

**HABITAT AND URBAN SERVICES**

*Sector Focus*



# Smart Cities

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Ajuntament de  
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 Barcelona  
Activa

# Summary



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# Why smart cities? Digitisation and urban management

At the beginning of the 19th century, less than 10% of the population lived in urban areas. As a result of the industrialisation and urbanisation processes, urban population exceeded that of rural areas in 2007, and today, **more than half of the world population** (about 55%) lives in urban areas. By 2050, this figure is expected to rise to 68%. And by 2030, the world is expected to have 43 large metropolitan areas with more than 10 million inhabitants, most of them in developing regions.

With the global population becoming increasingly urbanised, the necessary environmental transition will largely depend on what happens in cities and how resource scarcity is managed. For this reason, **applying intelligent technologies to city management** is an indispensable condition for the future of humanity and for the well-being of citizens.

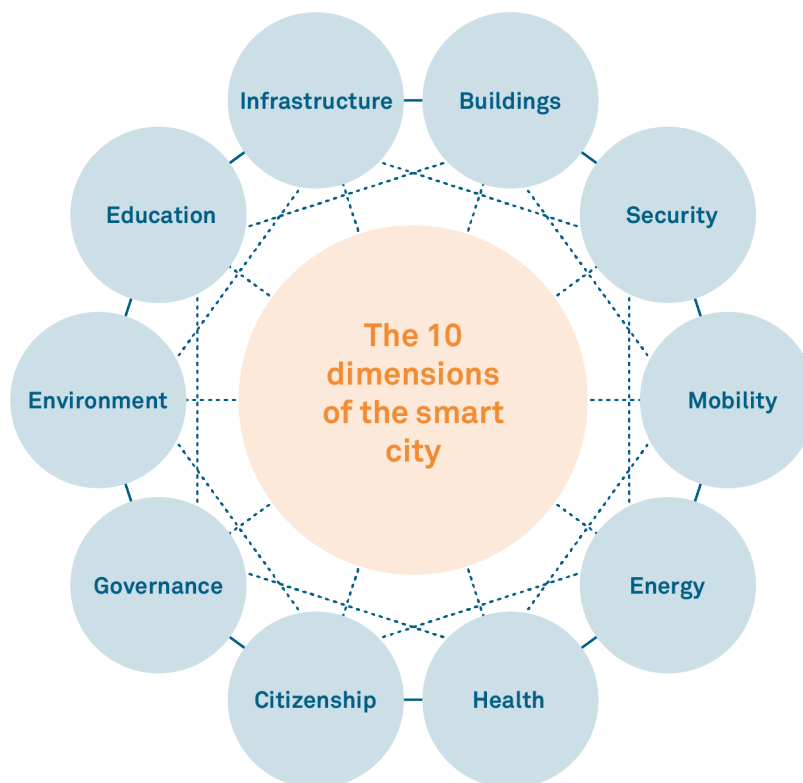
The concept of “**smart city**” began to be used at the same time as the digital technological change process that took place starting in the second half of the 1990s. This trend was strongly driven by the interests of companies in the information and communications technology sector. Their aim was to influence the strategies that local governments were starting to develop in the application of the new digital technology to city management: traffic control, public service fleets (transport, waste collection), provision of services to citizens, as well as extension of the network to access the Internet while reducing the digital divide, among others.



Thus, city strategies promoted by local governments evolved from a vision of cost-efficiency and sustainability to putting **citizens at the centre**, inviting them to participate in the co-creation of strategies for the development of the smart city. In the process of creating public policies, it was key to have data and compare it with what other cities were doing. Barcelona is favourably positioned as the host of the Smart City Expo, the largest annual sector event.

The digital technology that makes a smart city possible was inevitably established, and today it is already part of areas of city management such as economy, mobility, citizen quality of life, education, city governance, urban infrastructure management (essential services such as the provision of energy, water and communications), security, environmental management, waste management, smart innovation, citizen culture, and health. Smart cities have different specific aspects, and an **intuitive classification** would be as follows:

**Figure 1.** Smart City Dimensions



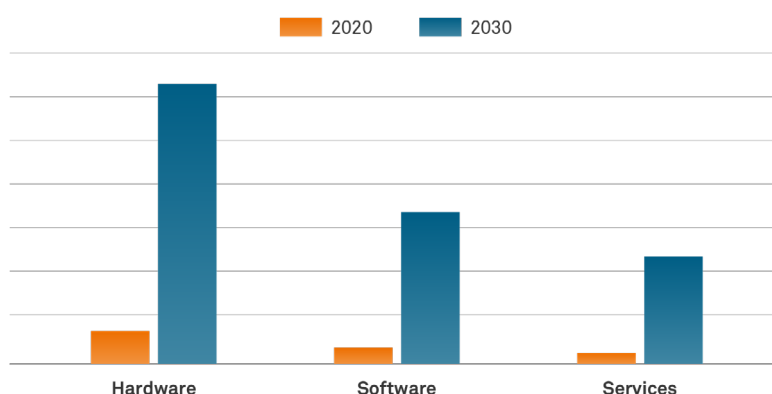
Source: Prepared by the authors.



## Vectors of a smart city

The development of technological solutions that apply to city management can be found in **three components: hardware** (widgets and materials), **software** (digitisation) and **services** (new development induced by demand). Growth is expected to occur in these vectors, particularly in hardware and not so much in software and new services.

**Figure 2.** Component Smart Cities Market



Source: Prepared by the authors, based on data from Allied Market Research.

According to the latest forecasts made by Gitnux to quantify the expected impact of **smart city deployment** in the coming years:

- **Lighting** is expected to be the fastest-growing application for smart cities, with an average annual growth of 24.4% from 2019 to 2026.
- Building **energy management systems** will account for almost 35% of the global smart city market share by 2027.
- 50% of smart city goals are expected to include **climate change mitigation strategies** by 2025.

The **vectors** that accelerate and model smart cities are the following:

- **Technological change.** Smart cities use the potential of ICT to promote sustainable development through the most efficient city management. In this sense, the application of the latest developments in digital technology (Artificial Intelligence, the Internet of Things and the Metaverse, among others) will promote new developments.
- **The market.** Free competition between technology companies encourages research and innovation to offer the best solutions and make urban management processes more efficient. The smart city market is driven by factors such as research and innovation of products and services. Thus, energy supply, mobility management and the provision of public services are markets in which digital technology will enter strongly to activate a smart city, which will configure a promising market.



- **Local governments are involved in the promotion of the smart city by issuing regulations as well as by designing and implementing public and private collaboration strategies to promote change.** Appropriate government regulations must be established to ensure the effective and ethical deployment of smart technologies. Smart cities use digital platforms and e-government solutions to streamline administrative processes, offer online services and improve citizen participation, online portals to access government services, digital payment systems, open data solutions and citizen participation platforms, among others. Government regulations must also be enforced to ensure the ethical use of technologies in smart cities, which involves guidelines to use artificial intelligence and facial recognition technologies responsibly in order to prevent any kind of discrimination.
- **Public and private collaboration in its broadest sense**, in which three-way projects are articulated: public sector, private sector and lobby groups, and citizens in general.
- **The climate emergency and the subsequent ecological transition** are the new global paradigm, which **guides the strategies of the private sector and defines public sector strategies**. Consequently, it is key for large urban clusters to evolve towards the smart city. Smart technology and environmental awareness must be intertwined in the urban fabric. Cities must be proactive and responsible with the planet.

In short, smart cities will grow in the vectors described above and, more specifically, in the cases and solutions exemplified below:

- **Distributed generation:** electricity generation is not centralised but distributed throughout the territory through an individualised supply (microgeneration).
- **Interconnected smart networks:** they allow the bidirectional circulation of data between the control centre (service centre) and the user.

- **Smart measurement of consumption:** energy expenditure data of each user through real-time telemetry.
- **Smart buildings:** defined by their energy efficiency model and integrated energy production systems.
- **Smart sensors:** collect the necessary data from any operating system.
- **Mobility:** implementation of the electric vehicle and public and private charging stations, in addition to the smart management of traffic.
- **Smart citizenship:** citizens are the fundamental part of the smart city, their active participation is always necessary.
- **Urban solid waste management:** control of the level of waste bins to identify collection routes that are less disturbing and more efficient.
- **Transport management:** devices that allow drivers to quickly locate open parking spaces to avoid congestion and tension among private vehicle drivers.



# What will smart cities demand from professionals?

The application of digital technology as smart city solutions will increase in the face of the need to manage increasingly complex cities. And, consequently, more qualified people will be needed to occupy the new jobs that will manage urban operating systems, centralised control rooms, smart transport systems, energy networks, smart metres, sensor networks, smartphone applications and shared economy platforms, among others. This reality is already established in the labour market, but forecasts suggest that the demand for these professionals will increase as the market is expected to continue expanding economically.



One of the main economic advantages of smart cities lies in their potential to catalyse **job creation in various sectors**, particularly in the **ICT sector** and the field of **installation, maintenance and equipment of essential services**. Thus, the labour market provides high-skilled jobs related to the research, development and innovation of ICT solutions, as well as medium and high technical level jobs.

Consequently, the expansion of the smart city will require the following **skills** from professionals:

- Analytical ability applied to data science, using specific software available on the market.
- Technical knowledge in installation and maintenance operations in essential supply networks.
- Knowledge of connectivity technologies, understood as smart technologies which increase efficiency and capacities in different fields (such as entertainment, transport and public services) when combined.
- Management of complex projects, since different actors intervene in the definition of a smart product or widget.
- Business strategy skills to define commercial and product innovation strategies, especially in the field of technology-based startups.
- Knowledge in commercial management.
- Management of databases to exploit the results of the use of digital technologies by citizens.
- Security of digital devices, especially in terms of data management.

# Impact of smart cities on professional profiles

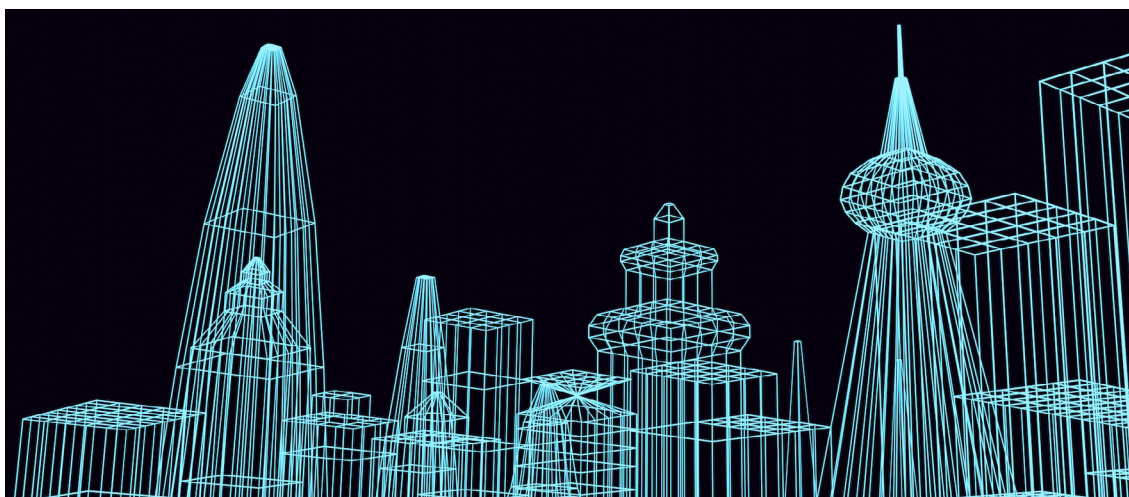
Among the professional profiles that make up the smart city sector, **some have existed for longer** (Big Data Expert, IoT Specialist, Geographic Information Systems Technician) and **others have been established more recently**, such as the Expert in Digital Twins, the Digital Network Analyst, the Circular Transport Routes Planner and the Circular Economy Manager. However, it must be understood that the vast majority of professional profiles that will help develop and consolidate smart cities already exist. They come from the fields of digital technology, systems engineering, mechatronics and installation and maintenance of urban service networks.

The forecast of the impact of smart cities on professional profiles is difficult to establish due to the sector's dynamism, which shows the evolution of digital technology and the preferences of users in the social use of new technology. However, some of the new professional profiles include the following:



## Expert in digital twins

- **Justification:** smart cities involve equipping roads, buses, water pipes, lights... with millions of sensors and other widgets using the Internet of Things. Thanks to digital twins (digital models), their performance can be monitored and controlled remotely and in real time. They support rapid decision-making through optimised operational management, for example by fixing the infrastructure before it breaks, optimising the use of energy and finding underused resources.
- **Description and functions:** an Expert in Digital Twins works with a team to integrate data from multiple sources (such as water, lights, traffic, garbage collection and hospitals) within the city to allow real-time analysis and decision-making, for example about repairs to be made and consumption management and control. They create dashboards to help decision-makers quickly understand whether and when there is a problem.





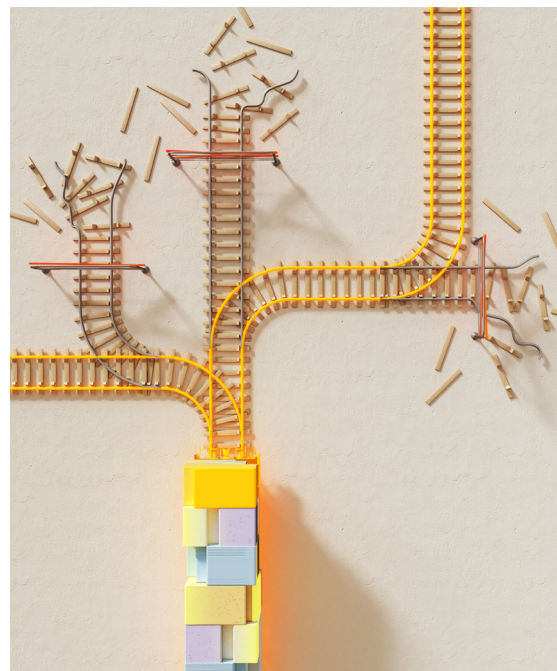
### Microgrid Analyst

- **Justification:** As renewable energy unfolds, cities, neighbourhoods and buildings produce energy independently for their own consumption or to sell to the general grid. This energy comes from different sources (solar, wind, traditional sources...) and has different destinations (offices, hospitals, houses, electric vehicle chargers...). The increase in complexity must be managed.
- **Description and functions:** a Microgrid Analyst recommends the cheapest energy source available to the community at all times, depending on the state of the existing infrastructure, weather forecasts, present and future needs. They understand what can be automated and what rules regulate the local flow of energy. They work with those who make decisions about which energy sources should be developed for each specific area, assess what connections should be established with the general network as well as in which components to invest, and interact with authorities, investors and users.



### Smart Transport Planner

- **Justification:** planning helps cities address various challenges more efficiently, such as traffic congestion, environmental sustainability, safety, travel time, parking and transport costs. It can also boost the local economy, improve the economic equity of residents and allow faster responses to public safety.
- **Description and functions:** a Smart Transport Planner promotes an open data ecosystem between mobility, local transport, parking and last-mile logistics providers. They use data to influence regulations and investment plans by providing precise and measurable objectives aligned with political goals (reducing pollution, increasing mobility options and reducing travel time, among others). They ensure the implementation of the decisions made and evaluate them.







### Smart City Ethics Manager

- **Justification:** ethics is key to the creation of smart cities. As millions of people interact with digital automation, it is necessary to avoid risks that negatively affect part of the population, and to ensure that privacy remains a right.
- **Description and functions:** a Smart City Ethics Manager coordinates the dozens of actors that affect the life of citizens of a smart city –such as government organisations, civil society and NGOs– to ensure that digital ethics promotes social value through the creation of ethical guidelines. Their main goal is to avoid the opacity of the system and blind automation, which reduce supervision and ownership. They also work in control frameworks and data use. They prevent technologies deployed for a certain purpose from extending to another.



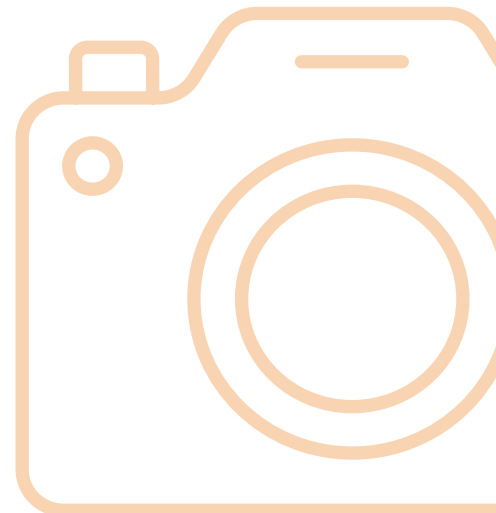
### Circular Economy Manager

- **Justification:** smart cities must be planned to integrate a circular economy by definition and from the beginning, designing systems for waste, maintaining high-quality materials in use for as long as possible and returning materials to the environment in a way that has a positive impact.
- **Description and functions:** a Circular Economy Manager evaluates and selects a product or group of products suitable for circular economy (buses, school supplies, voting machines, among others) and plans its impact throughout its process. Next, they engage in dialogue with lobbies or stakeholders to design products that align with the philosophy of the new economy. Finally, they create legal guidelines on materials, such as the use of recycled materials. They may also include design instructions for modular designs or easy disassembly.

## The intelligent city, focused

The evolution towards smart cities is unstoppable. It is driven by the growth of cities, the need for energy efficiency, self-propelled technological change and the need to ensure people's quality of life. This, however, creates a **market that presents risks**, such as the important financial investments that must be made (often outside the reach of local governments), the potential strong dependence on technology service companies, the deepening of the digital divide between citizens (some social groups may remain outside the process of digitisation and deployment of the smart city) and the divide between the functional hierarchy of nearby cities, which may affect decentralisation processes by accelerating depopulation and centralising services.

On the other hand, in terms of economic growth and importance of the sector, the sources consulted show that, in the coming years, investment in the deployment of smart cities will grow, which also ensures **job creation**. The evolution of the market is difficult to predict in terms of which technological solutions will mark the future of smart cities, but this is a market with a future that will affect the daily lives of citizens like no other.



# A focus on smart cities

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