices and systems that optimize the expenditure of these resources are required. Through its connectivity, the vehicle will consume energy resources more efficiently, and will allow the driver to save to a greater extent thanks to the information on expenditure provided by the vehicle's integrated connectivity services.

Resources under pressure



The connected vehicle will have to provide solutions to the needs of an increasingly digitalized and globalized population, with needs to travel efficiently and sustainably. The increase in population and the growth of large metropolitan areas will mean that more trips from home to the workplace (commuting) will be made. The connected vehicle will make such trips easier, faster, safer and more enjoyable.

Sustainability



The drastic increase in the urban population is giving rise to many metropolises that, in order to be sustainable, require smart, efficient management to become smart cities. These smart cities will increasingly involve interactive infrastructure and a network system that will enable vehicles to exchange information (V2V, V2I, V2X). Hence the vehicles will require integrated connectivity systems to be more efficient and be fully adapted to the requirements of the environment.

A more urbanized and interconnected world



By gathering information about the customer, companies can adjust their supply to meet demand. In an increasingly digitized and computerized global environment, the automotive industry will have access to drivers' personal data. The connected vehicle will allow collecting driver information in real time (preferences, routines, on-board needs, etc.) and adjust the supply of the different providers of services and applications to suit their needs. The connected vehicle manufacturers and companies handling private data must ensure their privacy and responsible use.

Big data and the challenge of privacy



With the advent of 5G and the IoT, people increasingly want to be interconnected everywhere, at all times and with everyone, and now with everything that surrounds us. The digitization of things, the use of mobile devices to monitor our tasks centrally is increasingly becoming a reality thanks to the IoT. The connected vehicle, as an indispensable element for our day-to-day mobility, will adapt to the needs and comfort of the user, who will be able to control it, interact with it and receive information remotely.

Connectivity and technological invasion



In an increasingly globalized world in which responsibility lies with us all, collaborative dynamics in different sectors such as the economy, ecology and energy are in the order of the day. Post-materialist values and responsibility permeate all segments of society and to achieve greater efficiency and social welfare citizens collaborate and cooperate. The connected vehicle will allow connecting the different road users, be they pedestrians or drivers, and make more rational and efficient use of it through collaborative methods such as car sharing or car pooling services.

Collaborative economy



Source: EIC (DGI-ACCIÓ).

Trends concerning the Connected Vehicle

The connected vehicle ecosystem is constantly evolving. The speed with which its environment is developing involves the emergence of the following trends:



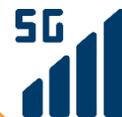
New legislation. The proliferation of legislation concerning vehicle connectivity services significantly increases the need for implementation and cost reduction. This can lead to a reduction in the cost of these technologies, encouraging integrated implementation in vehicles.



Digital security and privacy. The connected vehicle will be a technology that facilitates personal information about the driver. This could pose a threat to users' privacy and intimacy if security measures are not taken and businesses do not use data responsibly.



Business innovation and new start-ups. The growth of the sector and connected vehicle sales represent a new business model and opportunities for new businesses and start-ups. Just in 2016, the major world vehicle manufacturers acquired 25 start-ups focusing on connectivity.



The connected vehicle as a catalyst of 5G. The connected vehicle will be a catalyst for the deployment of 5G, which is necessary for the vehicle's connectivity as well as the exchange of data with its environment with the least possible latency and the highest speed and reliability.



Web-based applications. The centralization of the applications of mobile devices in a web server is an uncertain trend and is the subject of debate at European level. This centralization would mean the possibility of using the same applications on a mobile phone or in the vehicle, favouring integrated systems.



IoT and shared connectivity plans. The IoT and users' growing dependence on mobile devices means that the latter use the applications already installed in preference to those of the vehicle. This entails that the operators generate connectivity plans for different devices, which minimizes the need to purchase a data plan especially for the vehicle.

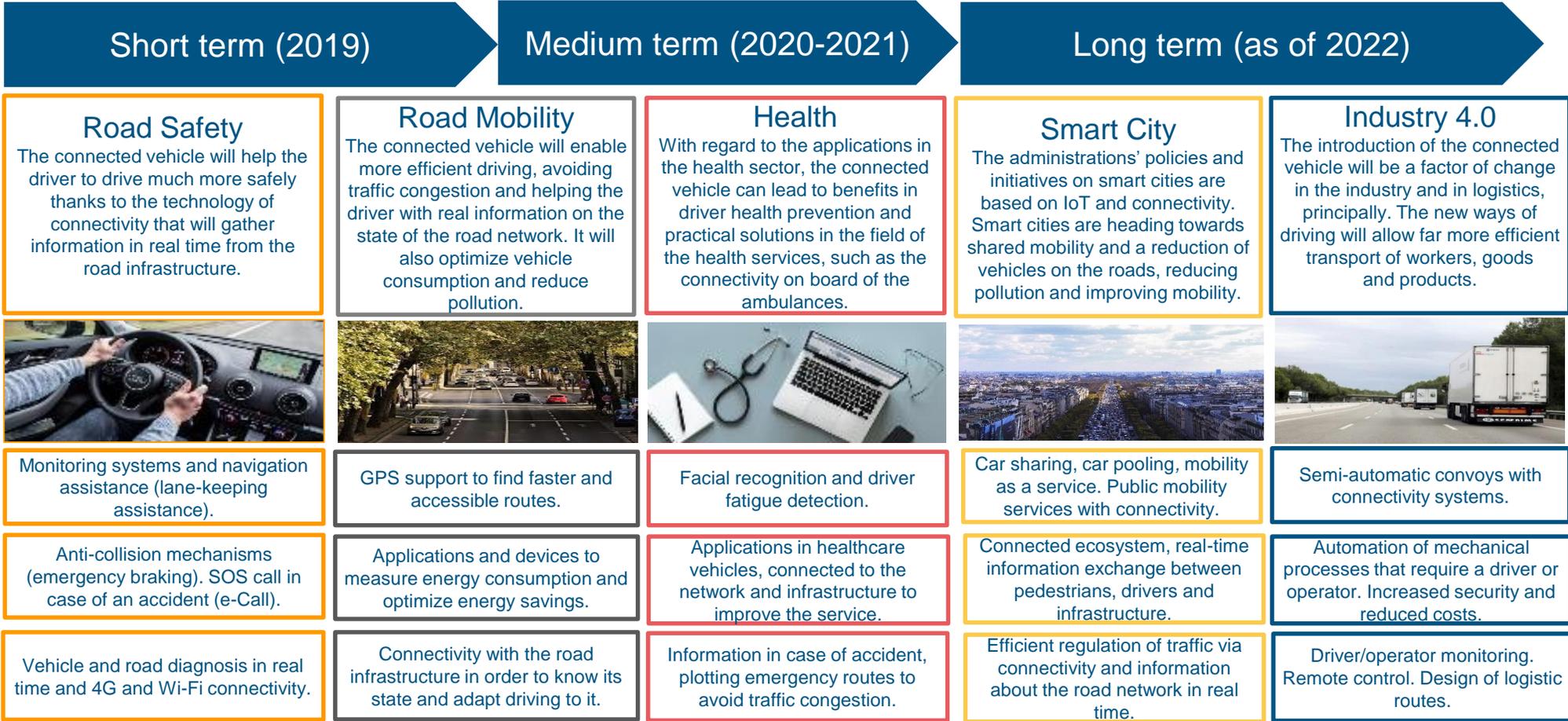


High costs of communication and of vehicle components. The need for greater bandwidth to gain access to services related to vehicle connectivity, or having components to enable connectivity, could mean an additional cost that the market would be reluctant to assume.



Adaptation of the connected vehicle to the environment and vice-versa. Connectivity will enable digitizing and accessing multiple services through mobile or vehicle-integrated devices (eg: paying for tolls and parking from the car; information about the roads and traffic; system to detect obstacles or pedestrians in the middle of the road with a braking mechanism, etc.).

Recent and prospective applications by demand sector



Source: EIC (DGI-ACCIÓ) based on Everis, El País, la Escuela de Organización Industrial (Spanish Ministry of Industry), Hibridosyelectricos.com, and Companion Applus+Idiada project.

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Read the full report here:

<http://catalonia.com/.content/documents/connected-vehicle-in-catalonia.pdf>

More information on the industry, related news and opportunities:

<http://catalonia.com/trade-with-catalonia/automotive.jsp>

