ICT | Internet of Things

Internet of Things (IoT for short) is the name given to the growing range of Internet-connected objects with integrated sensors that can process and share complex information without human intervention. Currently, IoT is composed of a collection of different networks and different purposes but is not connected. For example, today's automobiles have multiple networks to control engine operation, security measures, communication systems and so on. Similarly, commercial and residential buildings have different control systems for heating, ventilation and air conditioning, telephony, security and lighting. As IoT evolves, these and many other networks will be connected with the incorporation of security capabilities, analysis and management.

ORIGIN OF THE INVESTMENT OPPORTUNITY

ECONOMIC/BUSINESS	DEMAND	REGULATIONS	TECHNOLOGY

To know the origin of IoT the impact that the Internet has had on education, communication, business, science, government and humanity must be taken into account. IoT represents evolution of the Internet, and arises from the need for companies and final consumers to gather, analyse and distribute data that can be converted into information, that is, into knowledge .

IoT is very important because it is the first real evolution of the Internet, an evolution towards **revolutionary applications** with the potential to improve the way people **live, learn, work and play**. IoT has already ensured that Internet has become sensory, ie, sensitive to temperature, pressure, vibration, light, humidity, stress, etc. All this is possible thanks to the technological evolution and transformation.

If IoT's capacity to perceive, collect, transmit, analyse and distribute data on a mass scale is combined with the way people process information, humanity will have the knowledge and wisdom necessary not only to survive but to prosper and improve.

In companies, IoT arises from the need to have all possible information to make the products and services they offer their customers higher quality and meet their needs. **Collect and analyse** all data representing that trend will allow them to advance their business.

LOCATION OF THE INVESTMENT OPPORTUNITY IN THE SECTOR VALUE CHAIN

Telecommunications networks → **Production** → Commercialisation → Services

This opportunity is in the manufacturing link. IoT is possible thanks to the manufacture of essential physical components that allow "objects or things" are connected to the Internet.

DIFFERENTIATING FACTORS OF THE INVESTMENT OPPORTUNITY

CONSUMER/USER

- Innovation
- Price
- Quality

They may be companies or end users. There are the following benefits:

- Cost **savings**.
- **Comfort**.
- **Ability to manage** household objects from outside.
- Data **personalisation and analysis**.
- Real-time **information**.

Businesses, thanks to IoT, **will discover new business opportunities**.

COMPANY/INNOVATION

- Operations
- Supplies
- New business lines

- Crossing the threshold of connecting more objects to the Internet than people opened a huge **window of opportunity** for creating applications in the areas of automation, the **use of sensors** and **communication between machines**. In fact, the possibilities are almost endless.
- That is, the opportunity arises for companies to launch **products that achieve the conversion of data** into information and knowledge.

SOCIETY

- Environment
- Well-being
- Safety

- IoT has an **impact** on the **Spanish government**, enabling an **improvement** in the provision of basic **public services**.
- The use of IoT in **lighting, irrigation systems or separate waste collection** can produce cost savings and therefore directly benefit citizens by reducing the tax burden, as well as there being a greater efficiency in cities.

INVESTMENT OPPORTUNITY LIFE CYCLE

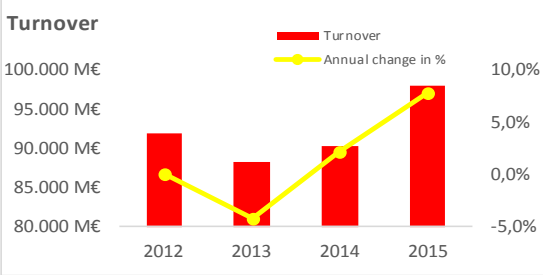
DEVELOPMENT | INTRODUCTION | **GROWTH** | MATURITY

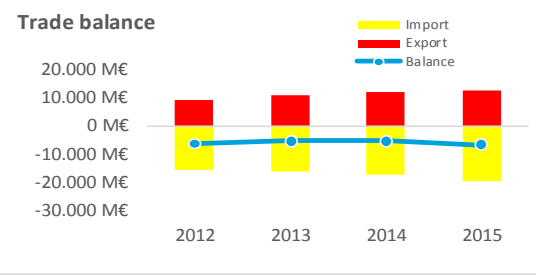
As happens with many new concepts, IoT roots can be traced to the Massachusetts Institute of Technology (MIT), to the work of the Auto-ID Centre. This group, founded in 1999, conducted research in the field of emerging networked RFID (RFID) and sensor technologies. **Internet of Things came about between 2008 and 2009** as a simple moment in time when more things were connected to the Internet than people. (1)

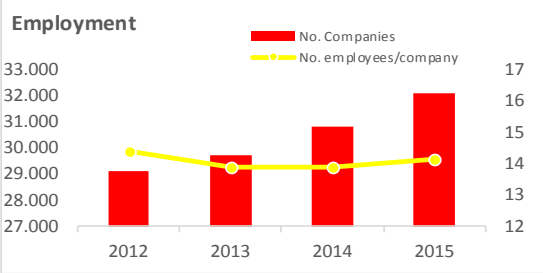
Year after year the number of mobile devices connected to the network has been increasing. In **2006 it was estimated that 2 billion devices were connected**, in **2011 the number of connected devices exceeded the number of people on earth** and by 2020 there are expected to be 50 billion Internet-connected devices.

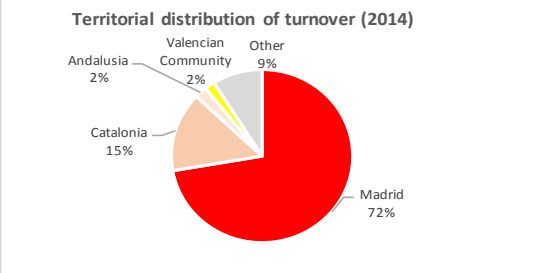
Sources: (1): Internet of Things. How the next evolution of the Internet changes everything - CISCO

CHARACTERISTICS OF THE ICT SECTOR (2)









SUPPLY

TOP 5 COMPETITORS

#	Company	Net sales	Last available data
1	Telefónica	€59,104 M	2014
2	Indra	€4,909 M	2014
3	Samsung	€1,877 M	2013
4	Google	€52.178 M	2013
5	Telecom*	N. avai.	-

* Data not available in the queried database, SABI.

DEMAND

GROWTH

- In 2015 approximately **one billion wireless devices** were connected to the Internet, **60% more than in 2014**, and reaching **2.8 billion devices**.
- In addition, IoT will generate **300 billion dollars** in revenue in **2020**, with estimates on the number of connected devices, ranging from 25 billion to over 200 billion. These devices also need sensors, networks, infrastructure and back-end analysis software to be useful.

SUCCESS STORIES

Thinking Things, the first commercial product of Internet of things. Modular set of low-cost devices that integrate various sensors and, through a connection to the cloud, allow the full potential of the Internet of things to be exploited. It is a plug and play solution so that users can employ Thinking Things without any knowledge of programming or how to enable additional infrastructure. The temperature, light and humidity conditions of the home or office can be remotely controlled and managed.
All this is much easier thanks to FIWARE, open initiative to create a sustainable ecosystem seizing the opportunities of the new digital era thanks to internet technology, in which Telefonica is one of the greatest drivers and provides a powerful set of APIs. Through these, a large number of **applications for different types of industries can be developed**.

Telephone and Telepizza have created a small device, called Click & Pizza, which stick to the fridge and allows for a pizza to be ordered with one click. The goal is that any home can place an order immediately. Telepizza has experienced significant growth in online sales penetration at home. Sales through mobile devices accounted for 27% of total e-commerce sales.
The development of these applications is easier with FIWARE, an initiative promoted by Telefónica and developed around the Internet of the future.

NEC are carrying out a pioneering project in the field of waste collection for Ascan-Geaser in Santander, which provides the service needed to analyse data in real time as a tool for decision making in managing intelligence. The project involves the deployment of a complete technology solution, including sensor technology in recycling containers to read the fill level in real time, the infrastructure necessary to collect data from sensors such communications devices shipped in pickup trucks for the management of vehicles and routes, and mobile applications to aid in the work of collecting, cleaning and maintenance of the workers in street.

Sources: (2) Annual Report of Information Technology, Communications Sector and Content in Spain 2015. 2016 Edition.

POSITIVE FACTORS FOR INVESTING IN SPAIN

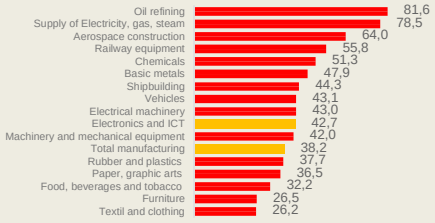
Favourable factors in Spain for the development of the opportunity

High penetration of Smartphones	In Spain the most used device to access the Internet is the **smartphone**, with **88.2%** followed by **computer** with **78.2%** [5]. It is also remarkable the increase of people who use the Internet. It has increased from **76.1% of Internet users in 2014 to 80.8% in 2015** [3].
Access to the FI-WARE platform for entrepreneurs	FI-WARE is the central project of the program of Public-Private Partnership developed around the Internet of the Future signed between the European Commission and a number of ICT companies. This program has two main objectives: to create an open platform (FI-WARE) that integrates the key technologies for the development of applications in the Internet of the Future, and on the other hand, to create sustainable open ecosystem of innovation around FI-WARE technology.
Agreements for the implementation of IoT	Large companies sign agreements to boost the implementation of IoT in specific areas, one example is that of Telefonica and the Foundation for Research in Ethology and Biodiversity (FIEB) to develop the capabilities of the IoT in the field of wildlife protection in Spain .
Social factors and habits	In Spain, **Internet penetration** continues to rise steadily and there is an **online population over 30 million people**. **80%** of regular Internet users use **mobile devices** to access it. [4] Broadband **access of Spanish companies** is above the European average at **99%**. [5]

Favourable factors for the sector in Spain

Macroeconomic situation	**The Added Value of the information technology and communications sector** in 2015 was 45,296 million euros, representing 4.9% of the added value of the Spanish economy. Sector exports totalled **13,032 million euros.** [2]
Labour market	The **average productivity per employee** in the ICT sector is **52,100 euros** per year. Their **average individual remuneration** is **42,700 euros per year**. The **Unit Labour Cost** accounts for **81.8%** of the ratio between the remuneration per employee and the individual productivity (productivity defined as value added per employee). [6]

Remuneration per employee (thousands of €)



Graph created using data from the Sectoral Presentation: Electronics and ICT.

Incentives	The Ministry of Energy, Tourism and Digital Agenda allocated **80 million euros to R&D in the ICT sector in 2016 to promote high value technologies** in industries of the future (Components and Systems, Internet of the future, High Performance Computing (supercomputing), robots and autonomous systems, Internet of Things, cloud computing solutions for mass data processing…), Cybersecurity and digital trust, agrifood and environmental management, energy efficiency, transport and logistics, and digital content.
I+D+i	There are 15,736 **innovative companies** and the **percentage of innovative companies is** roughly **28.5%**, spending a total of **13,6747 million euros** on innovation.[7]
Talent	Installs in Spain **Google Campus to the world's largest entrepreneurs, ahead of London, Seoul and Tel Aviv**, demonstrating confidence in the creativity and talent in the country by leading companies the sector. These facilities provide work areas and technical advice for the implementation of new projects. TechHub is involved in this project which manages a **global community of digital entrepreneurs**.
Geographic location	Spain is **within reach of three main regions**: the **European** region, the **Mediterranean** region and the **Atlantic** region. Spain is considered to be the gateway between North Africa and Europe, and a key link to Latin America, not only because of its geographical location but also because of its strong historical and cultural ties with the region. In Spain the **Canary Islands** play a key role with regards to **maritime traffic** with **West Africa**.
Technological and research infrastructure	Spain has a very advanced technological infrastructure as shown in areas such as: the presence of **84 technology parks** that house more than 5,000 technology companies and a **broadband coverage of 96.5%**, one of the few OECD countries that has had included in its legislation since 2012 the **universal obligation of 100 Mbps broadband supply**. In the **business** arena, broadband penetration exceeds that achieved in the European Union. In 2016 **99%** of **companies** in **Spain** that access the Internet do so by broadband [5].
Transport infrastructure and logistics networks	There are **250 airlines** operating in Spain in its 47 airports; its high-speed rail network is the 2nd best in the world and the best in Europe; it is ranked **1st in the EU for its motorway network**; and it has excellent sea connections to its **46 ports** distributed along the Atlantic and Mediterranean coasts.

Technology centre locations

Graph created using data from Spanish Foundation for Science and Technology.

Sources: (3) The Information Society in Spain 2015-Telefónica. (4) Survey on Equipment and Use of Information and Communication Technologies in Households. Year 2016.- INE.

(5) ONTSI. (6) Electronics and ICT Sectoral Presentation. April 2015. Ministry of Energy, Tourism and Digital Agenda (7) Innovation in companies Survey 2016