

IoE-Driven *Smart City Barcelona* Initiative Cuts Water Bills, Boosts Parking Revenues, Creates Jobs & More



EXECUTIVE SUMMARY

Objective

- Improve citizens' quality of life and stimulate new Smart City economy

Strategy

- Use new ICT technologies cross-directionally to transform the city

Solution

- Citywide sensors capture vital information for smart water, smart lighting, and smart energy management projects

Impact

- \$58 million annual savings using smart water technology
- \$50 million annual increase in parking-fee revenues due to use of smart parking technology
- 47,000 new jobs created as a result of Smart City efforts

Background

In January 2014, Cisco released the results of an in-depth analysis of the economic benefits of the Internet of Everything (IoE) for the public sector. Cisco's model revealed that some \$4.6 trillion in "Value at Stake" would result from the adoption of IoE capabilities across 40 key public sector use cases over the next 10 years, including smart water, smart buildings, smart energy, smart parking, and more (<http://bit.ly/1aSGIzn>).

As a next phase of its analysis, Cisco engaged Cicero Group, a leading data-driven strategy consulting and research firm, to undertake a global study of IoE capabilities across these 40 use cases – how the best public sector organizations are "connecting the unconnected," as Cisco terms it. To that end, Cicero Group conducted interviews with dozens of leading public sector jurisdictions – federal, state, and local governments; healthcare organizations; educational institutions; and non-governmental organizations (NGOs) – to explore how these global leaders are leveraging IoE today.

The research examined real-world projects that are operational today, are being delivered at scale (or through pilots with obvious potential to scale), and that represent the cutting edge of public sector IoE readiness and maturity. The aim of the research was to understand what has changed in terms of the jurisdictions' people, processes, data, and things, and how other public sector organizations can learn from (and replicate) the trail blazed by these global IoE leaders. In many cases, these jurisdictions are Cisco customers; in others, they are not. The focus of these jurisdictional profiles, therefore, is not to tout Cisco's role in these organizations' success, but rather to document IoE excellence, how public sector entities are putting IoE into practice today, and to inform a roadmap for change that will enable the public sector to address pressing challenges on multiple fronts by drawing on best practices from around the globe.

About Smart City Barcelona

Smart City Barcelona seeks to efficiently provide city services at multiple levels to all citizens by harnessing information and communications technology (ICT) through development and implementation of the Barcelona Smart City Model. The model identifies 12 areas under which Smart City projects are initiated: environmental, ICT, mobility, water, energy, matter (waste), nature, built domain, public space, open government, information flows, and services. Currently, the city has 22 major programs and 83 separate projects that fit into one or more of these 12 areas. Some of these projects include smart lighting, smart parking, smart water management, and smart waste management.

Barcelona currently has more than 500 kilometers of fiber-optic network, development of which began more than 30 years ago when the city networked two municipal buildings with optical fiber. It was upon this initial network that current Smart City efforts were established. The Smart City project received a massive infusion of attention and focus when the current mayor was elected nearly three years ago. Since that time, the city has put extensive effort into developing a coordinated strategy and approach toward its Smart City efforts.

In 2012, the city government structured its Smart City projects under the umbrella of “Smart City Barcelona.” In addition to implementing smart technologies, the city has also utilized these connectivity projects to deliver coordinated services across departments. This has helped to eliminate departmental silos and improve the resident experience in Barcelona. IMI, the Barcelona Municipal Institute of Information Technology, played a key role in this initial organizational formation, which emphasized involvement of the government, residents, and the business community in developing and shaping the city’s technological initiatives.

Barcelona is currently using an open tender procurement process to identify a developer to build what the city calls its City OS. This operating system will sit atop the city’s established network of sensor technology to collate and analyze data that is collected across the network. City officials envision this OS as an open platform working across the various specific smart technology projects operating in the city. The city sees this platform as the key to unlocking IoT benefits associated with data analytics and predictive modeling.

Ms. Julia Lopez is coordinator of Smart City strategy for the city of Barcelona and coordinator of the ICT International Office for Urban Habitat of Barcelona. She is responsible for overseeing Smart City initiatives and coordinating technology initiatives across city departments. She also is charged with envisioning the city a generation from now, and with helping align current strategies to achieve that vision. The Smart City team also includes Manel Sanroma and Josep Ramon Ferrer.

Separately, Ms. Lopez also manages development and promotion of the city’s ICT strategy among other international cities and groups. This involves both formal and informal cooperation with other municipalities and government entities, as well as promoting Barcelona’s Smart City efforts globally. A trained telecommunications engineer, Ms. Lopez has worked for the city for seven years, including two and a half years as coordinator of Smart City strategy. She was appointed coordinator of the ICT International Office in January 2014.

The [Barcelona Smart City] model identifies 12 areas under which Smart City projects are initiated: environmental, ICT, mobility, water, energy, matter (waste), nature, built domain, public space, open government, information flows, and services.

“We are not really putting focus on a concrete area, but going little steps forward and thinking about how technology can be used to transform the lives of our citizens. When I am referring to citizens, I am referring not only to those citizens like me who live in the city, but also to companies who are part of the city. As our mayor always says, we have a social dream, which is to transform the city in a generation’s time through technology. We think this is the only way to create a sustainable model of living.”

Julia Lopez,
Coordinator of Smart City Strategy,
City of Barcelona

Objectives

According to Ms. Lopez, the seed for Barcelona’s Smart City program began more than 30 years ago when the city first installed fiber-optic lines to connect two municipal buildings. Since that time, the city has continued to develop its fiber-optic network.

In 2011, the current mayor made integration of city technology a key component of his election platform. After taking office, his administration immediately began implementing a comprehensive Barcelona Smart City program. The first overarching goal of was to improve efficiency of city services and to address sustainability and environmental concerns. According to Ms. Lopez, the mayor wanted “to transform the lives of our citizens ... [and] the companies who are part of the city.”

The Barcelona Smart City program aims to provide city services at multiple levels to all citizens based on the use of Internet and telecommunications technology.

Strategy

Underlying Barcelona’s approach to its Smart City efforts is the idea that the city functions as a “network of networks.” Ms. Lopez indicated that an initial part of the city’s strategy development was to consider how it could connect the different city-affiliated “networks” – for example, transportation, energy, and technology. From this, a blueprint was established.

Barcelona’s mayor has placed significant emphasis on development of Barcelona’s Smart City capabilities. One key step has been the establishment of a Smart City Strategy team within the mayor’s office. This office is charged with promoting and coordinating Smart City application development throughout the city organization. This senior-level political support has been crucial to Barcelona’s ability to develop its Smart City projects.

Increased government transparency has also been a critical component of the Barcelona Smart City strategy, helping city officials communicate and explain why they are developing new smart applications or publicly sensitive solutions, such as newly reconfigured bus routes. This has been helpful in gaining public support for projects, especially in a difficult fiscal environment.

Ms. Lopez believes that the political desire to examine and create a Smart City is vital to successfully implementing these projects. “This would not have been possible if we did not have top-down political vision,” she says. “This has been very important. You can start thinking bottom-up, but the big, final push was at the political level. If you don’t have political willingness, it is impossible.”

When initially rolling out the project, Ms. Lopez indicated that coordinating across the various city departments was a challenge. The key to success in this case became the top-level support from the mayor, which helped to cut through various layers of city bureaucracy and bring departments together.

“We recognize that all of these developments cannot be done only by the city. You have to follow a strong and well-thought-out public/private partnership approach in which you have to account for both large and small private sector participants.”

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The city took a tailored approach to encourage different public sector areas and departments to participate in the project. This included consolidating and streamlining projects already in motion before the blueprint for the Smart City project was developed. Ms. Lopez said, “It is difficult in a city like Barcelona, with 1.6 million residents and more than 16,000 [public] workers, to go through different departments that historically have worked quite isolatedly and tell them they have to start collaborating. On one hand, we had new projects thanks to the work that we did mapping some initiatives and finding synergies. On the other hand, we also took pre-existing projects and initiatives and tried to find synergies between them. Ultimately, we transformed from five different networks – each managed by different departments – to managing a single network via the city’s IT department.”

The city also had to adapt to dealing with large multinational companies that may not be accustomed to working at the municipal level. According to Ms. Lopez, partnering with key technology firms has been a crucial part of developing Barcelona’s Smart City capabilities. “We recognize that all these developments cannot be done only by the city,” she said. “You have to follow a strong and well-thought-out public/private partnership approach in which you have to account for both large and small private sector participants.”

Ms. Lopez indicated that the city contracting with the tech firms to ensure that the system architecture remains open and not linked to proprietary technology. On many occasions, this has led to funding for new, sustainable business models. For instance, while this has meant companies cannot rely just on added revenue coming from future software upgrades, Ms. Lopez indicated that companies have come onboard more readily because they now have a successful platform they can market and sell in other municipalities.

Ms. Lopez indicated that the city uses its data to engage city residents in the Smart City process. The city’s open government platform brings citizens and public servants into closer contact and provides transparency into government operations. Additionally, the Open Data project allows citizens to access data collected by the city. This allows residents to see what is being accomplished through the Smart City process. Ms. Lopez says the hope is that by training and engaging city residents, the city can assuage questions or concerns about the program during the initial phases of implementation.

“We have to be very open and explain things,” Ms. Lopez said of communicating the projects and initiatives to the public. “I’m sure you have heard that Spain is in an economic crisis. We have to go to our citizens to explain very well why we do what we do.

“It is a change that affects the city and citizens in the midterm and long term, but in the short term, our citizens have other worries, so it is something we have to take care of,” Ms. Lopez added. “We have to explain it is something that is for the good of the citizens in the future.”

“If we can pull this off, I assure you, it will be a revolution.”

Julia Lopez,
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Solution

The city looked at ways to use the Smart City initiative to create a single Internet and telecommunications architecture for the city. The existing fiber-optic network provides the backbone for the various smart technology projects. This infrastructure backbone is operated by the local telecommunications firm, a public-private contract that was awarded via tender. “The fiber-optic network was one of our main projects, and we call it transversal because it is the layer on top of which we develop all of the Smart City projects in the city,” said Ms. Lopez.

Barcelona is structuring the various projects in three technological layers. The first layer consists of sensors that have been deployed throughout the city in conjunction with the various projects. Currently, this platform is being used for smart water, smart lighting, and smart energy management projects, as well as others. The city plans to expand use of the sensor network in coming years. The city’s sensor platform is called Sentilo (www.sentilo.io) and was developed specifically to aid the city in bringing all of its sensor data together. Barcelona has since made the Sentilo platform fully open source and provided it for download on Github so other cities or organizations can use it for similar purposes.

The intermediate, or second, layer of the technology architecture is the City OS, a platform created by the Barcelona city government to aggregate and analyze all data gathered from various city applications. This includes modeling for data analytics and predictive analytics applications. According to Ms. Lopez, this initiative is still in development, and there is a tender out for bid.

The third layer of the “urban platform” is the sharing of data and analytics provided by the City OS with both clients within the city government and external data users. This will enable both public and private sector development of applications to improve city services and operations, along with helping to produce a better educated administration and citizenry. “If we can pull this off, I assure you it will be a revolution,” Ms. Lopez stated.

The city developed a master plan developed in 2012 that includes projects to remotely control street-level lighting and to transition 50 streets and more than 1,100 lampposts to LED technology. In addition, Barcelona worked with utilities to create a program to achieve greater energy efficiency, deploying more than 19,500 smart meters in the Olympic Villa. The plan also includes implementing remote irrigation control for the city’s green spaces, which thus far includes 77 remote-controlled fountains and two networks that provide hot water in 64 buildings.

The city’s smart transportation initiative includes deploying orthogonal bus lines and zero-emissions mobility options, which include more than 500 hybrid taxis, 294 public electric vehicles, 262 recharging points, 130 electric motorbikes, and 400 private electric vehicles.

The city also initiated the Open Government program, which aims to bring transparency of the municipal government to citizens. This started with the deployment of 44 “Citizens Attention” kiosks and the launch of an Open Data portal that allows private citizens and companies to develop applications that address needs of city residents.

“The first visionaries of the city were those people in the ‘80s in the city of Barcelona,” Ms. Lopez said. “They decided to try to connect municipal buildings with optical fiber. No one was thinking that this was something that could be useful, but 35 years after, we now have one of the larger fiber-optic networks owned by a city We have more than 500 kilometers of cooperating network. Thanks to these visionary people that decided to connect these first two buildings, we now have a powerful network that is giving us the ability to develop and test the smart services in the city.”

Barcelona Deputy Mayor Antoni Vives indicated that Barcelona is saving \$58 million annually using smart water technology, and that the city has increased parking-fee revenues by \$50 million annually utilizing smart parking technology. Vives also stated that Barcelona has created 47,000 new jobs through its Smart City efforts.

Figure 1. Barcelona: New and Better Connections.



Source: Cisco Consulting Services, 2014

Impact

During his presentation at CES in January, Barcelona Deputy Mayor Antoni Vives indicated that Barcelona is saving \$58 million annually using smart water technology, and that the city has increased parking-fee revenues by \$50 million annually utilizing smart parking technology. Vives also stated that Barcelona has created 47,000 new jobs through its Smart City efforts.

According to Ms. Lopez, Barcelona Smart City has educated city officials on how the city operates and helped increase efficiencies. The pilot programs have allowed project leadership to determine the best course of action for initiatives, such as the Urban Lab pilot on IT-enabled lighting. “Installing new lighting in the city, but also connecting lampposts to our fiber-optic network that can be controlled point-to-point, was a pilot in the Urban Lab in 2009 and 2010. Different technology was tested, and we came to a conclusion about which technology was most suitable for us.”

Increased transparency and citizen engagement through the Open Government platform has been another benefit, which has helped citizens realize the importance of supporting the Smart City efforts by making them feel engaged in the process.

Yet another benefit has been the IT industry connections made through Barcelona's pilot programs – with both smaller entities and industry leaders – that will help the city have suitable partners for funding and implementation of the long-term Barcelona Smart City goals.

Lessons Learned / Next Steps

Going forward, the city anticipates deploying its planned City OS, which city officials anticipate will help the city begin to see significant benefit as data is compared and analyzed, allowing for improved planning and decision making. Additionally, the city anticipates further development of some of the pilot projects currently being tested, as well as greater empowerment of the private sector in application development as additional city data is released.

Ms. Lopez says that a big takeaway from the implementation of the Barcelona Smart City initiative is to set clear objectives and map out the steps necessary to attain the goals. The involvement of top-down political leadership to ensure that projects have full support is a key factor, as well as having a leadership structure to coordinate the different aspects of the project. "You have to think 'Do you want to be smart? What do you want the city to be as it grows, and how can you use technology to accomplish this?'" she said. By strategizing early on, potential roadblocks can be seen and needed resources identified before challenges arise. "You have to start setting up the projects and, once you have the vision and a good army to help you develop the projects, it is easier," Ms. Lopez explained.

Of the specific projects currently in development, Ms. Lopez sees the Zero Emissions Mobility initiative as one having particular promise. This initiative involves multiple projects, including electric vehicle recharging ports at the street level and promoting private initiatives to supply electric rental cars, all with the focus of helping Barcelona's development as a technology-efficient, data-driven, environmentally sustainable 21st century city.

As it implements the 83 projects across the 12 identified areas, Barcelona is hoping to see dividends in the form of a more efficiently run city with a citizenry engaged with an open government, as well as a technological infrastructure that will attract companies and investment. By aggregating and analyzing the data being collected from all the sensors, Barcelona Smart City hopes to gain a better idea of what needs to be done to become a city of the future.

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