

# 5 THINGS YOU WANT TO KNOW ABOUT A SMART CITY

**A** smart city is an urban area that uses different types of electronic data collection sensors to supply information which is used to manage assets and resources efficiently. This includes data collected from citizens, devices, and assets that is processed and analyzed to monitor and manage traffic and transportation systems, power plants, water supply networks, waste management, law enforcement, information systems, schools, libraries, hospitals, and other community services. The smart city concept integrates information and communication technology (ICT), and various physical devices connected to the network to optimize the efficiency of city operations and services and connect to citizens. Smart city technology allows city officials to interact directly with both community and city evolving.

The infrastructure and to monitor what is happening in the city and how the city uses Information and Communication technology (ICT) to enhance quality, performance and interactivity of urban services, to reduce costs and resource consumption and to increase contact between citizens and government. Smart city applications are developed to manage urban flows and allow for real-time responses. A smart city may therefore be more prepared to respond to challenges than one with a simple "transactional" relationship with its citizens. Yet, the term itself remains unclear to its specifics and therefore, open to many interpretations.

Major technological, economic and environmental changes have generated interest in smart cities, including climate change, economic restructuring, the move to online retail and entertainment, ageing populations, urban population growth and pressures on public finances. The European Union (EU) has devoted constant efforts to devising a strategy for achieving 'smart' urban growth for its metropolitan city-regions. The EU has developed a range of programs under 'Europe's Digital Agenda'. In 2010, it highlighted its focus on strengthening innovation and investment in ICT services for the purpose of improving public services and quality of life. It's been estimated that the global market for smart urban services will be \$400 billion per annum by 2020. Smart City technologies and programs have been implemented in a number of municipalities in some major cities and countries around the world. Singapore, Dubai, Milton Keynes,

Southampton, Amsterdam, Barcelona, Madrid, Stockholm, China and New York have been developing a number of smart city initiatives.

## Definition of a smart city:

**1** In From Intelligent Cities to Smart Cities Mark Deakin and Al Waer list the following four factors as a true definition of a smart city:

1. The application of a wide range of electronic and digital technologies to communities and cities
2. The use of ICT to transform life and working environments within the region
3. The embedding of such Information and Communications Technologies (ICTs) in government Systems
4. The territorialisation of practices that brings ICTs and people together to enhance the innovation and knowledge that they offer. Deakin defines the smart city as one that utilizes ICT to meet the demands of the market (the citizens of the city), and that community involvement in the process is necessary for a smart city. A smart city



would thus be a city that not only possesses ICT technology in particular areas, but has also implemented this technology in a manner that positively impacts the local community.

## 2 Smart city characteristics

It has been suggested that a smart city (also community, business cluster, urban agglomeration or region) uses information technologies to:

1. Make more efficient use of physical infrastructure (roads, built environment and other physical assets) through artificial intelligence and data analytics to support a strong and healthy economic, social, cultural development.
2. Engage effectively with local people in local governance and decision by use of open innovation processes and e-participation, improving the collective intelligence of the city's institutions through e-governance, with emphasis placed on citizen participation and co-design.
3. Learn, adapt and innovate and thereby respond more effectively and promptly to changing circumstances by improving the intelligence of the city.

They evolve towards a strong integration of all dimensions of human intelligence, collective intelligence, and also artificial intelligence within the city. The intelligence of cities "resides in the increasingly effective combination of digital telecommunication networks (the nerves), ubiquitously embedded intelligence (the brains), sensors and tags (the sensory organs), and software (the knowledge and cognitive competence)".

These forms of intelligence in smart cities have been demonstrated in three ways:

**Orchestration intelligence:** Where cities establish institutions and community-based problem solving and collaborations, such as in Bletchley Park, where the Nazi Enigma cipher was decoded by a team led by Alan Turing. This has been referred to as the first example of a smart city or an intelligent community.

**Empowerment intelligence:** Cities provide open platforms, experimental facilities and smart city infrastructure in order to cluster innovation in certain districts. These are seen in the Kista Science City in Stockholm and the Cyberport Zone in Hong Kong. Similar

facilities have also been established in Melbourne.

**Instrumentation intelligence:** Where city infrastructure is made smart through real-time data collection, with analysis and predictive modeling across city districts. There is much controversy surrounding this, particularly with regards to surveillance issues in smart cities. Examples of Instrumentation intelligence have been implemented in Amsterdam. This is implemented through.

- A. A common IP infrastructure that is open to researchers to develop applications.
- B. Wireless meters and devices transmit information at the point in time.
- C. A number of homes being provided with smart energy meters to become aware of energy consumption and reduce energy usage
- D. Solar power garbage compactors, car recharging stations and energy saving lamps.

## 3 Smart city technology framework

Several concepts of the Smart city rely heavily on the use of technology; a technological Smart City is not just one concept but there are different combinations of technological infrastructure that build a concept of smart city.

**Digital city:** it combines service oriented infrastructure, innovation services and communication infrastructure; Yovanof, G. S. & Hazapis, G. N. define a digital city "a connected community that combines broadband communications infrastructure; a flexible, service-oriented computing infrastructure based on open industry standards; and, innovative services to meet the needs of governments and their employees, citizens and businesses". The main purpose is to create an environment in which citizens are interconnected and easily share information anywhere in the city.

**Virtual city:** In these kinds of cities functions are implemented in a cyberspace; it includes the notion of hybrid city, which consists of a reality with real citizens and entities and a parallel virtual city of real entities and people. Having a smart city that is virtual means that in some cities it is possible the coexistence between these two reality, however the issue of physical distance and location is still not easy to manage. The vision of the world

without distance still remains unmet in many ways. In practice this idea is held up through physical IT infrastructure of cables, data centers, and exchanges.

- **Information city:** It collects local information and delivered them to the public portal; In that city, many inhabitants are able to live and even work on the Internet because they could obtain every information through IT infrastructures, thanks to the sharing information method among citizens themselves. Using this approach, an information city could be an urban centre both economically and socially speaking; the most important thing is the linkage among civic services, people interactions and government institutions.
- **Intelligent city:** it involves function as research or technological innovation to support learning and innovation procedure. The notion emerges in a social context in which knowledge, learning process and creativity have great importance and the human capital is considered the most precious resource within this type of technological city. In particular one of the most significant feature of an intelligent city is that every infrastructure is up to date, that means have the latest technology in telecommunications, electronic and mechanical technology. According to Komninos and Sefertzi, the attempt to build an "intelligent" Smart City is more a radical innovation rather than an incremental innovation owing to a big quantity of efforts to use IT trying to transform the daily life.
- **Ubiquitous city (U-city):** It creates an environment that connect citizens to any services through any device. According to Anthopoulos, L., & Fitsilis, P., U-city is a further extension of digital city concept because of the facility in terms of accessibility to every infrastructure. This makes easier to the citizen the use of any available devices to interconnect them. Its goal is to create a city where any citizen can get any services anywhere and anytime through any kind of devices. It is important to highlights that the ubiquitous city is different from the above virtual city: while the virtual city creates another space by visualizing the real urban elements within the virtual space, U-city is given by the computer chips inserted to those urban elements.
- **Cognitive Smart City:** Cognitive smart city expands the concept of the smart city by referring to the convergence of the emerging Internet of Things (IoT) and smart city technologies, their generated big data, and artificial intelligence techniques. Continuous learning through human interactions and consequently performing a dynamic and flexible behavior and actions based on the dynamic environment of the city are the core components of such framework.

# 4 Smart city Human framework

Human infrastructure (i.e., creative occupations and workforce, knowledge networks, voluntary organizations) is a crucial axis for city development.

- **Creative city:** creativity is recognized as a key driver to smart city and it represents also a version of it. Social infrastructures, like for instance intellectual and social capital are indispensable factors to build a city that is smart according to the human framework. These infrastructures concern people and their relationship. Smart City benefits from social capital and it could be possible and easier to create a Smart city concept if there are mix of education and training, culture and arts, business and commerce as Bartlett, L. said.
- **Learning city:** according to Moser, M. A., learning city is involved in building skilled workforce. This type of city in the human context improves the competitiveness in the global knowledge economy and Campbell established a typology of cities that are learning to be smart: individually proactive city, city cluster, one-to-one link between cities, and city network. That lead a city to learn how it should be possible and realistic to be smart through learning process followed by city workforce.
- **Humane city:** It exploits human potential, in particular the knowledge workforce. Following this approach, it is possible focus on education and builds a center of higher education, which is the city, obtaining better-educated individuals. According to Glaeser, E. L., & Berry, C. R., this view moves a smart city concept in a city full of skilled workforces; the same reasoning could be made for those high tech knowledge-sensitive industries which want to migrate in a so dynamic and proactive community. As a consequence of the above movement, the difference between Smart City and not are getting wider; Smart places are getting smarter while other places getting less smart because such places act as a magnet for creative people and workers (Malanga, S. 2004).
- **Knowledge city:** It is related to knowledge economy and innovation process; this type of Smart City is very similar to a learning city, the only difference refers to "a knowledge city is heavily related to knowledge economy, and its distinction is stress on innovation" (Dirks, S., Gurdgiev, C., & Keeling, M.).

The concept of knowledge city is linked with similar evolving concepts of Smart City such as intelligent city and educating city. The most important feature of this city is the fundamental concept of knowledge-based urban development, which has become an important and

widespread mechanism for the development of knowledge cities.

## 5 Smart city platforms and Technologies

New Internet technologies promoting cloud-based services, the Internet of Things (IoT), real-world user interfaces, use of smart phones and smart meters, networks of sensors and RFIDs, and more accurate communication based on the semantic web, open new ways to collective action and collaborative problem solving. Online collaborative sensor data management platforms are on-line database services that allow sensor owners to register and connect their devices to feed data into an on-line database for storage and allow developers to connect to the database and build their own applications based on that data.

In London, a traffic management system known as SCOOT optimizes green light time at traffic intersections

by feeding back magnetometer and inductive loop data to a supercomputer, which can co-ordinate traffic lights across the city to improve traffic throughout.

The city of Santander in Cantabria, northern Spain, has 20,000 sensors connecting buildings, infrastructure, transport, networks and utilities, offers a physical space for experimentation and validation of the IoT functions, such as interaction and management protocols, device technologies, and support services such as discovery, identity management and security. In Santander, the sensors monitor the levels of pollution, noise, traffic and parking.

Electronic cards (known as smart cards) are another common platform in smart city contexts. These cards possess a unique encrypted identifier that allows the owner to log into a range of government provided services (or e-services) without setting up multiple accounts. The single identifier allows governments to aggregate data about citizens and their preferences to improve the provision of services and to determine common interests of groups. This technology has been implemented in Southampton. To read more please refer to the following recourses.



Image: Draco2008 from UK - Bletchley Park.