# Part 1: Smart Cities: Concepts and Issues

# 1 Smart cities' digital transformation

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The functioning of modern cities is inextricably linked with the dissemination, implementation, and use of modern technologies and digital tools. Dameri (2013) defined technology as the main factor in their development, whilst Ostrom et al. (2015) identified technology as the most dramatic change and a "Game Changer" in the field of services. Strengthened and accelerated by the development of Artificial Intelligence (AI), robotics, cloud computing, big data, the Internet of Things (IoT), and mobile computing technologies, digital transformation is becoming an important topic for academic and practical reflection (Buhalis et al., 2019). While the concept of "smart city" continues to evolve, the development of smart cities is supported, powered, and integrated by digital technologies, propelling urbanization. In the era of ubiquitous globalization, digital solutions are becoming the most powerful and effective additions to life in cities. The integration and application of these solutions inevitably lead to digital transformation.

Many researchers emphasize that IoT, big data, AI, and immersive technologies (virtual and augmented reality – VR / AR) are the main elements of digital transformation (Buhalis et al., 2019; Albino et al., 2015; Ostrom et al., 2015; Ivanov, 2020; Mohanty, 2016; Glebova, 2020). Ivanov (2020) identifies automatic technologies, such as industrial and social robots, self-service

kiosks, AI, chatbots, face recognition technology, voice-controlled technologies, worn and implanted technologies, additive manufacturing (3D printing), IoT, and other technologies that are used to produce and deliver goods and services. They create products and services based on technology, such as: digital assistants, smart homes, service robots, mobile applications, HVAC, intelligent transport devices, face recognition tracking systems, etc. Observation of the market realities shows that IoT products and services are gradually becoming available to every consumer. City digital twin technology is emerging, and it is a useful tool to create, develop and maintain smart cities (Grübel et al., 2022). Earlier, urban planners used the predecessors of digital twins, technology through CAD (Computer-Aided Design) and smart maps powered by geospatial analytics. Digital twins provide an opportunity to manage an area (for example, city, district, street) cost-effectively and efficiently (Glebova et al., 2022). Digital twins make a virtual simulation of architectural and technological plans before implementing them in a reality (Ramu et al., 2022). These modern digital-based products and services are designed to increase automation, safety, and comfort. Smart urban environments are usually consolidated into several smartphone applications. Internet connectivity combined with large data sets, display devices, and personalized delivery options makes it possible to access products and services instantly. New buildings use more digital tools, as they become more connected and accessible, facilitating day-to-day operations.

This chapter provides the theoretical basis for learning and analyzing the concept of a smart city. It explores digital transformation phenomena in the urban area, the main drivers of change, various impacts, and the contributions of stakeholders of smart city development projects in any context. The chapter focuses on the main challenges for smart cities, related to technological progress, and explains what makes modern cities smart. It proposes a conceptual framework for the implementation of digital technologies within the concept of a smart city. Albino et al. (2015) developed different and overlapping systems for the dimensions of smart cities, namely: (1) security, quality of life, lifestyle, (2) infrastructure and services, (3) connectivity, ICT and communication, (4) people and society, (5) environment and sustainable development, (6) management and administration, (7) economy and finance and 8) mobility and transport. They define a smart city as a multidimensional structure and analyze it in the context of digital transformation.

One of the indicators of intelligence is the Cities in Motion Index (CIMI). This parameter assesses urban areas based on 10 key criteria, namely: management, town planning, public management, technology, environment, international popularization, cohesion policy, mobility and transport,

human capital, and economy (Berrone et al., 2015). As illustrated in Figure 1.1, London, as an example of a smart city, takes the lead in the overall ranking for its results in terms of international reach (1st place), human capital (1st place), mobility and transport (3rd), and the economy (12th). However, London does not have such a strong position in terms of social cohesion (position 45) and environment (position 34). Ongoing initiatives and processes aim to transform this metropolis into a smart city across all factors (Berrone et al., 2015).
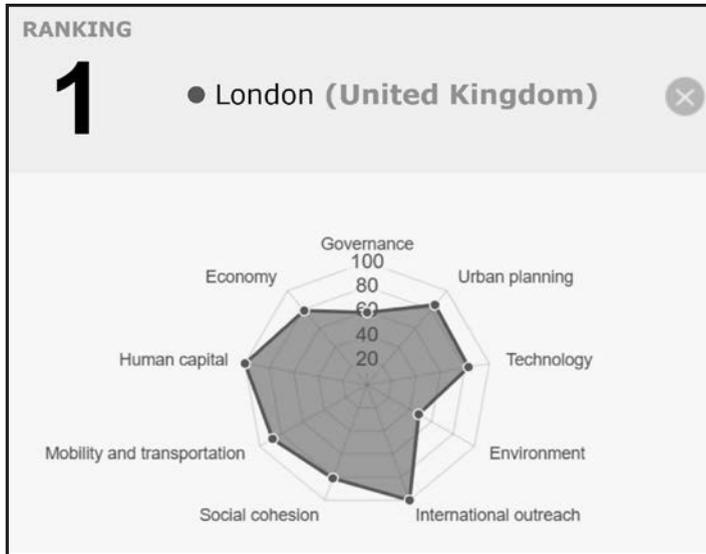


**Figure 1.1:** CIMI ranking of London. Source : screenshot from https://citiesinmotion. iese.edu/indicecim

Considering the main dimensions, the challenges in cities and the effects of digital transformation should address:

- Digital infrastructure structure
- Automation and robotization
- Personalization
- Connectivity, internet coverage, connected future
- Information availability
- Safety and security
- Variety of intelligent transport and mobility options
- Wellness, healthcare, and sport culture
- Mobile applications: consolidation all needs
- Evolving customer experience.