

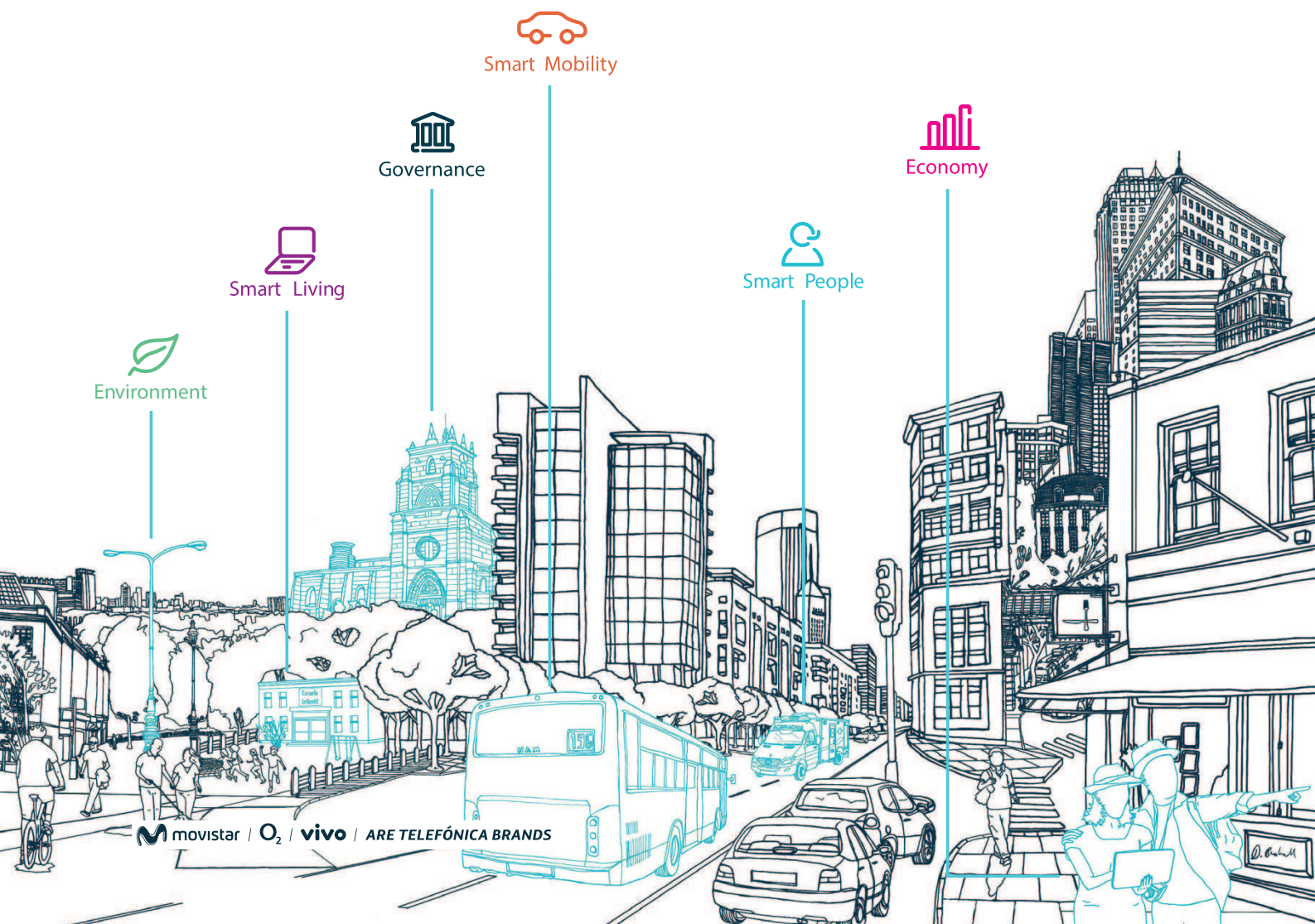
# Telefónica

One city.  
Hundreds of *possibilities*

## SMART CITIES

AN OPPORTUNITY FOR EUROPE

The city as a platform for Digital Transformation



## *The city as a platform for Digital Transformation*

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The 21st century is going to be the century of cities. The world is undergoing the largest wave of urbanization: more than half of the population is now living in the cities. The digital revolution is leading us to a hyper-connected world and a sharing society. Hence, the Smart City concept, at the confluence of these two mega-trends is especially relevant.

Europe, well-positioned in the development of its cities, has now the opportunity to leverage the city as a platform for digital transformation of the economy and the society. Latin America can take advantage of the digital transformation to meet the economic and social challenges ahead.

New technologies allow the improvement of the citizens' quality of life and a more efficient delivery of services by public administrations, in an environmentally sustainable way. Besides, there is an opportunity to go beyond. Cities are meant to become a fundamental tool for the development of public policies and economic growth in the coming years.

Cities have always managed to adapt to new challenges. Now it is the time to address the cities' new digital ecosystem, to respond to environment the citizens. The digital revolution will allow the Smart City to be at the heart of a new digital ecosystem of innovation and entrepreneurship, expanding and transforming the information of citizens and organizations.

Cities must provide a digital infrastructure, a platform for digital services. This will allow not only the provision of nowadays services, but the development of new services by any provider or entrepreneur supported on a common digital infrastructure of the city. The city may thus foster a flourishing, creative, innovative and entrepreneurial digital ecosystem that will lay foundations for future economic growth.

The city platform must be set up to facilitate synergies and ensure interoperability with other services and systems such as transport, energy, health, etc. We need to encourage innovation based on an open platform and open data, promoting the city as a living lab for the Internet of Things and a tech hub.

Europe has the opportunity to repeat the success of the GSM standard, developing a digital single market of applications and services for cities and industries, attractive to European developers and entrepreneurs.

To do so, Europe must promote an open platform for the city, thereby generating the necessary scale and encouraging the creation of ecosystems in which the development of solutions arises not only from the city, but also from citizens and organisations.

In short, there is an opportunity to promote a shared vision and ensure the leadership of our cities, enterprises and industries, developing six areas of work in Europe.

## Action Programme

1 Foster Smart Cities to put into practice Large Scale Pilots (LSPs) and promote the development and adoption of Internet of Things solutions through:

- 1/ Innovative sample projects ("leading by example")
- 2/ The aggregation of demand and advanced procurement mechanisms in the public sector.

2 Promote a horizontal open platform standard in order to overcome fragmentation and encourage the development of a competitive offer and a balanced ecosystem, allowing the necessary scale.

The FIWARE open platform is becoming the *de facto* standard adopted by cities. It has been developed upon the basis of the European Future Internet initiative, conducted in partnership with industry. Its main aim is to promote the creation of an open and sustainable ecosystem based on standards, easing the development of smart applications in different sectors among others Smart Cities, Smart Industry, Smart Agrifood, Smart Energy.

3 Endorse data sharing and the use of open data in a safe and reliable manner, stimulating data-driven digital development ("Economy of Data")

4 Promote acceleration and funding programs for start-ups and SMEs launching new products and services for the city and industries, particularly those related to the Internet of Things. Ensuring that SMEs can gain access to the technology platforms and open data necessary for the development of innovative applications and services.

5 Encourage public-private models of relationship and new patterns for the more effective management of innovation and take-up actions (e.g. public-private partnerships, pre-commercial public procurement schemes and public procurement of innovative solutions)

6 Integrate city initiatives to stimulate the scale and the development of communities of agents around open horizontal platforms, supporting the creation of networks and interaction, the exchange of good practices and promoting skills and training activities (e.g. Open Agile Smart Cities (OASC))

For further information:  
<https://www.telefonica.com/en/web/public-policy/economic-growth>

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**SMART CITIES**  
AN OPPORTUNITY FOR EUROPE

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The city as a platform for Digital Transformation

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## ***The city as a Platform for Digital Transformation***

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## 1. THE CITY IN THE 21ST CENTURY



The 21st century will be (and already is) the century of cities. The growing **urban development** process is unstoppable and more than half the world's population now lives in cities, which are increasingly becoming centres of **economic, political and social influence**.

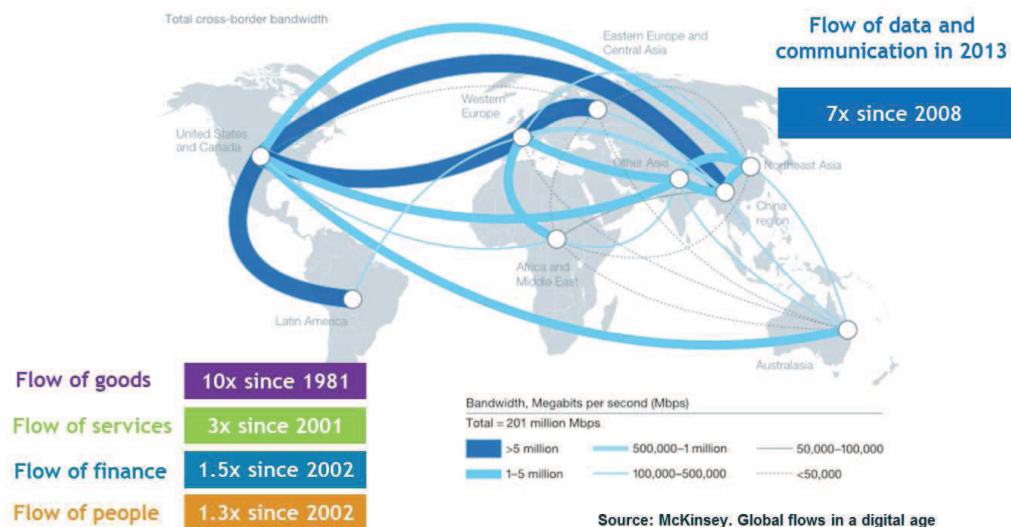
In parallel, the outbreak of the **digital revolution** is creating a hyper-connected and collaborative society which is decisively transforming the relationships between citizens.

**Europe** is at the forefront of quality of life in cities and in communications infrastructures as in their use. **Latin America** has the opportunity to leverage on the digital transformation in order to overcome the new challenges in cities.

### 1.1 Globalization and urbanization: The 21st century will be the century of cities.

#### -The urban dimension: the city as a gateway to a globalized world-

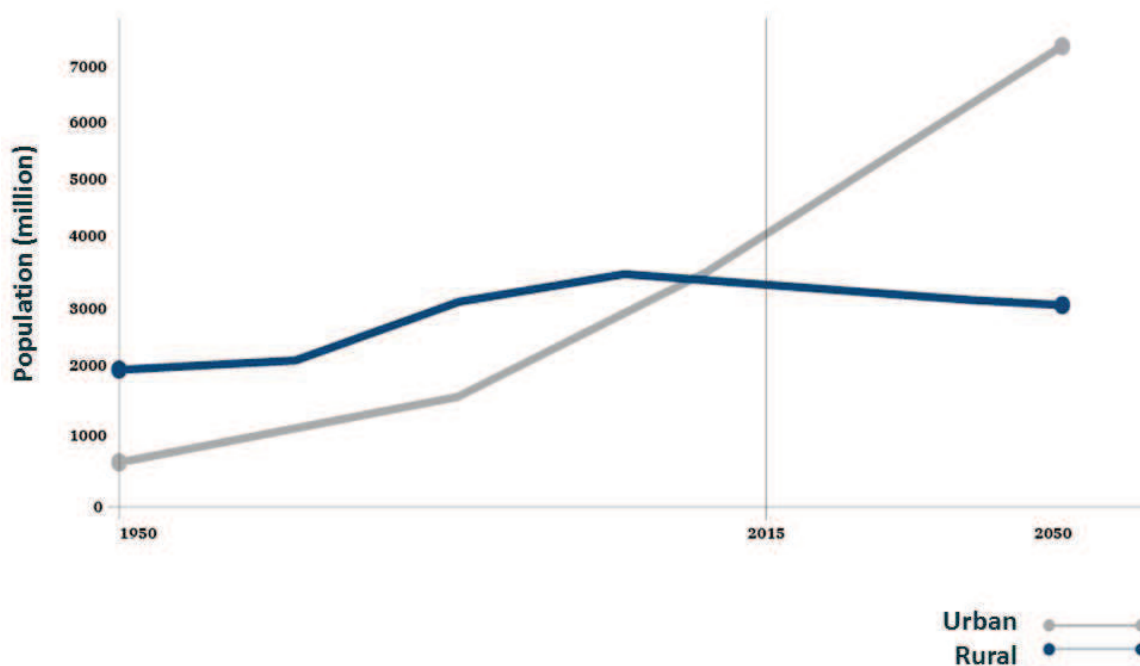
The world is becoming more **globalized** in its economic, technological, political, social and cultural processes as a result of the increasing **inter-relationship between markets and societies**, both in physical terms, due to the transport revolution which began in the 19th century, and from a services standpoint, owing to the current digital revolution and the increase in connectivity.



Global flows in a digital age. Source: McKinsey.

In a globalized world **the cities are gateways, the door to the global economy**. Cities, which have always been driving forces of innovation and competitiveness, are entering a new phase in the 21st century.

In 2007, for the first time in the history of mankind, the world's urban population exceeded its rural counterpart, **totalling 54% of the population in 2015**. **The world is becoming predominantly urban** and the trend is accelerating, especially in the emerging countries. Thus, 70% of the population is expected to be urban by 2050.

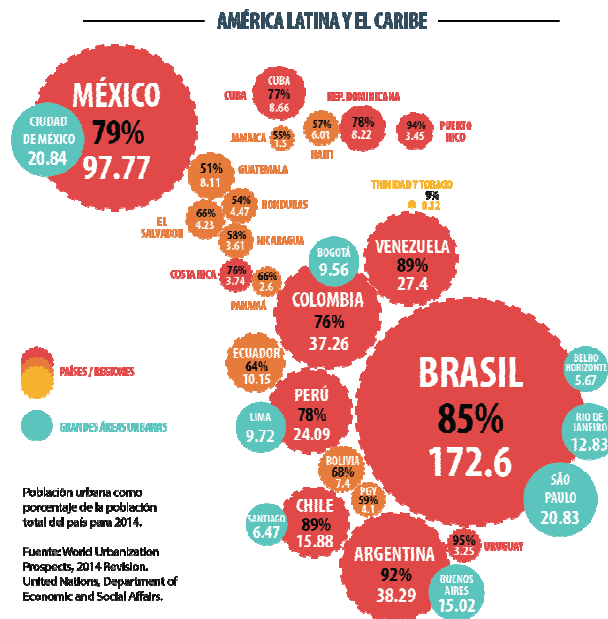


World urban and rural populations (1950-2050).

Source: UNESCO, 2015.

**The degree of urbanization at a regional level is not homogeneous.** As of 2015, the urban population already totals **82% on the North American continent**. **Latin America & the Caribbean forms the second most urbanized region on the planet**. **Europe** comes behind with **73%**, a figure expected to increase to 80% by 2020. The urbanization rate rose from 64% in 1980 to 79% in 2010. The contrast is provided by Africa and Asia, which still remain predominantly rural (40% and 48% of the urban population, respectively).

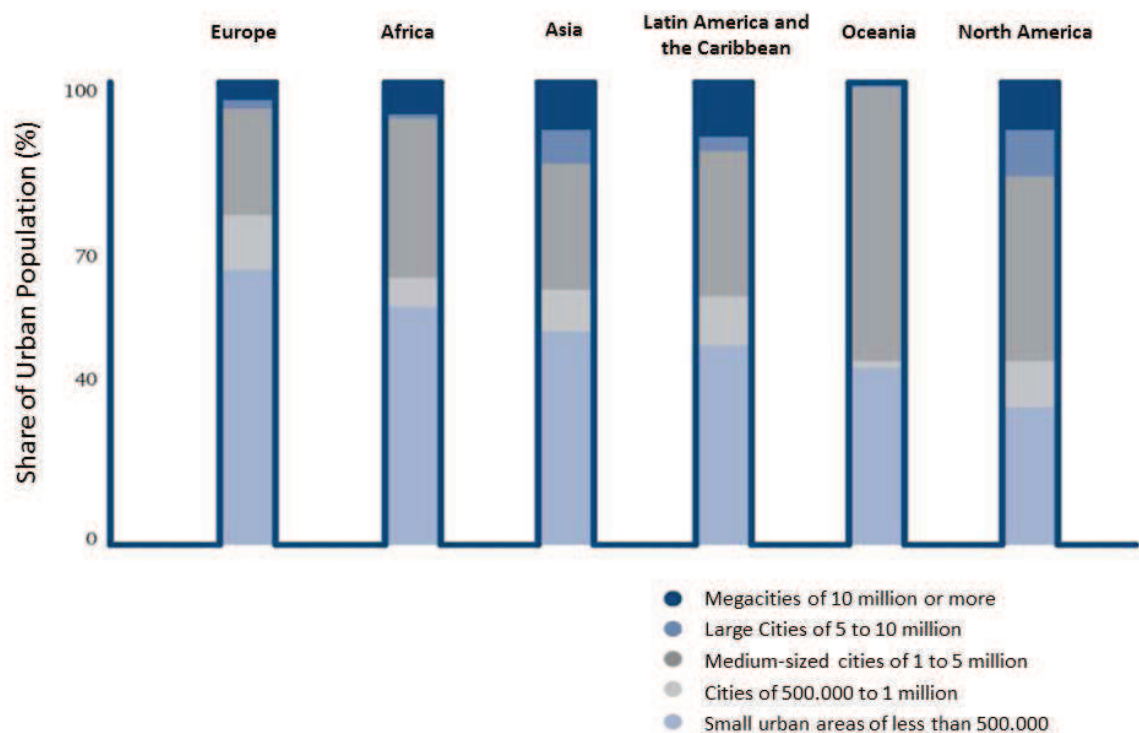




Moreover, large cities are growing, but small and medium-sized “emerging cities” account for most of the population and growth, particularly in Europe. In terms of typologies, the mega-cities (cities with more than 10 million inhabitants) are renowned for their scale and the concentration of economic activity, but they only provide a home for one in eight urban inhabitants in the world (12.5%).

As for large cities (with a population of between 5 and 10 million people), they account for a small but growing proportion of the global urban population (8% of the total). However, one in five urban inhabitants live in medium-sized cities (between 1 and 5 million) and the figure is expected to have risen to 36% by 2030. Finally, half the world’s urban population now live in settlements with fewer than 500,000 inhabitants. This proportion is expected to decline, but by 2030 it will continue to account for 45% of the world population living in cities.

Europe accounts for a particularly high percentage of the population in small and medium-sized cities (>75%), compared with the situation in America or Asia, where there is a higher proportion of people living in mega-cities or large cities.



Global distribution of the urban population by typologies and continents.

Source: UNESCO, 2015.

*-The economic, social and political role of cities and associated challenges-*

This quantitative dimension is complemented by the fact that cities are strengthening their **historical role** as centres where **innovation** takes place. Cities encourage free thought, creativity and entrepreneurship: “*city air makes you free*”.

From the **economic** viewpoint, **cities concentrate most of the economic activity and countries’ decision-making regarding investments. As such, they accounted for 80% of the GDP in 2010 with 50% of the population.** As countries move forward in the development process, the importance of agriculture decreases as a proportion of the gross domestic product, and industry and services begin to dominate the economy. Goods and services are often produced more efficiently in densely populated areas which provide access to skilled labour, financing, a network of companies and suppliers, and a critical mass of customers.

The growing economic importance of cities has its correlation in their **environmental and climatic impact and in the use of resources**; it is estimated that, at present, cities consume 75% of the world’s natural resources and energy and generate between 60% and 80% of

the gases responsible for the greenhouse effect while occupying only 3% of the world's territory<sup>1</sup>.



**Source: United Nations Environment Programme**

From a **social** point of view, cities have to face the challenge of assimilating citizens from many different origins, resulting from migratory processes in which, in addition to the economic, environmental or war-related reasons for leaving a country, there is the prospect of access to the global economy and an improvement in the living conditions which reaching the city entails in many cases. The challenge is twofold and this varied substrate should be used to generate innovation and culture.

Urban growth in both large and smaller cities increases pressure to locate **political** power at urban levels and **decentralize decision-making** in the search for more efficient, effective and participatory models to overcome the challenges. This administrative level is more conducive to policy experimentation, facilitating the emulation of best practices and greater flexibility and speed of adaptation.

Consequently, in a globalized world **the role of cities in economic, social and political terms is growing in parallel with the magnitude of their challenges.**

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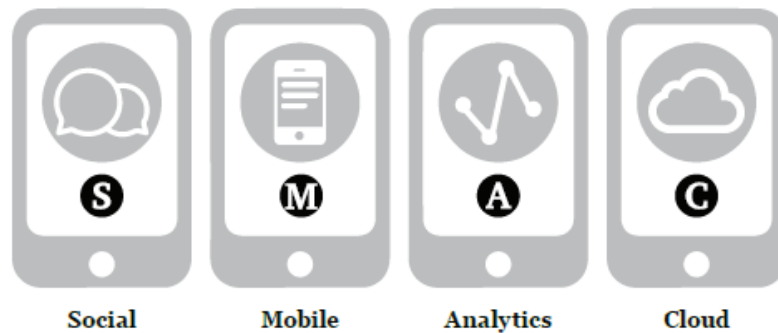
<sup>1</sup> United Nations Environment Programme. [http://www.unep.org/pdf/GI-REC\\_4pager.pdf](http://www.unep.org/pdf/GI-REC_4pager.pdf)

## 1.2 The digital revolution in the city

### *-The citizen is transforming digitally-*

The **degree of digitization of the economy and society** and the use of digital technologies are influencing the levels of well-being and development, as well as productivity and innovation, and is having important effects in terms of growth, income and employment. The **digital revolution** is transforming society. The pace of change is accelerating, the technological cycles are shortening and the traditional boundaries and borders are disappearing.

**Mobility and connectivity, collaborative society, cloud computing** and **big data** are some of the most important trends in the current digital economy and they are configuring the main levers of digital change



Levers of digital change

Source: Smart Cities La transformación digital de las ciudades.

PwC & IE Business School in collaboration with Telefónica

Technological advances are generating two new realities for citizens: **hyperconnectivity**, the result of the proliferation of connected devices, both between people and between machine-driven applications (Internet of Things - IoT) and a **collaborative society** with new relationship models and the creation of economic value.

At the end of 2014 the **number of Internet users** throughout the world totalled **3,000 million**. Two thirds of them live in developing countries. These figures correspond to **an Internet user penetration of 43% around the world**, 78% in the developed countries and 32% in the emerging countries. Over 90% of people who do not yet use the Internet live in developing countries.

The **world is increasingly mobile**. There are already 2,800 million broadband mobile accesses compared with 780 million households with fixed broadband. By 2020, 90% of the world population over 6 years of age is expected to have a mobile phone and more

than 90% of mobile accesses will be broadband. And this world is generating more and more information. Today, in just a few days, the same **amount of information** is generated by people and machines as that accumulated throughout history.

Moreover, the **collaborative society** paradigm is having an impact on the economy in a forceful way. There is no commonly accepted definition of the shared economy, but it can be said that its consumer society model is based on the exchange between individuals, upon agreement, of goods and services which previously remained idle or underused. Data and hyperconnectivity allow this change of paradigm.

The first consequence is that the productivity of the existing business models has increased. Beyond productivity, the shared society has facilitated the emergence of **new business models and new relationship models** which are considerably affecting cities. We can see examples in sectors such as the transport of passengers (e.g. Uber) and tourist accommodation (e.g. Airbnb). It is not just a matter of doing the same thing in a more efficient manner; the rules of the game are changing.

However, within this context, it cannot be forgotten that the **citizen is the most intelligent sensor**. A Smart City cannot be based solely on the technological capabilities of the companies integrated into the system or on the vision and ambition of urban managers. The Smart City needs to generate **civic commitment** in order to forge an alliance between the city and its interest groups and to ensure that citizens get involved, become committed and perceive their city as a common and exciting project of their own.

#### ***-An opportunity for the digital transformation of companies and administrations-***

Companies and governments have the opportunity to undergo digital transformation. It is possible to obtain a vision of the city to help the local authorities carry out a better urban management not only thanks to the information of **connected citizens**, but also by monitoring **social networks**. By using the information that the citizens provide, many critical situations can be managed in a more accurate way than when *ad hoc* sensors are used. Citizens may even contribute to the more efficient management of traffic, events, incidents in the public services and even natural disasters and emergencies.

In addition, **hyperconnectivity** is a result of the exponential increase of connected machines and devices. It is estimated that by 2020 there will be 50,000 million connected devices throughout the world<sup>2</sup>. This is the **Internet of Things (IoT)**

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<sup>2</sup> Source: Cisco. Internet of Everything. <https://www.cisco.com/web/about/ac79/docs/innov/loE.pdf>

The abundance of Internet-connected devices represents a formidable source of **feedback for a city**, its residents and its businesses, provided that the City is conceived **openly** and allows **interoperability, connectivity** and access to **open data**.

We can add two technological levers for companies and administrations to these citizen realities (hyperconnectivity and collaborative society):

- **Cloud computing**, which makes systems more efficient, reduces obsolescence and provides instant scalability in a model, where we pay for the capacity used, enabling the development of more flexible business models, which may involve both the citizen and the (large or small) companies, as well as the city itself.
- **Big Data**, which can offer intelligence **by the processing and analysis of large volumes of data from different (internal and external) sources** in an agile way and with reduced response times. The cost of compiling, storage and processing in terms of economic cost and time has been drastically reduced.

Every day we create 2.5 trillion bytes of data. 90% of the data in the history of the world has been created in the last two years. The real-time capability for the analysis of large volumes of structured and unstructured data has therefore become a key competence. This concept is also beginning to be applied to the whole economy in areas such as disaster management, health services and collaborative (crowd-based) projects.

The *open data* environment cannot be understood without the reality of *big data* and *cloud computing* and the possibilities they offer for real-time access to large volumes of data.

For the city leaders, the objective to be set is to **integrate** the enormous variety of data managed, in existing urban solutions and by citizens, **into the Smart City**. Fixed and mobile networks, water, power supply and traffic management networks are some examples of existing solutions which, when they are properly combined, represent an unprecedented data source. The challenge is compiling the information, filtering it, interpreting it and offering, in real time, the possibility of providing an appropriate response.

**These trends suggest we can move towards a future in which everything is smart and connected.** This includes cities, of course, but also the networks of basic services, households, businesses, energy, health services and transport. All these developments will facilitate the **transformation process of the city**.



### 1.3 Europe at the forefront

Europe is at the forefront of **quality of life in cities**. In general terms, European cities maintain a high quality of life as a result of their stability, high living standards, infrastructures and advanced public services infrastructures.

In the basic quality of life indexes, which take into account factors such as the political, social, economic and cultural environment, medical considerations, education, public services and transport, security, leisure, consumer goods, housing and the environment, **Europe has more than 15 cities among the 25 cities in the world with the best quality of life**. Oceania and Canada account for more than 5 and the rest are divided between Asia and North America, depending on the rankings.<sup>3</sup>



Highest-Lowest quality of living ranked cities.  
Quality of living worldwide city rankings 2015 – Mercer survey.

Europe has **good communications infrastructures and connectivity service penetration among users and companies**.

At the end of 2014 more than 216 million EU households (99.4%) had broadband access to at least one of the main fixed or mobile technologies (97% fixed broadband access).

<sup>3</sup> Quality of Living worldwide city rankings 2015 – Mercer survey. <https://www.imercer.com/content/quality-of-living.aspx>

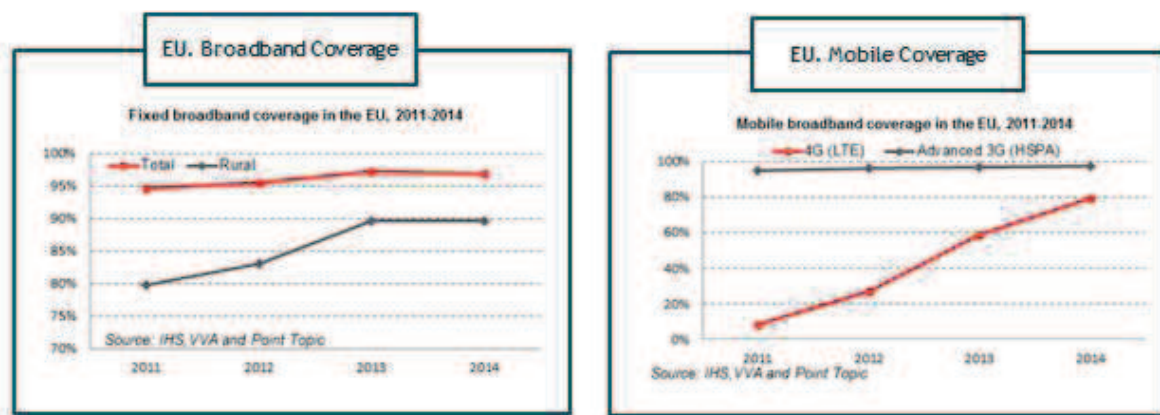
The Monocle Quality of Life Survey 2015  
<http://monocle.com/film/affairs/the-monocle-quality-of-life-survey-2015/>

Economist. The world's most 'liveable' cities.

Coverage of fixed new-generation access services totalled 68.1% of households in all the Member States of the EU.

The **penetration rates for mobile telephony in Europe** are among the highest in the world, both in terms of single subscribers (79%) (50% globally, 70% in North America, 52.3% in Latin America) and so is the **penetration of smart phones** (49%)<sup>4</sup> and, therefore, mobile broadband, although currently the greatest growth is in Asia Pacific, which is the world leader in new mobile subscriptions.

With regard to LTE, coverage in Europe has continued its rapid growth, rising from 59.1% to 79.4%<sup>5</sup>, although it still lags behind countries such as the USA, where there is more than 90% coverage.



Although European countries still lag behind in the adoption of LTE, compared with their counterparts from Asia Pacific and North America, some European operators have been able to promote the adoption of LTE thanks to the increased availability of devices and the re-farming of the spectrum.

Moreover, with regard to **M2M connections**, at the end of 2014 China was the largest cellular M2M market with 73 million connections or 30% of the global total. In Europe the number of connections exceeds 50 million, followed by the USA with 42 million connections and Japan with 11 million.

<sup>4</sup> Source: GSMA. The Mobile Economy 2015

<sup>5</sup> <https://ec.europa.eu/digital-agenda/en/news/study-broadband-coverage-europe-2014>

### ***1.4 Latin America, the digital transformation for overcoming challenges***

We are currently witnessing a **change of economic cycle in Latin America**. The slowdown and deceleration signals (lower prices of raw materials, rising costs of external financing, lower capital inflows, etc.) are already visible, adding to some structural problems in the region: low levels of productivity, high levels of inequality and shortcomings in infrastructure and security.

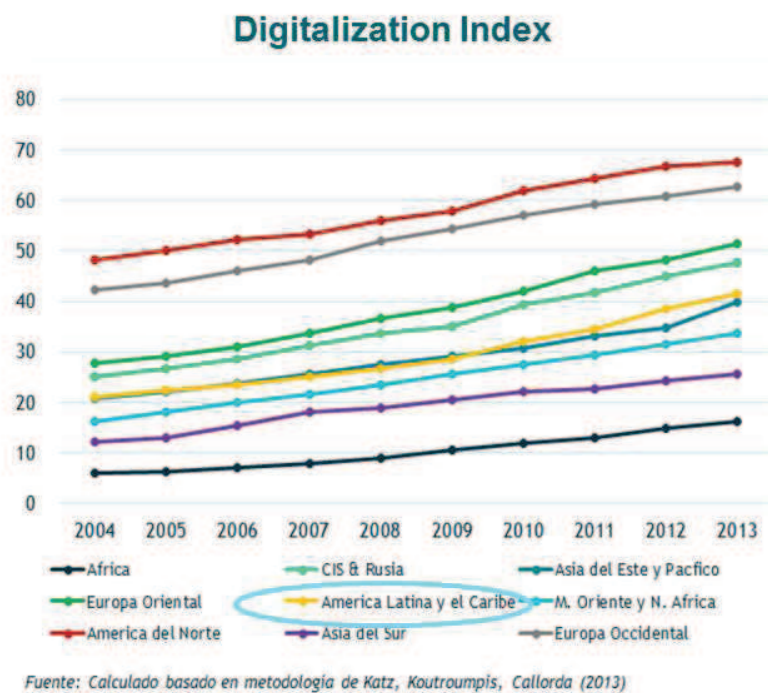
Within this environment, the need to undertake profound structural reforms is becoming a requirement to prevent the Latin American countries from falling behind. Among these reforms, it is important to ensure the **prioritization of the digitization of the region** so that Latin American countries can harness the enormous potential they have in terms of growth and employment, essential for reducing poverty and inequality.

The case of Latin America is no different from that of the rest of the world. If we examine the data for the region we can find figures which demonstrate the **wide interest of Latin Americans in joining the digital world**.

- The penetration of mobile connections is now greater than 100% (52.3% of single subscribers) in Latin America, while more than 30% of these connections have internet access;
- In just five years, from 2007 to 2012, the number of mobile accesses multiplied by 7;
- In 2012 Latin America led the world growth of Internet traffic with 48%, a figure much higher than those of Western Europe and the USA but also higher than those of Eastern Europe and Asia.
- Two of the countries with the highest number of Internet users are in Latin America: Brazil lies fourth and Mexico twelfth<sup>6</sup>.
- It has almost 130 million users of social networks. Five of the top ten markets in the social networks are located in the region. 78% of the connected population are users of social networks, a figure above those of Western Europe, with 54%, and North America, with 64%.

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<sup>6</sup> Internet World Stats, 2015



País	Índice (2013)
Argentina	49.30
Bolivia	27.97
Brasil	43.44
Chile	53.82
Colombia	43.56
Costa Rica	50.04
Cuba	18.83
Ecuador	44.63
El Salvador	38.66
Guatemala	27.16
Honduras	26.37
México	42.55
Nicaragua	25.25
Panamá	50.17
Paraguay	34.92
Perú	40.76
R. Dominicana	36.29
Uruguay	53.61
Venezuela	38.94

We can also find another great advantage of Latin America to deal with the crisis through **digitization**: its **population**. Latin America has a young population, much more permeable to technological advances. The above, together with the fact that, in Latin America, entrepreneurs are mainly young people, allows a new technological vision for Latin American companies and SMEs that fosters their access to the digital world.

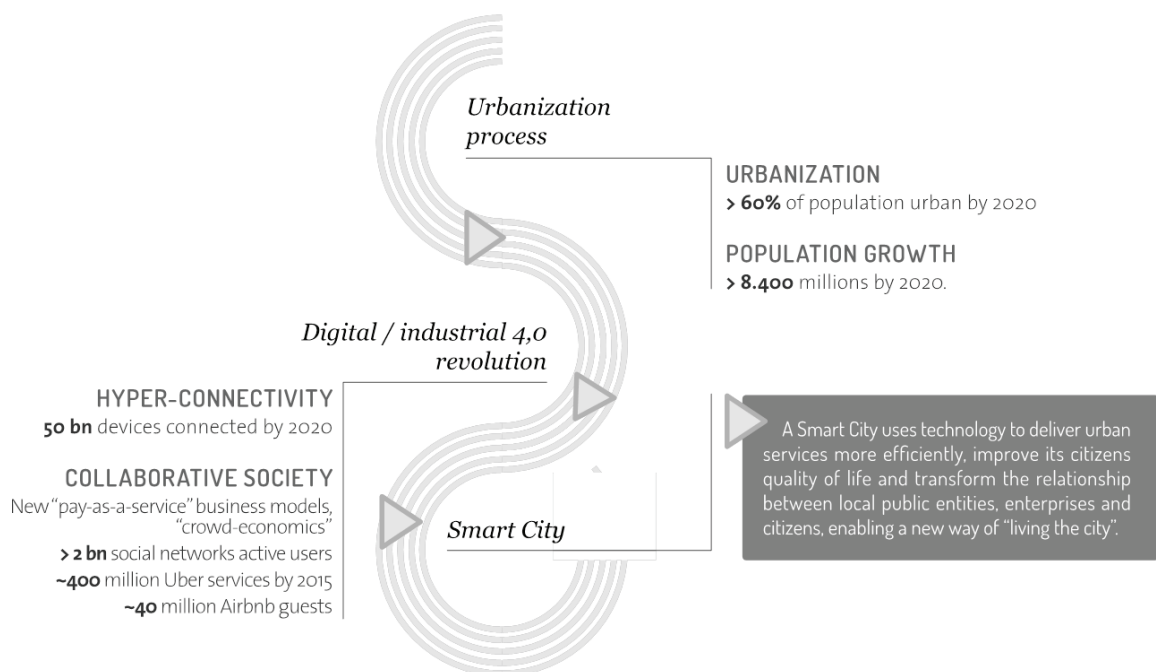
All the above contributes to the fact that the degree of digitization is growing rapidly in the region, **giving Latin America the opportunity to develop its digital economy and enjoy the related great advantages, where cities will play a key role.**

## 2. SMART CITY: THE RESPONSE OF THE CITY TO IMPROVE THE QUALITY OF LIFE, ECONOMIC DEVELOPMENT AND SUSTAINABILITY

### 2.1 What is a Smart City?

The **Smart City** is the response of our cities to the **confluence of the two aforementioned mega-trends**: urbanization and the digital revolution, which concur in time and space and generate the need to create a new concept of city.

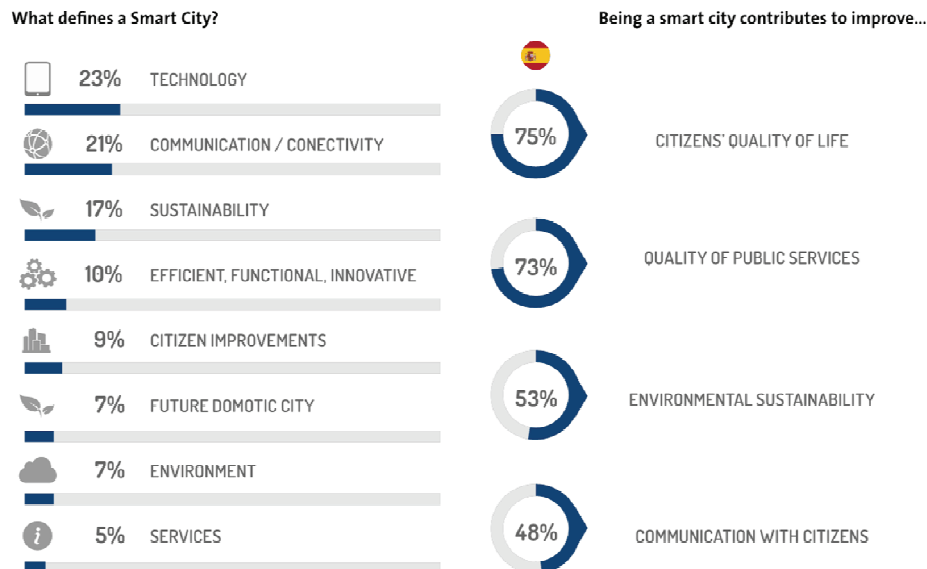
But the *Smart City* is not an end in itself. The *Smart City* is a means of **improving public services, the quality of life of citizens and transforming the relationship between local authorities, businesses and citizens, seeking a sustainable model.**



**Source: Smart Cities La transformación digital de las ciudades.  
PwC & IE Business School in collaboration with Telefónica**

In this sense, we can regard a **Smart City as one that uses technology** to provide more efficient urban services, improve the quality of life of its citizens and transforms the relationship between local authorities, businesses and citizens, providing a new way of living in the city. The differential element with respect to the previous situation is that technology, on this occasion, has a disruptive nature and alters the pattern of the relationships between the agents of the city: citizens, the productive sector, administration, etc.

**Citizens** perceive the concept of *Smart City* as being mainly linked to technology, connectivity and sustainability, with the objective of improving the quality of life, public services and the environment.



**Vision of the citizen regarding the concepts which define a *Smart City* and its objectives.**

**Source: Smart Cities La transformación digital de las ciudades.**

**PwC & IE Business School in collaboration with Telefónica**

In this sense, in order to identify the attributes defining a Smart City, AENOR in Spain has proceeded to analyse the existing definitions, identifying key terms.

Categorías	Palabras Clave	% ocurrencia
TIC, comunicaciones, inteligencia e información	11	26%
Infraestructura y servicios	9	17%
Medio ambiente y sostenibilidad	7	17%
Las personas, los ciudadanos, la sociedad	9	12%
Gobernanza, gestión y administración	7	10%
Economía y finanzas	4	8%
Calidad y estilo de vida	1	6%
Movilidad	2	4%
Total	50	100%

**Attributes defining a Smart City. Source: AENOR.**

We can observe the key role of **ICT** in a Smart City; **Sustainability** in aspects related to physical and logical infrastructures, the environment, society and the economy; improvement in the **quality of life** of citizens, not only in economic terms but also in promoting well-being, culture and social cohesion; **Governance** to promote the improvement and efficiency of public services. The goal is the **improvement** of economic,



social and environmental standards, using information and communications technology for the purpose.

In accordance with the above, AENOR defines *the concept of Smart City as below*: “A **Smart City** is a just and equitable city, focused on the citizen, a city which continuously improves its sustainability and resilience by exploiting its knowledge and available resources, especially information and communications technology (ICT), in order to improve the quality of life, the efficiency of the urban services and innovation and competitiveness, without compromising future needs in economic, governmental, social and environmental aspects.”

## 2.2 Smart city, in what fields?

### *-A Smart City in different vertical fields-*

The cities at the forefront of the concept of smartness are those which have successfully integrated the urban services into **smart sectoral systems** allowing the establishment of unified management formulas.

**Smart urban services** are a reality in consolidation phase. They are becoming common in all the cities. Thus, many of them already have services such as real-time information on bus arrivals, the detection and automatic processing of traffic offences, tele-care, video surveillance and many more. These are specific applications resolving well-defined problems.

But the **catalogue of smart urban services is spreading** in parallel with the investment in the necessary infrastructures (sensors, cameras, networks, data processing centres, software, etc.) for their implementation.

The traditional concept of Smart City can be broken down into **different areas**. The specific model, upon the basis of that adopted by the European Parliament (EU, 2014), can be broken down into six areas: *smart economy, smart governance, smart environment, smart mobility, smart society and smart living*, the latter of which can be divided into two fields: security, sanitation and health. While today there is broad flexibility in this type of classification, this is a general framework that companies and institutions are increasingly adopting.



These fields are defined by AENOR in the following terms:



The **Smart Economy** field groups together the attributes related to the ability of the city to develop in terms of employment and economic and financial growth. The Smart Economy seeks to increase productivity in the city by means of **efficiency** and the creation of new services and **business models** which encourage **innovation** and efficiency. A smart economy also implies a **local and global interconnection** between goods, services and knowledge.



The **Smart Governance** field groups together attributes related to the ability to efficiently administer resources, execute policies and suitably balance the interests of citizens, social organizations, companies and administrations. The main tool for achieving this is ICT, enabling the smart management of processes and interoperability between agents in order to share information, not only within the city but also with other national and international agents. Smart Governance means the **global management of services**, integrating government and public and private organizations so that the city can function efficiently and effectively as a single organism. A city with smart governance includes mechanisms to ensure a **fair, equitable and transparent environment, optimal and integrated management of the services** (e-government) and the **protection of information** as a fundamental right of citizenship.



The **Smart Environment** field groups together attributes related to the **environment**, the **physical structures** of energy, water and urban development, as well as the ability to be sustainable in its functioning at present and in the future. A smart environment includes mechanisms to ensure the harmonious development of infrastructures, designed to meet the needs of citizens, ensuring the preservation of the environment for future generations and access to and enjoyment of urban space for society.



The **Smart Mobility** field groups together attributes related to transport and logistics. For example, integrated, interconnected, efficient and sustainable systems of public transport and real-time information systems for citizens. Smart mobility means the safe, efficient and sustainable management of logistical and transport systems to facilitate citizens' **access, use and enjoyment of the urban space**, promoting the **efficient mobility** of people and access to all services, particularly citizens with **disabilities**. Smart Mobility prioritizes access to **affordable and ecological transport options**, saves **time** for citizens on their journeys, reduces **costs** and decreases contaminating **emissions**.



The **Smart People** field groups together attributes related to the human capital of the city, **education, social inclusion and citizen collaboration**. A smart society is characterized by enhancing the education and creativity of citizens, respect for plurality, the social inclusion of the most disadvantaged members and the active participation of citizens in decisions which affect them.



The **Smart Living** field groups together attributes related to improving the **quality of life of citizens** and their lifestyle in **physical and material** terms (health, safety, housing, income) and **social terms** (culture, family, associations, personal development) in order to promote innovation, education, social cohesion and citizen collaboration. Smart Welfare means how the citizens or inhabitants of a city perceive their quality of life. A Smart City is characterized by being a desirable place to live and work, promoting initiatives for the well-being of citizens in all aspects: environmental well-being, such as urban infrastructure, housing and security, and social well-being, such as the promotion of culture, leisure and responsible consumption.

### **-A Future beyond the vertical areas: integration and a shared horizontal vision-**

But, **beyond the vertical solutions**, the challenge is to tear down the functional silos and **integrate all the sectoral systems into a horizontal platform for integrated city management**, thereby overcoming a fragmented model of sectoral applications working in watertight compartments without any connection with each other. The future is based on intelligence shared by all the agents in the ecosystem, whereby the city platform behaves as a facilitator of collaborative solutions and as the **centre of an innovative ecosystem**.

This is the great issue on which efforts will focus in the coming years and about which many doubts and questions are being raised. **The platform is thereby configured as the technological heart of the Smart City.**



"Vertical" organizational model

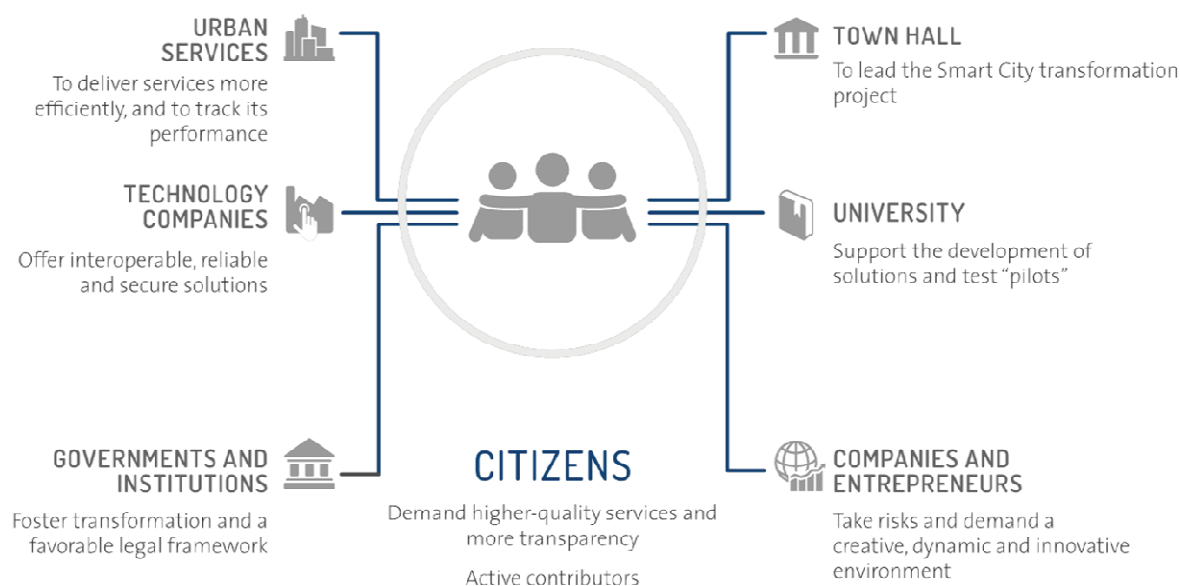
Open platform as the technological heart of the smart city



"Cross" organizational model with strong leadership, integrated and horizontal view

But, why is it so difficult to create a comprehensive management platform? To successfully execute the change, it is important to have a **shared consensus vision of the city among all the participants in the ecosystem and a long-term plan of action.**

## ECOSYSTEM



**Ecosystem of value agents in the *Smart City*.**

**Source: Smart Cities La transformación digital de las ciudades.**

**PwC & IE Business School in collaboration with Telefónica**

Today, the sectoral systems are not yet consolidated and their **integration** into a single platform faces **barriers which are, not only technological, but also political and organizational**, inasmuch as they entail a new way of organizing the management of the city.

### **2.3 Smart Cities in Europe, Latino America and the World**

In this scenario of gradual assumption of commitments to improve urban services via digitization, what are the most advanced cities doing? What meaningful experiences can be transferred to our city halls?

#### ***-City initiatives-***

The most advanced cities have traditionally been **medium-sized cities**, with a peripheral position and some administrative autonomy, which has allowed them to have the resources to focus on excellent urban management. This is the case of cities like Singapore<sup>7</sup>, Amsterdam<sup>8</sup>, Hong Kong, which repeatedly appear as benchmarks in urban management and which are pioneers leading the way towards the *Smart City*.

However, another generation of cities leading innovation in *Smart Cities* has more recently appeared: the *Smart Labs*, which share being settlements on a smaller scale (small town, neighbourhood, district, etc.) and being newly-created, allowing an urban design specifically tailored to their technological potential.

This innovation in medium-sized cities and **Smart Labs** is being quickly adopted by the global urban leaders (**global hubs**), which are aware of the importance of technology applied to the city to maintain its position at the forefront of the global urban hierarchy.

For it, they have the resources and the political priority and they are cities which host the political and economic decision-making centres. Against them, there is their large scale and a greater rigidity resulting from the need to maintain pre-existing structures.

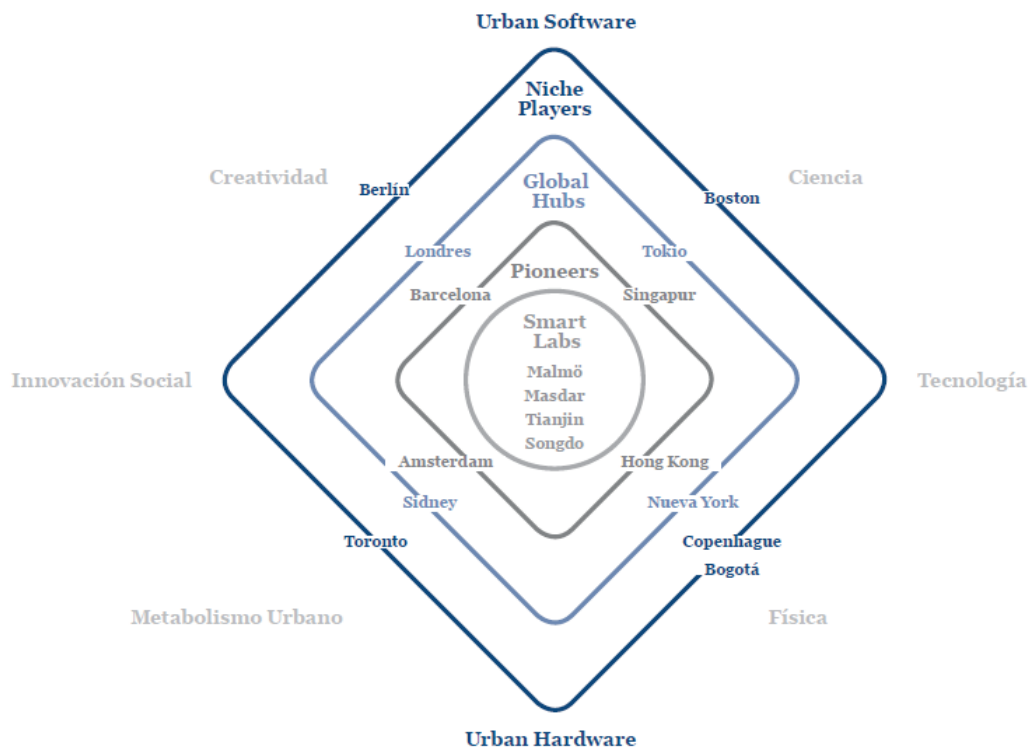
London, Tokyo, Sydney and New York are global leading Smart Cities, attempting to strengthen their competitive advantages in the global urban arena, adapting social innovation centres, nuclei of scientific creation, sustainable and liveable spaces and hubs equipped with fluid mobility.

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<sup>7</sup> Singapore. e.g. Driverless vehicle initiative. Oct 2015 <http://www.reuters.com/article/2015/10/13/us-singapore-transport-driverless-idUSKCN0S60SZ20151013>

<sup>8</sup> Amsterdam Smart City <http://amsterdamsmartcity.com/?lang=en>

Finally, the second-degree urban centres are attempting to adapt these models to their regional peculiarities and **specialize (*niche players*)**, such as the creative city (Berlin), the city of science (Boston), sustainability in resource management (Toronto) and sustainable mobility (Copenhagen).



**Map of types of Smart Cities**

**Source: Smart Cities La transformación digital de las ciudades.**

**PwC & IE Business School in collaboration with Telefónica**

Moreover, cities like Santander, Barcelona, Valencia and Madrid have developed pioneering experiences of urban transformation, which can be regarded as successful and that are recognized as global benchmarks. As a result, **Spain is at the international forefront of Smart Cities.**

In Latin America there are examples of “Projeto Cidade Digital” (Digital City Project) with pilot schemes such as the city of **Aguas de San Pedro (Sao Paulo)**, whose aim is the modernization and digitization of public services. They will serve as a model for the execution of similar projects in other regions of Brazil. The transformation process is in full swing and goes beyond the modernization of connectivity and voice services, as it also covers the deployment of 20 different digital solutions in the areas of education, health and public administration.



All Cities and territories basically face the same problems, their citizens have the same needs and local governments seek to provide similar services. As a consequence, **international initiatives led by the cities have emerged, such as OASC (Open and Agile Smart Cities)<sup>9</sup>**, whereby cities are associated to strengthen **standards (based on FIWARE) facilitating the interoperability of applications and their portability to multiple cities**, as well as the sharing of experiences and services and best practices.

**This initiative, which is less than 9 months old as of November 2015, and which we will mention later, involve more than 70 cities in 15 countries**, mainly European – including Valencia, Santander, Málaga, Seville, Sabadell and Guadalajara in Spain and several cities in Europe and Latin America like Amsterdam, Helsinki, Dublin, Copenhagen, Aberdeen, Dundee, Edinburgh, Glasgow, Inverness, Perth, Stirling, Rio das Ostras (Rio de Janeiro), Olinda (Recife), Anapólis (Goiás), Porto Alegre (Rio Grande do Sul), Vitória (Espírito Santo), Colinas de Tocantins (Tocantins) and Taquaritinga (São Paulo), etc. all seeking to create a market for smart cities.

#### ***-Regional initiatives-***

The **European Union** is spending billions of euros (113,000 million euros **until 2012**) **on the development of innovative projects and R&D, within the framework of Horizon 2020, many of which are conducted within the framework of Smart Cities<sup>10</sup>**. Some of the most important projects aim to develop **common platforms and services** at a European level, to enable the deployment of Smart Cities and the provision of services based on the Internet of the Future. The recommendations for using the FIWARE platform in the projects within the Horizon 2020 program, endorse the above<sup>11</sup>.

Smart cities are therefore used as a vehicle for achieving the European objectives for 2020, particularly in the fields of energy (*Smart Environment* and *Smart Mobility*), digital education (*Smart Economy* and *Smart Society*), Society (*Smart Governance* and *Smart Welfare* with initiatives to improve the quality of life, connectivity, open data and e-government), Growth and innovation (*Smart Economy*).

From a European perspective, **51% of cities with over 100,000 inhabitants have implemented initiatives in some of the defined areas** (mainly in *Smart Environment* and

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<sup>9</sup> OASC (Open and Agile Smart Cities) <http://connectedsmartcities.eu/>

<sup>10</sup> *Mapping Smart Cities in the EU. 2014.* <http://www.smartcities.at/assets/Publikationen/Weitere-Publikationen-zum-Thema/mappingsmartcities.pdf>  
*Emerging Technologies and Infrastructures. DG INFSO. Smart Cities & the Future Internet organised by Fireball, Eurocities and ENoLL on January 25th, 2012. Mario Campolargo*  
<http://www.slideshare.net/openlivinglabs/mcam-eurocities-25-january-2012-final>

<sup>11</sup> For example, see the introduction in [http://ec.europa.eu/research/participants/data/ref/h2020/wp/2016\\_2017/main/h2020-wp1617-leit-ict\\_en.pdf](http://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-leit-ict_en.pdf)

*Smart Mobility*). However, it is very unequal among countries, with Spain, the UK and Italy being the countries with the highest number of cities with some Smart characteristics and Italy, Austria, Denmark, Norway, Sweden, Estonia and Slovenia being the countries with a higher percentage of cities classified as “smart”.

The most successful projects tend to have a global vision of the city and are set up by means of public-private partnerships. Moreover, initiatives involving international companies providing technology tend to benefit more from the scalability and cooperation between cities.

In the referred European study<sup>12</sup> a series of recommendations for action are defined in five areas for the promotion of Smart Cities:

- ***Understanding of Smart Cities.*** Research and evaluation. Determination of case studies, benchmarking and best practices and establishment of metrics.
- ***Design of initiatives and strategies for Smart Cities.*** Establishment of guidelines, strategies and procedures, in particular conditioning aid.
- ***Governance.*** Development of European platforms, promotion of low-cost infrastructures and priority for public-private partnerships for both funding and governance models.
- ***Support for the development of Smart Cities.*** Stimulation of demand and use of pro-competitive mechanisms.
- ***From Smart City to Smart Europe.*** Enhancing the scalability, replicability and promotion of the growth of the ecosystem, developing PPP projects, grants to communities and innovation and by disseminating good practices.

Spain, as mentioned above, is a leader in Smart Cities. This initial leadership already has significant institutional support. Organizations such as the **Spanish Network of Smart Cities (RECI)**<sup>13</sup>, which groups together more than 60 cities, and the standardization efforts of the **Spanish Association for Standardization and Certification (AENOR)** are providing continuation to the EU-funded projects with the support of the **National Plan for Smart Cities, with a budget of 188 million euros**, conducted by the Secretariat of State of Telecommunications and the Information Society (SETSI).

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<sup>12</sup> *Mapping Smart Cities in the EU. 2014.* <http://www.smartcities.at/assets/Publikationen/Weitere-Publikationen-zum-Thema/mappingsmartcities.pdf>

<sup>13</sup> Spanish Network of Smart Cities (RECI) <http://www.redciudadesinteligentes.es/>

As for the **American Administration**<sup>14</sup> it has launched a project to promote Smart Cities in September 2015, with a budget of \$160 million, focused on the following strategic areas:

- ***Creating “Test beds” or “living lab” of the Internet of Things.*** *American Administration* indicates that the USA has a chance to become the leader in this field and that its cities have a high potential as living labs for these technologies. The successful deployment of these technologies is based on collaboration between agents.
- ***Collaborate with the movement of technological civic participation and forge cooperation between cities.*** These initiatives will allow the resolution of local problems directly and leverage the use of data for the development of new capabilities and participation. Collaboration between cities allows replicating the best practices.
- ***Leverage existing government actions:*** From R&D into sensors and cybersecurity to investments in broadband and transport, aspects which form the basis for Smart Cities.
- ***Promoting international collaboration.*** The products and services developed in this area represent an opportunity to export technology and solutions, given that 90% of urban population growth will occur in Africa and Asia.

In Asia, **Korea and Japan** are developing Smart City strategies, the first with the Smart Plan initiated in 2010 to interconnect the infrastructure and the second to use technology to address issues such as the impact of ageing, society, health, lack of energy resources and environmental sustainability and public safety.

In developing countries we should highlight the initiatives in **India** and **China**. India plans to invest 66 billion euros in the development of seven Smart Cities along the Delhi-Mumbai industrial corridor, with a public-private program (80%) linked to investment in publicly-funded infrastructure (20%). China is pursuing a Smart Cities strategy as part of its efforts to stimulate economic development and eradicate poverty. The program seeks to attract rural workers to Smart Cities, which can serve as centres of urban employment.

**Latin America** is beginning to develop certain projects based on Smart Cities. An example of cooperation is the agreement signed by Telefónica with the Polytechnic School of São Paulo (USP), also involving the Polytechnic University of Madrid (UPM), for the development of Smart City pilot projects. The agreement envisaged the creation in 2015 of a laboratory to develop and implement pilot projects in the field of Smart Cities. These projects are mainly focused on providing solutions in the area of the public lighting of cities, and will be extended later to management and sustainability in the areas of security and energy.

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<sup>14</sup> <https://www.whitehouse.gov/the-press-office/2015/09/14/fact-sheet-administration-announces-new-smart-cities-initiative-help>

In addition to the initiatives of cities and governments, certain private initiatives emerge, such as the one proposed by Google, planning the city as the centre of an ecosystem through its **SideWalk Labs Initiative**<sup>15</sup> launched in 2015.

**In short, cities, governments and the different agents are turning to the city as the heart of a digital transformation ecosystem and as enhancer of a sustainable economic development.**

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<sup>15</sup> *“Sidewalk will focus on improving city life for everyone by developing and incubating urban technologies to address issues like cost of living, efficient transportation and energy usage” [said](#) Google co-founder Larry Page [...] “We are at the beginning of a historic transformation in cities,” *We are at the beginning of a historic transformation in cities*,” Doctoroff said [now CEO of SideWalk labs and previously CEO of Bloomberg and Deputy Mayor for Economic Development of New York] in a [press release](#). “At a time when the concerns about urban equity, costs, health and the environment are intensifying, unprecedented technological change is going to enable cities to be more efficient, responsive, flexible and resilient.”*

<http://www.smithsonianmag.com/innovation/whats-deal-googles-sidewalk-labs-180955847/?no-ist>

### 3. THE CITY AS A PLATFORM FOR DIGITAL SERVICES: THE DIGITAL ECOSYSTEM OF THE CITY

Cities have always been able to adapt to the new challenges demanded by their citizens. Now it is time to address the **new digital ecosystem** of cities in order to respond to the new **digital environment** where its citizens are immersed.

The digital revolution will allow the **Smart City to be the centre of a new, innovative and entrepreneurial digital ecosystem**, expanding and making the information of citizens and organizations smart.

#### *3.1 Platform and Ecosystem, two related concepts. Open platform to foster a digital ecosystem.*

The planning of services **evolves into a collaborative model arising from the citizens ("bottom up")**, set against a model of centralised planning by the administration.

##### *- The evolution from isolated vertical solutions to a city platform.*

The city has the opportunity to **promote an ecosystem** so as to improve and optimize its existing services and encourage the creation and design of future services, while fostering the innovation and development of its organisations. **The city takes on a new role in this scenario: ecosystem management through the regulation, procurement and creation of the infrastructures that foster innovation and investment.**

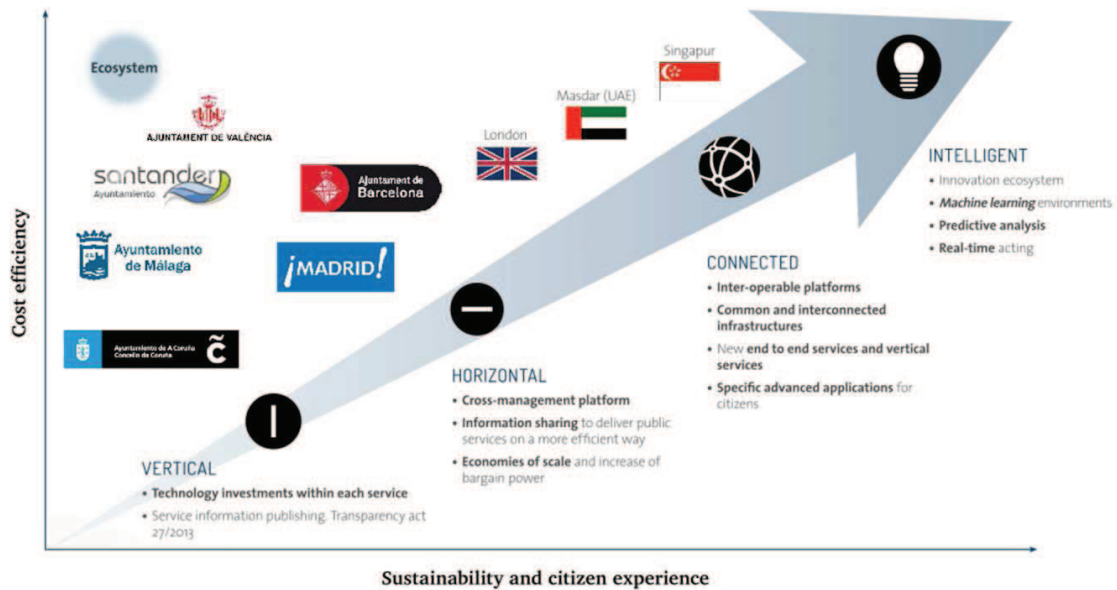
At present, most "Smart" cities have a vertical vision, mainly promoting greater efficiency in the provision of certain urban services. While each city plan differs, depending on its initial situation, its roadmap and the demands of their citizens, experts highlight four common phases **in the evolution towards a comprehensive, collaborative Smart City as the centre of an ecosystem.**

The four phases are defined and developed as follows:

1. **Vertical.** This involves the introduction of technology into the different urban sectoral and vertical services (management of water, waste, mobility, etc.).
2. **Horizontal.** The second stage is characterized by a horizontal vision with a platform integrating different services.
3. **Connected.** In this third phase, the goal is to have an interconnected city. Once the city has digitized its services and has implemented a horizontal solution, it must

interconnect the city, the citizens, the urban services, the universities and, ultimately, the entire local network.

4. **Smart.** In the most advanced phase of the Smart City's evolution model, the managers make decisions predictively and provide citizens with **city platform infrastructures** and **Open Data** with which all the agents in the ecosystem can participate in collaborative solutions, based on the **open platform infrastructure**. **The platform infrastructure is an enabler of new business models.**

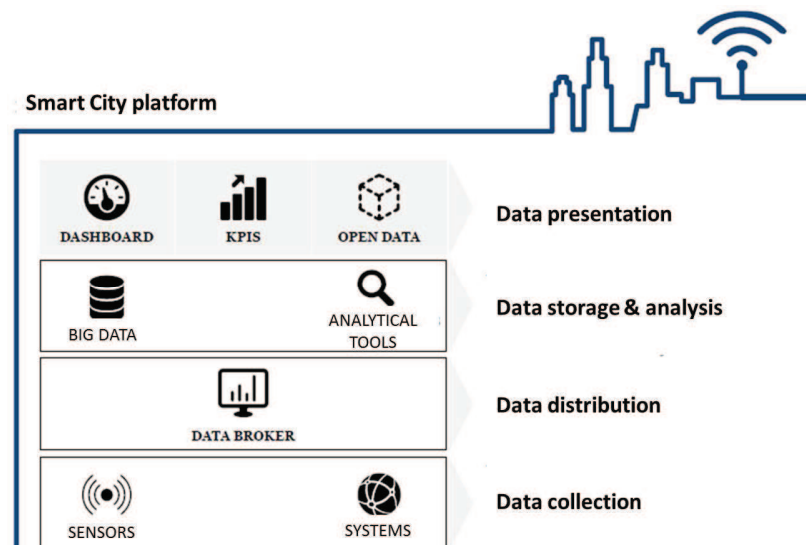


Smart City evolution model

Source: Smart Cities La transformación digital de las ciudades.

PwC & IE Business School in collaboration with Telefónica

The current models of platforms are based on the availability of a number of functions for the integration of data and their analysis, as well as certain KPIs, for **vertical solutions**.



Conceptual model of the *Smart City* platform.



Source: Smart Cities La transformación digital de las ciudades.  
PwC & IE Business School in collaboration with Telefónica

A **horizontal** platform must be able to integrate different solutions from the providers of each vertical service and ensure their interoperability, integrating different technologies, devices and systems through standards and integration APIs.

**Technological ecosystems are generated around a platform and the autonomous applications relying on it.** The generation of an ecosystem with autonomous agents is promoted inasmuch as the **platforms are open and it is simple to connect and build on them.** The interaction can lead to an increase in the value of all the agents and services.

An **integrated Smart City Platform** cannot be, despite its horizontal vocation, a simple addition of the smart sectoral systems integrated into it. In the opinion of the experts there are a number of requirements for the platform architecture which facilitate the growth of a sustainable ecosystem around it: being **open, standard, horizontal and scalable.**

...“STANDARD”	...“HORIZONTAL”	...“SCALABLE”
<b>Convergence</b> with European standards  <b>Open</b> , avoiding being captive by closed platforms  <b>Accessible</b> , enabling access to data by third parties  <b>Modularity</b> , enabling re-utilization	<b>Horizontality</b> , integrating different services and solutions from service suppliers  <b>Interoperability</b> , integrating different technologies, devices and systems	<b>Cloud</b> , easily scalable  <b>Service models</b>  <b>Robust</b> to failures  <b>Adaptability</b> to technological changes  <b>Security and privacy</b>

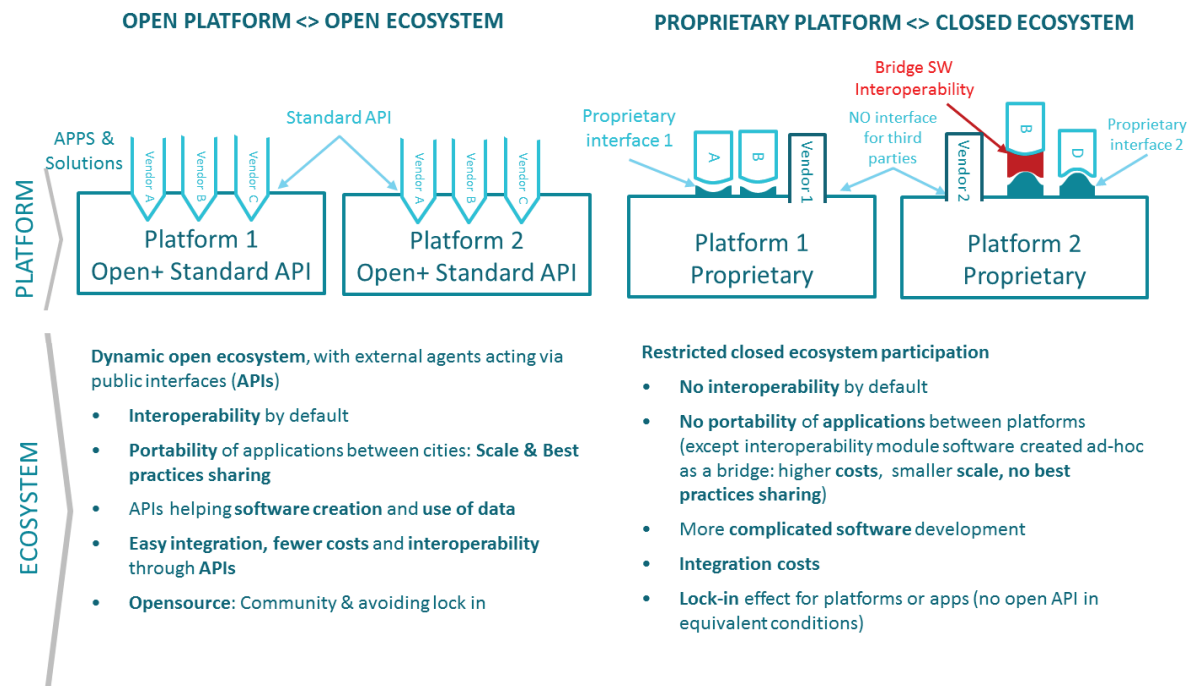
Summary of the platform requirements mentioned by the experts.

Source: Smart Cities. La transformación digital de las ciudades.  
PwC & IE Business School in collaboration with Telefónica

*-The open platform, much more than interoperability-*

An **open platform** is defined as one allowing external agents to interact with it **via public (non-proprietary) interfaces (APIs)** and which have ideally been defined by a reputed and impartial standardization body.

An **API** (application programming interface) is a set of software routines allowing the independent development of an application for the platform upon which it is based. This allows the **portability** of the software. A good API makes it easier to develop a program, by providing all the building blocks. Programmers then use these blocks and information to build their applications.



**Platform and ecosystem: two related concepts.**

**Open platform to foster a digital ecosystem.**

Some important issues when publishing an API are the stability of the interface and the availability of all access options onto the platform. The modifications in parts of the API, for example by adding new parameters, could damage the compatibility with the clients depending on that API. A delay in the provision of these interfaces could, in turn, generate a competitive disadvantage. Hence the importance of promoting an **open platform**.

Thus, the collection, management and publication of the data which can be public (i.e. **Open Data**) is uncoupled from the final service relying on such data. In many cases an external agent may be able to provide a more attractive final service than the producer of the data himself.

**Open standards tend to generate a free and highly dynamic market** because, as there are no restrictions on their use, others may build upon them, and so on. This is the case of the most common standards on the Internet. An open standard means that licences will be available free of charge, according to most definitions, such as the European Interoperability Framework.

An additional aspect of greater openness is having specifications with a reference implementation available under **an Open Source licence**. On the one hand, this allows specifications without ambiguities (it is always possible to check how an API has been implemented and how it works, for example). On the other hand, it facilitates the emergence of alternative platform suppliers in the marketplace, avoiding a single vendor or vendor lock-in. Indeed, any agent can build an offer based on the reference implementation and resume the management, development and maintenance of a platform, thanks to the rights of access and modification of the code, granted by these licences.

The adoption of an **open platform standard**, especially at an API level, is a key objective which goes a mere **interoperability** between applications. Although the goal of both is to provide an exchange between the information systems, the mechanisms to achieve this objective differ. Interoperability between applications, even when supported on distinct platforms, is feasible if an ad hoc bridge is developed between them.

In other words, the **open standards entail interoperability by definition or design**, while interoperability does not: it needs to be developed at a later stage, as a means of exchange between two or more products with customised software.

In addition, alternative developers may be forced to adapt their system to a dominant product or platform, or the platform owner may delay the cooperation if, for example, there are network effects favourable to them.

**Open platforms therefore facilitate a thriving ecosystem around them**, where third parties can develop services that can be transferred to other cities, without tailored adaptation. These platforms are essential for the creation of an increasing market with multiple customers, attracting investment from developers of applications.

### ***3.2 The City as a laboratory for new technologies (Living Labs of IoT) and the centre of an entrepreneurial ecosystem (Tech hubs)***

The development of the so-called Internet of Things - IoT - together with the Big Data services in the cloud will allow a new **generation of innovative services** transforming the life of individuals and businesses.

#### ***-The city as a Living Lab for the Internet of Things-***

**Smart Cities and the Internet of Things are two inseparable concepts.** Providing cities with technology facilitates, not only communications between their inhabitants, but also **connectivity between machines and devices over the Internet.**

**Cities become smarter through the deployment of smart infrastructures,** deploying for example, ubiquitous **sensors** allowing the monitoring of municipal facilities, or communications and wireless systems detecting available parking spaces and other systems for the management of lighting or the measurement of atmospheric and environmental conditions.

But we also find that **citizens and companies can form an active part** of the Smart City, not only by participating in its design, identifying needs, setting priorities and promoting initiatives, but also from a technological point of view, shaping a **human network of sensors** and **developing solutions for a broad market.**

The connected city generates an enormous amount of **information** helping smart decision-making and the implementation of more services for the city and its citizens. The true value of the Internet of Things lies in its applications, which, ultimately, are a result **of what we decide to do, among other things, with the vast amount of information captured in the Smart City.**

The city therefore offers an **opportunity to experiment and innovate in the field of Internet of Things or advanced communications** and in areas such as **privacy** and **security** policies, in a **real world**, allowing **rapid learning and adaptation.** This is what is called a **Living Lab.**

Cities become **living labs** and technology demonstrators, developing a supply of technological services, encouraging demand and the adoption of new solutions to improve citizen satisfaction and allowing the creation of new business models. They thus enable the generation of **leading companies both in the supply and the use of Internet of Things solutions, solutions that may be used in the industry and other countries.**

### ***-Tech Hubs: The city, heart of an entrepreneurial ecosystem-***

The city is also a **niche for entrepreneurs**. As we have seen above, ecosystem and platform are two related concepts. The existence of **connectivity infrastructures, available data on the city and an open and updated platform** is necessary for the so-called “Open Innovation”<sup>16</sup>

“Open innovation” is an innovation strategy whereby organizations go beyond internal limits and **cooperation with external agents takes on a fundamental role**. Within the context indicated above, this means combining internal with external knowledge in order to push through technological projects and commercialising solutions. This kind of innovation is the so-called **collective intelligence**.

Smart City and Living Labs concepts provide an opportunity for **experimentation** and stimulation **of new products and services** for a **broad market**. These products enhance the quality of life in the city and contribute to overcoming the challenges of the city, as well as challenges associated with the possibilities offered by the use of Internet of Things in different fields (e.g. home, industry, etc.).

An additional stimulus is possible thanks to **start-up accelerator programmes** (e.g. *Civic Accelerators*), **competitions for ideas and applications** (e.g. *Hackathons*), the availability of **open data** on the city, **crowdsourcing** or the use of the community for the development of services or completing data<sup>17</sup> (e.g. Wikipedia), “**embedded**” **agents or trainers** for the development of an innovation culture and knowledge development, as well as the sharing of best practices and applications between cities (e.g. *Code for Europe*)

This environment, in turn, facilitates the dissemination of new **digital skills**.

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<sup>16</sup> Open Innovation. A term coined by [Henry Chesbrough](#)

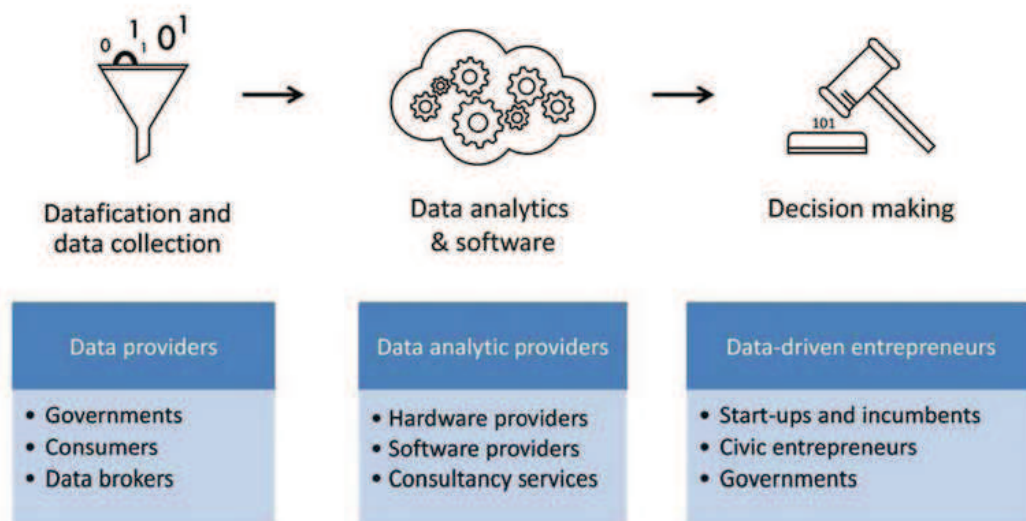
<sup>17</sup> In Helsinki, for example, different people from “Code for Europe” have created an application for cataloguing the artworks available at a public gallery. As citizens see the new works of art which have yet to be categorized, they add descriptions to the images. The application works by adding these data and generating a permanent label after a series of matching descriptions, thereby identifying them.

### 3.3 Open Data. Data-driven innovation as a driving force of growth.

Recently the OECD<sup>18</sup> published a report on **data-driven innovation for growth and well-being**.

The OECD estimates that the **market for public data** was about \$111,000 million in 2010 and that the potential of the applications based on them was about **\$500,000 million**, while a further \$200,000 million could be achieved by eliminating barriers, promoting digital skills and providing suitable infrastructures. SMEs would benefit most from the free use or the use at marginal costs of data.

The study shows **the main phases of the data value chains** and the **agents** involved. Phases range from “datification” and collection of data (whereby the data providers may be governments, consumers or intermediaries) to analysis and, finally, decision-making or the generation of value propositions (by individual companies, particularly start-ups and governments).



**Main phases of the data value chains and the main agents**

Source: OECD

The OECD offers a series of recommendations to maximize the benefit of data usage and mitigate risks. It aims to **encourage a policy of open data in society**, building confidence and fostering the principle of non-discrimination in their use.

<sup>18</sup> OECD. 6 Oct 2015. Data-Driven Innovation for Growth and Well-being. <http://www.oecd.org/sti/data-driven-innovation-9789264229358-en.htm>



**The city is an ecosystem where all of these agents are involved, having access to endless data.**

The provision of third-party information (**open data: data sets**), opens up new models, based on the participatory economy and entrepreneurship. And that through the provision of suitable infrastructures for third parties, due to which the information can be exploited to create new services: information that the city, and also third parties, can publish and consume. This is the “**Economy of Data**”.

In this case, **the city acts as a platform**, providing citizens and companies with valuable data collected from the entire ecosystem, which will enable the development of new services based on entrepreneurship and the collaborative economy.

The provision of **data poses some problems**. A Smart City has a large number of data streams. Smart sensors measure the energy use, and there is varied information coming from the cameras of the city, the user applications and the mobiles or the banks. There are more and more discussions about the “**ownership of the data**” and who can gain access to them. The “*Amsterdam Smart City*” program suggests, for example, that the data are owned by the person or company which generates them. Companies (and governments) should not share the data of a single person or group without the user’s explicit consent. Users must also be able to understand their available data existing as far as possible. This is a public policy issue.

**Privacy and security** are aspects to be addressed and Smart Cities provide the opportunity to make **governments pioneers and leaders in the use of data**. For example, Singapore has appointed a “data tsar” to ensure the protection of its citizens’ information.

**Open data and Big Data are terms linked to the concept of Smart City**. In an environment of transparency and participation such as the one promoted by a *Smart City*, the need to open up the information **to help the ecosystem develop new business models and innovative initiatives** for the city is more necessary than ever.

To enable this data economy to become a reality the data must be open but, above all, they must be **reusable, which entails the need for formats allowing interoperability between services and cities and open platforms**.

Finally, by providing municipal information to agents, **participatory democracy is facilitated**, increasing **transparency** culture and allowing the emergence of **new services and companies**.

#### 4. THE OPPORTUNITY FOR EUROPE TO HAVE A DIGITAL SINGLE MARKET OF APPLICATIONS AND SERVICES FOR CITIES

Europe has the **opportunity to repeat the success of the GSM standard**, developing a **digital single market of applications and services for cities, through an open platform**.

*Josep-Ramón Ferrer, former director of Smart Cities and ICT strategy of Barcelona City Council conceives “the Smart City of the future as a smart phone with its operating system and apps. Every smart phone represents a city equipped with an operating system which allows the development of solutions and apps, collaboration and communication in such a way that information and solutions are shared by cities”. He also predicts that “within 5 to 7 years there will be 2 or 3 city operating systems, just like the operating systems of smart phones with marketplaces where companies and entrepreneurs will be able to offer their applications and solutions”.*

**4.1 A Digital Single Market for cities by means of open platforms: The need for a digital city standard to achieve scale.**

**-A city is not a market, but Europe is-**

To make this possible Europe must **promote an open platform**, thereby generating the necessary **scale** and fostering the **creation of ecosystems** in which solutions arise not only from the city but also from organizations and citizens.

A reasonably-sized city is a necessary but not sufficient condition. The best practices in *Smart Cities* do not necessarily take place in the largest ones, although at the moment the international vanguard is located in large and medium-sized cities. This is facilitated by the fact that the **investment necessary for the implementation of services requires a critical mass** which is currently difficult to achieve in small and medium-sized cities.

Within this context, it is important to take into account that **a city does not configure a sustainable Market in itself** and that competitiveness will come from the scale and the possibility that the services developed can be scaled and transferred to other cities.

Achieving scale means transforming a small initiative into a larger one, moving up from single-city projects to multi-city projects, shifting to a national, regional and global scale by means of platforms with characteristics providing scalability, the transferability of solutions and the generation of ecosystems.

A horizontal platform must be able to integrate solutions from the different providers of each vertical service and ensure the interoperability and portability of applications,

integrating different technologies, devices and systems by means of its range of standard APIs.

Cities need interoperability between services to generate transversal solutions. But, even more, they need to develop an **open-platform standard** to promote **competitiveness** and the appropriate **scale**, giving rise to an **attractive market for European developers**, enable the **sharing of best practices and reducing the costs** of providing the services which are not tailored to each city, increasing development and integration costs and preventing a lock-in and the consequent increase in maintenance costs.

### *-A European ecosystem for entrepreneurship based on cities-*

The competitiveness of the European economy depends on the **generation of living ecosystems for entrepreneurs**, favouring entrepreneurship with newly-created companies (start-ups) and small and medium-sized enterprises (SMEs). This will lead to the generation of new world leaders based in Europe, encouraging the digitization of the economy and promoting competitiveness.

Europe is becoming a more welcoming environment for entrepreneurs although, unfortunately, the **global ecosystem provides less support** for the creation of new companies than, for example, United States, where universities, investors, etc. also form part of the ecosystem and where the availability of a sufficiently large market facilitates expansion. To build this type of ecosystem **Europe should increase its efforts to facilitate the creation of start-ups, improving their ability to grow and innovate and keeping them in Europe.**

**Europe wishes to promote innovation and entrepreneurship.** ICT is responsible for half the increase in productivity in the EU and the digital sector is expected to grow seven times faster than the overall economy in the EU. Therefore various programmes have been promoted and are being promoted, such as “Start-up Europe”, for the exchange of knowledge, together with European funding for the **Horizon 2020** framework for ICT research and development, which will amount to 12.5 million euros between 2014 and 2020. Many of these funds will be set aside for the generation of public-private projects and **new transversal initiatives, many of them linked to cities**, ranging from connectivity infrastructures to data analytics, the Internet of Things, cybersecurity, health, society, transport, etc.

Several large companies have collaborated with start-ups in Europe, including Telefónica, which for many years has conducted its **Open Future-Wayra initiative** (over 25,000

projects and investment in more than 330 start-ups, more than 60 of them in trade relations with Telefónica). But this is not enough.

There are a number of barriers hindering the development of these ecosystems that the generation of an **ecosystem of entrepreneurs based on a European city platform** would overcome:

- **People and the risk culture.** Despite having good education in general, European citizens are less likely to create companies than Americans. The innovation policy tends to focus on technology, while entrepreneurship is a broader concept and **focuses on the translation of innovation into action**. They have a common element: risk. An entrepreneurial environment can be developed only when people are willing to take risks. In Europe, in general terms, there are **strong cultural barriers against risk taking**.

Cities and **city solutions based on the provision of open data allow this shift to action**, the development of a **culture of entrepreneurship**, the possibility of a better understanding of **risk taking**, the encouragement of people and companies to try something out in a real environment, failing and learning in the process, thereby reducing the cultural barriers preventing risk taking.

Moreover, the **city platform** ecosystem promotes the **learning** of a series of **digital technical skills**.

- **A regulatory environment and the absence of a single market.** European entrepreneurs have to work within a more bureaucratic environment and a more limited market due to the lack of homogeneity.

A **single market of applications and services for cities by means of an open platform** can lead to an increase in **scale** and attractiveness for entrepreneurs. Homogenization and “de facto” standardization facilitate synergies.

The harmonization of the **data processing** and an **Open Data** policy for public data can be **experimented on within the framework of the cities**, generating a “test bed” for policies for these purposes, encouraging the generation of **digital confidence**.

- **Financing.** European entrepreneurs are generally insufficiently funded in comparison with those in the USA once they have completed the initial phase of setting up the start-up. There exist financial barriers preventing growth, flotations and mergers.

**Public funding mechanisms**, giving incentives to companies, particularly those which offer **innovative solutions generated within cities** (the Internet of Things, Big Data,

health, etc.). The availability of a global market for solutions further encourages private financing.

- **Technology:** Entrepreneurs depend on easy and profitable access to technologies. Experimentation in cities facilitates the generation of European technology and a greater interrelationship between user companies and those offering it, beyond city solutions (e.g. the transformation of industry)
- **Ecosystem:** An ecosystem of customers and partners is essential for the creation of companies, in order to quickly achieve a critical mass of customers and globalize their businesses.

By means of **experience** and a **collaborative context** within the ecosystem of cities and **at a European level**, which may also include universities and companies of all sizes, best practices are exchanged and collaborative innovation and a network of relationships are encouraged. In addition, the scope of a range of services can be extended to a critical mass of customers.

In short, the **city platform offers an opportunity to promote a European ecosystem based on cities for the digital transformation of the economy**, reducing barriers to entrepreneurship.

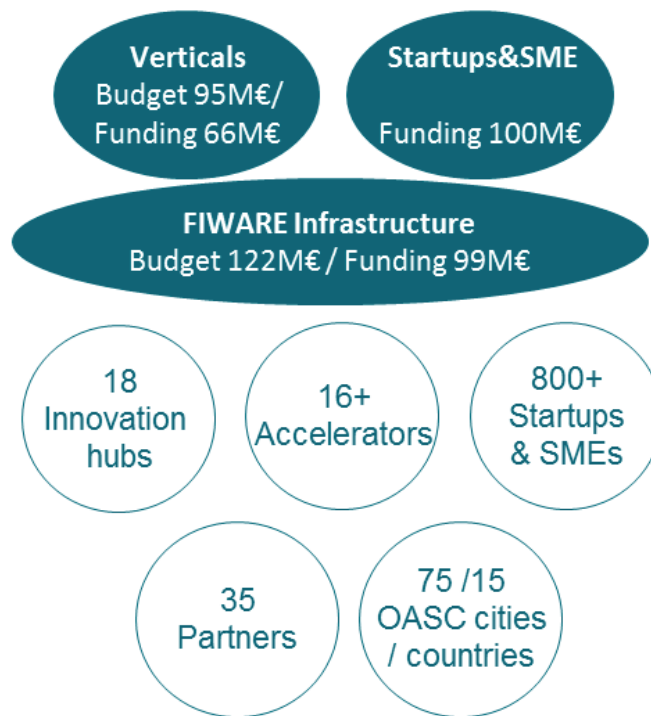
#### **4.2 The FIWARE platform as a European commitment**

The **FIWARE platform**<sup>19</sup> has been developed as part of the **Future Internet initiative FI-PPP** (*Future Internet Private Partnership Programme*)<sup>20</sup> launched by the European Commission in collaboration with the major players in the ICT industry. Its main aim is to promote the creation of an open and sustainable ecosystem based on standards, favouring the development of smart applications in different sectors (Smart Cities, Smart Industry, Smart Retail, Smart Agrifood, Smart Logistics, Smart Energy, Smart Home, etc.)

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<sup>19</sup> <https://www.fiware.org/>

<sup>20</sup> <http://www.fi-ppp.eu/>

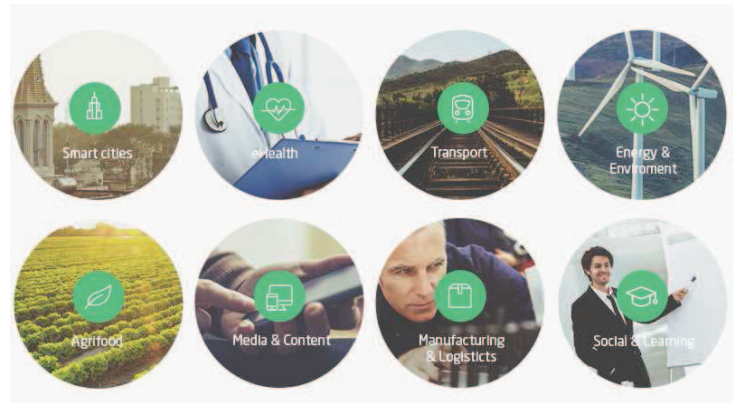


The European Digital Agenda considers some prior requirements to achieve the European Digital Single Market (DSM) and a knowledge society: a shared vision for the harmonization of technological platforms on a European scale and the integration and harmonization of the legal, political and regulatory frameworks. At this point, **FIWARE** offers a significant opportunity for the creation of a pan-European infrastructure to support “smart” applications.

For companies and developers, together with all the other players in the city, to be able to create these new applications and services, it is necessary for cities to provide a set of social, cultural and political conditions, closely related to the application of technology to the city, but also those related to **technological infrastructure**.

The FIWARE platform aims to provide a **framework for the development of smart applications in the Future Internet**. FIWARE offers an innovative service infrastructure, which will be based on components (called generic enablers), providing common functions reusable in different application domains.





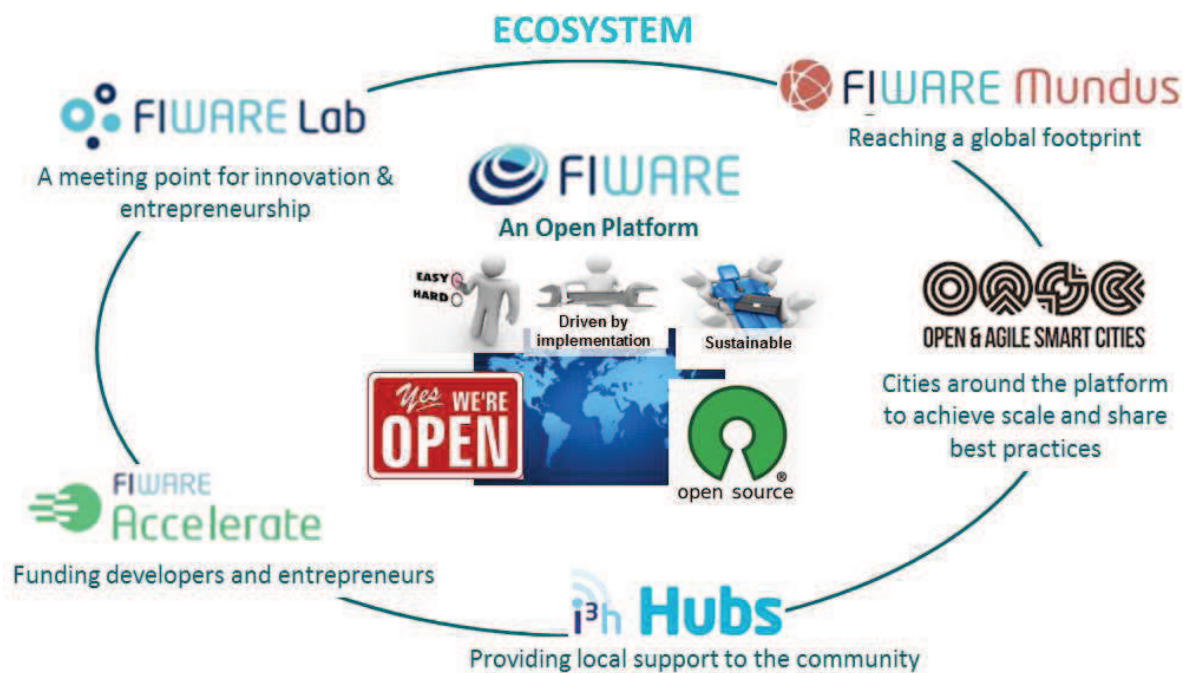
This is the objective the European Commission aims to achieve with the development of the [FIWARE](#) service platform: the development of a **common, open, public platform facilitating the development of smart applications and services hosted in the Cloud which envisage connection with the Internet of Things, as well as the processing and analysis of large-scale context information (Big Data)**. The specifications of the FIWARE platform are open, in other words, public and free of royalties. Similarly, they are supported by a benchmark implementation accessible under open-source licence.

**From the economic and social point of view** the aim of FIWARE is to increase the competitiveness of information and communications technology in the regions where it is adopted, introducing an innovative infrastructure to enable the creation and provision of high-quality and versatile digital, with security guarantees. Europe is a pioneer in the above adoption, but countries in other regions, starting with Latin America, are taking important steps towards its adoption.

Thus, FIWARE seeks **to promote innovation and an entrepreneurial spirit** in several ways. Firstly, it provides a set of **open APIs allowing developers to avoid dependence on specific suppliers**, thereby protecting the investment made by application developers while facilitating scalability and the possibility of reusing the applications. It provides a basis for the Future Internet, which seeks to configure a **sustainable ecosystem** so that service providers can develop new applications and solutions to meet the needs of citizens and so that cities, in turn, can actively participate in the creation of the content of the digital services.

FIWARE's contribution to encouraging the **culture of cooperation, collaboration and reuse in technological projects** is embodied in the [FIWARE Lab](#) **experimentation environment (entrepreneurship centres)**. FIWARE Lab is an open laboratory of innovation, an environment where the FIWARE platform is available and in operation free of charge to experiment with the development of applications. Cities can connect their networks of sensors and data sources to the FIWARE Lab and developers can use these data and experiment with them, creating specific pilot applications with real information. In turn,

the creators of these applications have the opportunity to connect with their potential customers, the very cities which have provided the data.



Thus, the value proposition to create an ecosystem around the FIWARE platform is based on the following pillars:<sup>21</sup>:

- **FIWARE Open Platform<sup>22</sup>**

The FIWARE platform provides a simple and powerful set of **APIs** (Application Programming Interfaces) which facilitate the development of smart applications to manage the context information (connection to information from sensors, information processing and Big Data analysis in the Cloud in a systematic and replicable manner). The specifications of these **APIs are public and free of royalties**. In addition, an **open source** benchmark implementation of the components is available, encouraging the emergence of multiple providers of the platform.

- **FIWARE Lab<sup>23</sup>**

The FIWARE Lab environment was launched in September 2013 and allows the creation of a testing and experimentation environment in which entrepreneurs can realize their innovative ideas. It permits the exploitation of public data made available by cities and organizations and the sharing of experiences by cities.

<sup>21</sup> [http:// www.fiware.org/about-us/](http://www.fiware.org/about-us/)

<sup>22</sup> FIWARE Open Platform <http://developer.fiware.org>

<sup>23</sup> FIWARE Lab <http://lab.fiware.org>

- **FIWARE Accelerator Programme<sup>24</sup>**

The FIWARE accelerator programme is aimed at promoting the development of solutions on the platform with a particular focus on SMEs and start-ups. As part of this program the European Union launched an ambitious campaign in September 2014, mobilizing 100 million euros of support. New initiatives to help entrepreneurship are emerging in other regions beyond Europe within the programme.

- **FIWARE mundus programme<sup>25</sup>**

Despite having begun in Europe, FIWARE was designed with a global ambition and the possibility of expanding to other regions, just like the solutions on the platform. This program is designed to cover the above endeavours, involving local and global agents. As early successes, several Latin American countries (Mexico, Brazil, Chile) are supporting the initiative and the deployment of nodes. Other opportunities exist in **Africa, the Middle East and Asia.**

- **FIWARE iHubs Network Programme**

The aim of the nodes of the FIWARE iHubs network is to provide local support to individuals and organizations/companies which adopt the FIWARE platform, offering training, consultancy and support. Its existence is based on the vision of “*think globally but act locally*”, essential in the development of a sustainable local economy.

In Europe alone, there are more than **16 FIWARE solution accelerator programs** and **18 iHubs** located mainly in Europe, as well as **more than 820 companies and entrepreneurs** offering FIWARE-based solution.

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<sup>24</sup> Accelerator Programme: <http://www.fiware.org/fiware-accelerator-programme/>;  
[http://www.fiware.org/wp-content/uploads/2015/05/fiware\\_infografia-marzo-v1.pdf](http://www.fiware.org/wp-content/uploads/2015/05/fiware_infografia-marzo-v1.pdf)

<sup>25</sup> FIWARE mundus programme: <http://www.fiware.org/mundus/>



### Map of FIWARE iHub, accelerator programmes and Fiware Lab SMEs

FIWARE thus fulfils the **requirements to be a comprehensive smart urban platform**.

#### **4.3 The commitment of cities to a common platform (OASC)<sup>26</sup>**

Cities around the world are seeking ways of stimulating **open innovation**. The reason is simple: Innovation is necessary to promote the digital transformation of cities and communities.

Innovation must be open in order to include a variety of interest groups and agents and to establish a sufficiently competitive but attractive market for entrepreneurs.

Moreover, as we mentioned above, a **city is not a market in itself** and the de facto global standards allow the reuse of solutions and the **expansion of the potential market** in the search for a sustainable model of public-private partnership.

Within this context it is important to highlight the coalition of cities within the framework of **Open and Agile Smart Cities (OASC)**, which recognizes the need to unite around common standards, committing to FIWARE as a point of reference.

During the last CeBIT congress held in March 2015, 31 cities in Finland, Denmark, Belgium, Portugal, Italy, Spain and Brazil launched the **Open and Agile Smart Cities (OASC)** open initiative designed to accelerate the adoption of common rules and principles to transform cities into engines of growth and innovation. In the second phase, in September 2015,

<sup>26</sup> <http://connectedsmartcities.eu/open-and-agile-smart-cities/>



there were a total of **61 cities in 12 countries in Europe (51), Latin America (7) and Asia Pacific (3)**, with cities of the importance of Amsterdam, Dublin, Edinburgh, Lisbon, Helsinki, Copenhagen, Milan, Valencia, Porto Alegre in Brazil and Brisbane in Australia. A **third wave** in November 2015 extended the total to over **75 cities in 15 countries**.



### Cities forming part of the OASC initiative

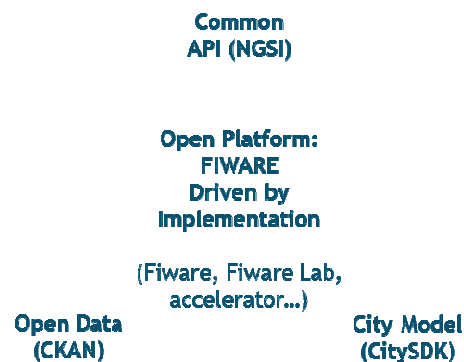
The aim of the initiative is to **boost the use of a shared set of application developments** for multiple cities and to make them interoperable between and within the cities. The cities forming part of the initiative agree upon a series of simple, functional and de facto standard forms of access.

The cities which join the OASC initiative undertake to adopt the following principles:

- **Implementation-driven approximation** set against the “designed by a committee” approach. Practical experience during the implementation and experimentation is established as a de facto standard. The communities of developers can thus (1) co-create upon the basis of APIs and basic models, (2) influence the definition of a new model and (3) assist in the development of data models and APIs. This will facilitate the participation of organizations and communities such as start-ups/SMEs selected by means of the “FIWARE Accelerator” (projects focused on *Smart Cities*), program initiatives, etc. It also allows the use of the resources available in the FIWARE Lab

environment and experimentation with the proposed APIs and data models, as well as the use of open data.

- **API:** The initiative has adopted the open-licence “FIWARE NGSI API”, which allows the control of real-time data which describe what is happening in the city at any given time, thereby preserving security.
- **Data model:** The FIWARE NGSI API is agnostic to the data model, in such a way that the definition of data models completes the formula allowing **full interoperability and portability of applications**. Following the driven-by-implementation model, the first set of data is based on the data model for citizen participation services developed by the **CitySDK** project.
- **Open Data/API Publication platform:** the OASC initiative is committed to the adoption of standards in the publication of data and resources for the consultation via API (e.g. FIWARE NGSI) of real-time information on the city. Thus, the Open Data publication platform must be open, flexible and easy to share and configure. The CKAN platform<sup>27</sup>, currently integrated as a FIWARE component, serves as a reference implementation of this application platform for the publication of the information.



### Technological principles for a model city

The OASC initiative allows the establishment of a public-private partnership context, incorporating providers of FIWARE platforms and developers.

In addition, the applications can be transported between all the cities, thereby allowing the generation of a sustainable ecosystem, which is the commitment of this initiative.

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<sup>27</sup> <http://ckan.org>



## 5. THE NEED FOR A EUROPEAN POLITICAL COMMITMENT TO SEIZE THE OPPORTUNITY

Europe has the **opportunity to repeat the success of the GSM standard**, developing a **digital single market of applications and services for cities, industries and enterprises**, attractive to European developers and entrepreneurs and encouraging the creation of an ecosystem for the digital transformation of the economy.

Today, policy makers and industry continue to work together around European Commission initiatives that function still too much as **fragmented silos** when **addressing new technological fields** like **Internet of Things (Future Internet), Cloud Computing, Big Data, Smart Cities, 5G or Factories of the Future (Digitising European Industry)**. All of these technologies and **related initiatives** are components of the future digital environment and require cross-sectorial coordination.

The **Industrial Internet** creates an opportunity for **pan-European services**, with a critical market uptake to make them potential **global standards**. This change, however, needs a more **comprehensive and holistic approach**.

To do so, Europe **may leverage an open platform for the city**, thereby generating the necessary **scale** and encouraging the **creation of ecosystems** in which the development of solutions arises not only from the city, but also from organizations and citizens. Since the **city is living lab or a testbed for the Internet of Things and a tech hub**, Smart Cities' initiatives foster technology adoption and development.

Promoting a **Cloud based open platform for the city and industries** around the **Future Internet initiative** could foster standards that **facilitate synergies among cities and industries** and ensure **interoperability** with other services and systems such as transport, energy, health, manufacturing, logistics, etc.

In short, there is an opportunity to promote a shared vision and ensure the leadership of our cities, enterprises and industries, developing the following six areas of work in Europe:

1. **Foster Smart Cities** to put into practice **Large Scale Pilots (LSPs)** and promote the development and adoption of **Internet of Things solutions** through 1) innovative sample projects ("*leading by example*") and 2) the aggregation of demand and advanced procurement mechanisms in the public sector.
2. **Promote a horizontal open platform standard** in order to overcome fragmentation and encourage the development of a competitive offer and a balanced ecosystem, allowing the necessary scale.

The [FIWARE](#) open platform is becoming the “de facto” standard adopted by cities. It has been developed upon the basis of the European Future Internet initiative (FI-PPP), conducted in partnership with industry. Its main aim is to promote the creation of an open and sustainable ecosystem based on standards, easing the **development of smart applications in different sectors** among others Smart Cities, Smart Industry, Smart Agrifood, Smart Energy.

3. **Endorse data sharing and the use of open data in a safe and reliable manner**, stimulating data-driven digital development (“**Economy of Data**”).
4. **Promote acceleration and funding programs for start-ups and SMEs** launching new products and services for the city and industries, **particularly those related to the Internet of Things**. Ensuring that SMEs can gain access to the technology platforms and open data necessary for the development of innovative applications and services.
5. **Encourage public-private models of relationship** and new patterns for the more effective management of innovation and take-up actions (e.g. public-private partnerships, pre-commercial public procurement schemes and public procurement of innovative solutions)
6. **Integrate city initiatives to stimulate the scale** and the development of communities of agents around open horizontal platforms, supporting the creation of networks and interaction, the exchange of good practices and promoting skills and training activities (e.g. [Open Agile Smart Cities \(OASC\)](#))



*Telefonica*

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**SMART CITIES**  
AN OPPORTUNITY FOR EUROPE

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The city as a platform for Digital Transformation

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