5G in Catalonia

October 2018

Technology snapshot

Generalitat de Catalunya
Government of Catalonia

5G in Catalonia: Technoloy snapshot

Catalonia Trade & Investment
Government of Catalonia

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Collaboration
I2Cat
5G Barcelona

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1. 5G: definition and global importance to industry

Definition of 5G: a leap forward in connectivity

Connectivity is growing at an extremely high rate:

42%
increase in data traffic
between 2014 and 2019.

X2
the number of connections will be doubled
between 2016 and 2020.

IoT & smart cities
will increase the density of devices and the need for more broadband

For this reason, 4G and LTE networks need to evolve towards a new network that can withstand these changes and upgrade telecommunications in the technologies of the future. **5G will mean a far bigger leap forward** than occurred in previous generations. Specifically, this network will include a set of ground-breaking features:

Far higher bandwidth:
between 10 and 100 Gbps

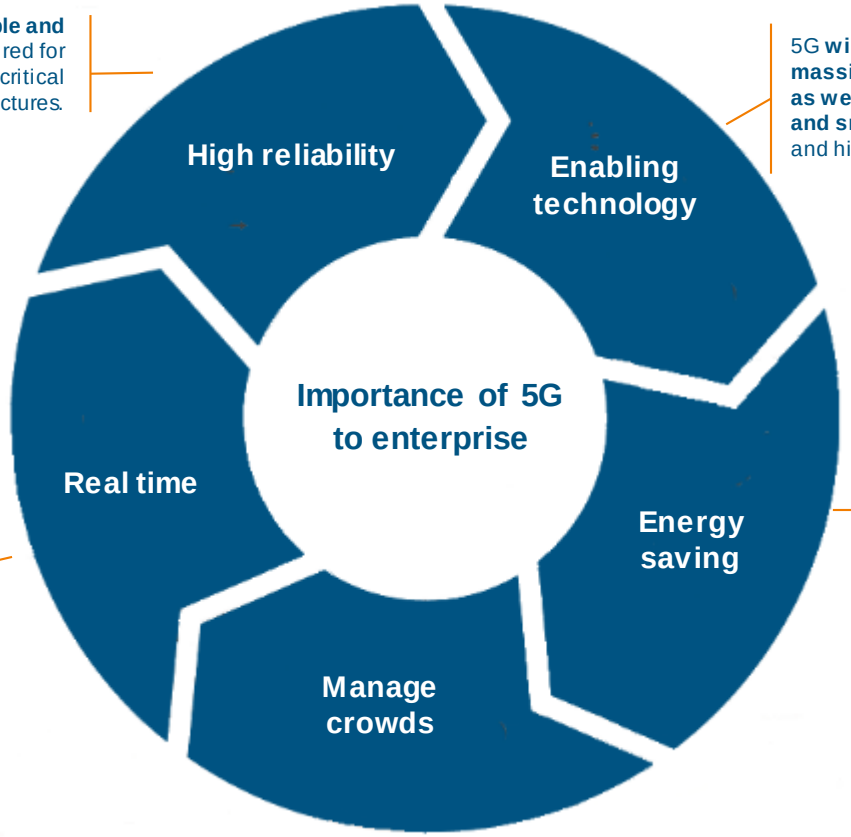
Very low latency:
of approximately 1 ms

Very high connection density:
approximately 1 million connections per km2

Improved management of energy and connections
more efficient, safer and smarter

Source: ACCIÓ based on Frost & Sullivan

Importance of 5G to enterprise



5G will enable **highly stable and secure connections** required for operating remote devices and critical infrastructures.

5G **will enable the development and massive use of the internet of things (IoT), as well as the smart, connected vehicle, and smart cities,** thanks to huge bandwidth and high connection density.

Low latency of less than one thousandth of a second will allow **real-time control of devices located many kilometres away**, such as vehicles or medical facilities.

Currently, the large number of 4G base stations needed to provide service to an area are a major energy consumer. 5G will optimize this energy consumption via **radio-level optimization and virtualization techniques** that allow switching off stations when they are inactive.

Crowds at sports events and demonstrations have always collapsed the 4G network, rendering it unusable. 5G **will also allow connection in these situations where there is a high density of connections**.

Source: ACCIÓ

2. Main world magnitudes

World leading companies in 5G

The leading companies in the field of **5G telecommunication operators** worldwide are:

vodafone, orange, AT&T, CHINA MOBILE, Telefónica, T-Mobile, verizon, kt

The leading companies in the field of **5G mobile phone manufacturers** worldwide are:

HUAWEI, Apple, mi, SAMSUNG, Google, LG

The top 7 companies in the field of **5G network and component providers** worldwide are:

ERICSSON, HUAWEI, QUALCOMM, NOKIA, SAMSUNG, ZTE, intel

Source: I2Cat

World 5G market: prospective data and industry impact

Currently, 5G is still being developed and therefore does it not generate income. The network will not be sufficiently widespread as to generate a significant amount of income until the beginning of the 2020s .

It is expected that in 2026, once the technology is fully developed, widespread, operational and mature, **the income derived from 5G on a global level will be some $1,307,000M, broken down as follows:**

- **$230,000M** from the **provision of infrastructure and connectivity**
- **$646,000M from enabling the connected services** that allows each vertical sector of application to adapt its digital tools
- **$432,000 for the supply of digital applications and services**, offering innovative digital platforms and tools

It is expected that of this $1,307,000M, a total of $619,000M will be generated by telecom operators, which will continue to operate their connectivity services and expand their current positions in derived services and applications.

5G is expected to have a major economic impact especially in the sectors of energy, manufacturing, public safety and health.

Figure 2: 5G-enabled industry digitalization revenues for ICT players, 2026

Source: Ericsson and Arthur D. Little

Source: ACCIÓ based on Ericsson

Main regions and key hubs in the world

North America – Possible leader in adopting 5G

The U.S. is expected to be the world leader for 5G technology, just as it was for 4G technology. Companies such as Verizon Wireless, AT&T, Cisco, Nokia, Ericsson, Samsung and Qualcomm have many collaborative initiatives to develop 5G technologies and applications in the region. In fact, Verizon Wireless will introduce 5G to between 3 and 5 of the country's cities by the end of 2018, one of which is Sacramento.

Europe – Horizon 2020 initiatives

With the Horizon 2020 initiative, Europe is making significant progress in 5G; but the lack of technology infrastructure developers in the region may delay its initial adoption. In addition, European operators have access to a frequency of 32 GHz, which many hardware developers may not be able to support in the initial phase of this technology, until standardization.

Asia Pacific – *Early adopters*

Asia Pacific is moving quickly towards its first 5G network. In fact, during the 2018 Winter Games in South Korea, the most advanced large scale test in the world was conducted. Asian companies such as Huawei and KT Corporation are investing heavily in the development of this technology in the region.

Source: ACCIÓ based on Frost & Sullivan

3. 5G in Catalonia

5G in Catalonia: main conclusions of mapping

Although 5G technology is not yet available, there are currently 22 companies in Catalonia developing 5G projects.

Because the technology is still being developed, no figures concerning turnover or number employees linked to 5G are available.

The ecosystem is made up of a combination of large mature companies and startups.

73% of companies invoice more than one million euros and 55% more than ten million euros

5G
in Catalonia

Number of companies according to segment:
1. Equipment manufacturers: 5
2. Integrators: 3
3. Network and/or infrastructure providers: 5
4. Solution developers: 9

68% of companies are SMEs.

It is a mature sector: only 28% of companies are under 10 years of age.

Average level of internationalization:

18% of companies have subsidiaries abroad.

27% of companies export.

The number of companies working in 5G in Catalonia in the near future is expected to reach about 70.

Source: Acció according to Orbis, ACCIÓ directories and i2Cat

Companies and stakeholders ecosystem

Partial illustrational table

Institutions

Generalitat de Catalunya

Ajuntament de Barcelona

Associations

Barcelona

Mobile World Capital Barcelona

GSMA

Universities and R&D centres

UPC

i2cat

CTTC

1. Equipment manufacturers

NOKIA

CISCO

HUAWEI

JUNIPER NETWORKS

ERICSSON

2. Integrators

Atos

indra

T-Systems

4. Solution developers

accent advanced systems

VISYON

enide

ENGIDI

WORLD SENSING

VOLTA Networks

watchity

sensefields

NBYCOMP

AIS Advances in Surgery Channel

Users

FGC

Clínic Barcelona Hospital Universitari

etra

SEAT

B

acciona

3. Network and/or infrastructure providers

Telefónica

vodafone

orange

MÁSMÓVIL

Neutral operator

cellnex driving telecom connectivity

Note: The use of these brands is merely for information purposes. The brands mentioned in this report belong to their respective owners and under no circumstances the property of ACCIÓ. This is a partial representation for the purpose of illustrating the main companies that belong to the 5G ecosystem in Catalonia, but other companies may exist that have not been included in the study.

Source: I2Cat

4. Macrotrends and applications by 5G demand sector

5G responds to the macrotrends of the future

Connectivity and invasion of technology

People increasingly want to be interconnected everywhere, at all times and with everyone, and now with everything that surrounds us, thanks to IoT. And in conjunction with the new emerging technologies, this means that the network is not able to cope with the current demand for data, which 5G will be able to handle.

Ageing population

Between 2015 and 2050 the senior population is expected to increase by over 130%. This increase in the ageing population creates needs for more convenient, precise and efficient treatment for patients. 5G is the technology that will facilitate telemedicine and remote surgery thanks to its low latency and high bandwidth.

Resources under pressure

By 2050, double the resources than today are expected to be used, and the growing demand for energy by a saturated technological infrastructure contributes to this. 5G enables sending concentrated signals accurately and efficiently, while saving large amounts of energy.

Smart and sustainable mobility

The mobility needs of a huge, digital, ageing population are most diverse. Autonomous and connected vehicles of the future need a network that enables them to exchange a large amount of information with the road infrastructure and infotainment systems efficiently, quickly and safely.

An increasingly urban world

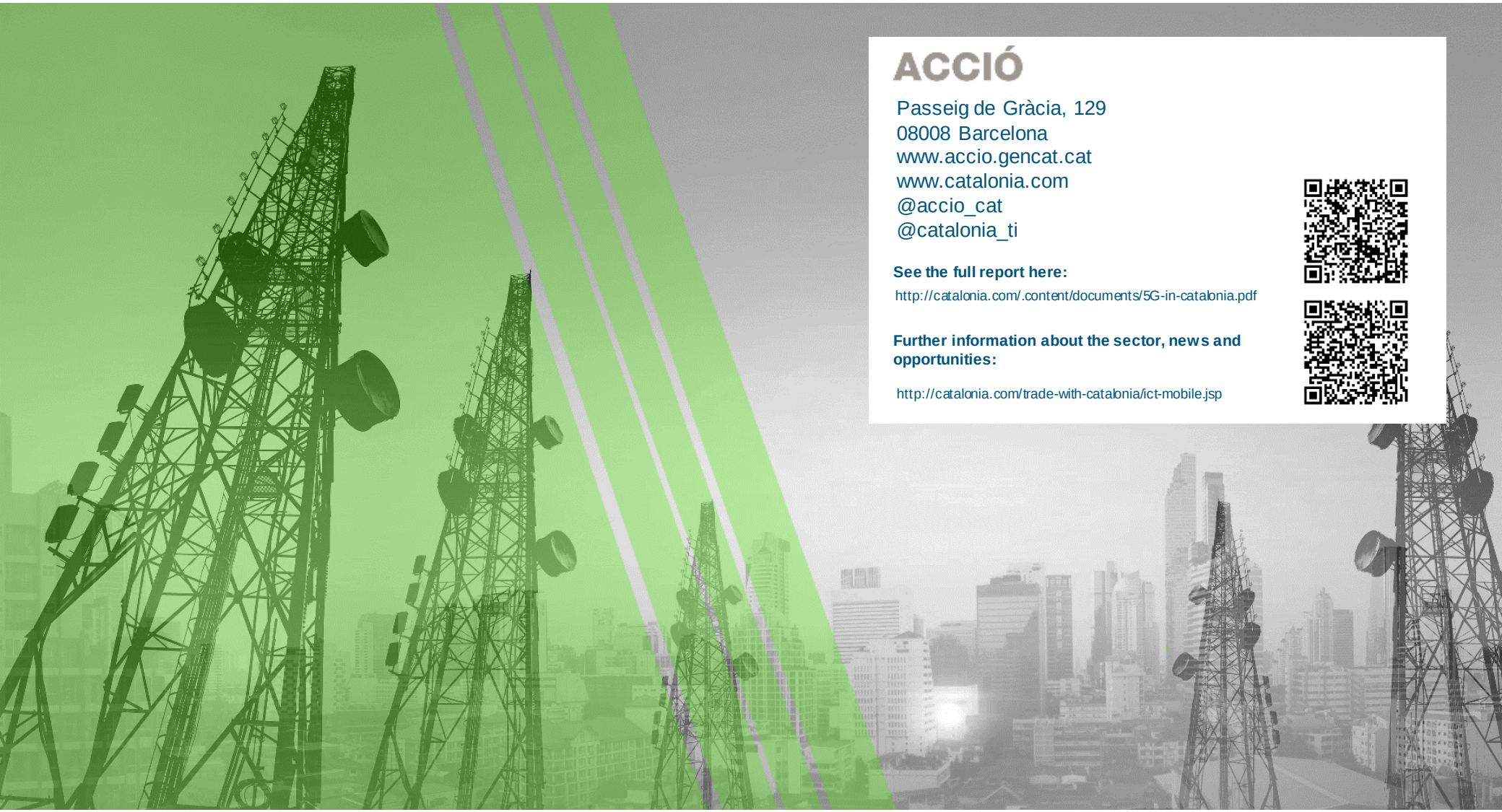
The drastic increase in the urban population leads to many metropolises that, in order to be sustainable, require intelligent, efficient management to become smart cities. These cities require a network capable of handling all the data generated by the IoT necessary for them to function.

Source: ACCIÓ, authors' own

Recent and prospective applications by demand sectors

Short term (2018)		Medium term (2019-2020)		Long term (as of 2021)
Media Support for interactive applications that require a high bandwidth, often dedicated to entertainment. Effective connection management by streaming services.	**Transport** 5G is a necessary 'driver' for the autonomous vehicle and other high-performance multimedia services in motion, regardless of speed and location.	**Health** The development of telemedicine, especially remote surgery and remote patient monitoring, requires fast connections with very low latency.	**Industry 4.0** Productive robotics will require connection with very low latency for remote control, and with very high bandwidth for mass automation.	**Smart City** The smart cities policies and initiatives of the of the administrations are based on IoT, which uses 5G as a facilitator technology.
				
High definition video and video call together with fixed wireless	Autonomous/connected vehicle	Remote diagnosis and surgery	Cloud computing and Mobile Cloud computing	Advanced resources management
Virtual reality videogames	Real time vehicle and road diagnosis	Personalized telemedicine, wearables and health monitoring	Automation and monitoring of production processes	Advanced traffic control
Real time immersive broadcasts and social networking	Massive monitoring of assets	Precision robotic surgery	Real time preventive maintenance	Surveillance of public safety

Source: authors' own based on Frost&Sullivan



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See the full report here:

http://catalonia.com/.content/documents/5G-in-catalonia.pdf

Further information about the sector, news and opportunities:

http://catalonia.com/trade-with-catalonia/ict-mobile.jsp

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