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Fig. 1 London's Queen Elizabeth's Olympic Park

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Smart Cities: London, Paris, Barcelona, Milan

Definitions and Strategies

INFORMATION AND COMMUNICATION TECHNOLOGIES (ICT)
SMART CITY
SMART ECONOMY
SMART ENVIRONMENT
SMART PEOPLE

This study examines and contrasts the implementation and results of smart initiatives across four domains – smart people, smart economy, smart environment, and information and communication technologies (ICT) – in four large-sized smart cities: London, Paris, Barcelona, and Milan. By investigating these domains, the study intends to assess the effectiveness of smart city strategies. It examines how technology and data-driven approaches have been implemented to enhance citizen participation, promote environmental sustainability, and stimulate economic growth.
This research contributes to an in-depth comprehension of the many facets of smart cities and their potential to transform urban environments.

INTRODUCTION

Smart cities have emerged as a promising solution to complex challenges that urban areas face with rapid population growth. With the development of technology, smart cities such as London, Paris, Barcelona, and Milan have implemented smart city strategies to improve the quality of life for their residents, increase resource efficiency, and promote sustainable development. However, despite the growing interest and investment in smart city initiatives, comprehensive research is required to evaluate the effectiveness and impact of these strategies in attaining their intended objectives. Rapid urbanization and population growth in these cities have created numerous problems, including traffic congestion, environmental degradation, and insufficient infrastructure. Smart city strategies address these issues using digital technologies and data-driven approaches to optimize resource allocation, enhance service delivery, and create more habitable and sustainable urban environments. The implementation of smart city strategies in London, Paris, Barcelona, and Milan reflects the recognition of the potential benefits of incorporating innovation and technology in urban administration. While there is a growing body of research on smart cities, most existing literature has focused on specific case studies or aspects of smart city development. To identify common trends, share best practices, and benefit from each other's experiences, a comparative analysis of smart city strategies across multiple cities, such as London, Paris, Barcelona, and Milan, is necessary. This study seeks to contribute to the existing body of knowledge by addressing these gaps and providing a thorough analysis of smart city strategies in London, Paris, Barcelona, and Milan. Through a comparative analysis, the study will identify similarities and differences between the strategies and shed light on the factors contributing to their development. The study aims to compare and contrast the implementation of smart initiatives in four domains – smart people, smart environment, smart economy, and information and communication technology (ICT) – in the large smart cities of Barcelona, Paris, London, and Milan. By investigating these domains, the study intends to evaluate the efficacy of smart city strategies and identify best practices in these cities. It will investigate how these cities have utilized technology and data-driven approaches to promote citizen engagement, environmental sustainability, and economic growth. Therefore, the following research question is posed: How do the objectives, priorities, and implementation approaches of the smart city strategies in London, Paris, Barcelona, and Milan differ in four domains, and what factors contribute to these differences?

AN ANALYSIS OF SMART CITY DEFINITIONS AND STRATEGIES

Smart cities have emerged as a focal point of urban development initiatives, with cities around the globe attempting to harness the potential of technology and innovation to improve various aspects of urban life. However, the concept of smart cities is complex and encompasses a variety of definitions and strategies. The purpose of this paper is to provide an analysis of smart city strategies and definitions based on the field's most influential literature.

The smart city, in the context of urban development, is characterized by the integration of advanced information and communication technologies (ICT), knowledge-based institutions, and a focus on creating high-quality living environments. The primary objective of smart cities is to improve the quality of life for citizens by optimizing resource utilization and promoting sustainability. This definition highlights the multi-dimensional nature of smart cities, encompassing technological innovation, institutional support, and a focus on the well-being of citizens (Giffinger et al., 2007: 15).

A different perspective on the definition of a smart city suggests a multi-faceted framework that includes three fundamental considerations: technology, people, and institutions. According to this framework, smart cities should utilize technology to enhance urban

services, actively engage citizens in decision-making, and establish effective institutional structures to support smart city initiatives. This definition highlights the importance of considering not only the technological aspects of smart cities but also their social and institutional dimensions (Nam and Pardo, 2011: 286).

It is imperative to acknowledge the significance of digital technologies and e-participation in promoting transparency and encouraging citizen involvement in smart cities when devising strategies. The judicious deployment of these technologies empowers citizens to participate actively in decision-making processes, leading to more democratic and responsive governance. Furthermore, public-private partnerships are often utilized to carry out smart city initiatives. These partnerships enable collaboration between governments, private businesses, and citizens, leveraging their combined resources, expertise, and networks to advance the development of smart cities (Anthopoulos, 2017: 222).

The authors highlight the importance of new media and citizen participation in urban design. They argue that incorporating new media technologies and platforms enables citizens to actively participate in the planning and design of their cities, leading to more inclusive and user-centered urban environments. This approach aligns with the idea of smart cities that prioritize citizens as key stakeholders and active participants in shaping urban development (De Lange and De Waal, 2013: 2).

The analysis of definitions reveals common elements such as the use of digital technologies, citizen engagement, and sustainability. Strategies including public-private partnerships and citizen-centered approaches have facilitated successful implementations. However, privacy, interoperability, equitable access, and sustainability must be carefully addressed as obstacles. By considering these factors, policymakers and city planners can develop inclusive and effective smart city initiatives that improve urban life and foster sustainable development (Table I).

Table I Key Dimensions of smart cities

Author	Dimension	Environmental	Economic	Social
Bakici et al., 2010	High-tech, connections, ICT, sustainable, greener city, competitive, innovative	+	+	+
Caragliu et al., 2011	Human and social capital, ICT, Infrastructure, sustainable economic growth, quality of life, participatory governance	+	+	+
Giffinger et al., 2007	Economy, mobility, environment, people, living, governance	+	+	+
Nam and Pardo, 2011	Information, infrastructure, efficiency, mobility, decision making	+	–	+
Townsend, 2014	Technology, Infrastructure, architecture, social, economic, environment	+	+	+
Siemens, 2017	Resilience, social and human aspects, technology, services	+	+	+
ARUP, 2010	Engaged citizens, efficient, interactive, engaging, adaptive, and flexible city	+	–	+
Deloitte, 2018	Technology, city operations, data, networks, decision-making	+	+	+
International Business Machines IBM, 2009	Interconnected information, operations, optimization of resources	–	–	+
Evergreen, 2018	Resilience, inclusivity, collaboration, data, quality of life	+	–	+
Future Cities Catapult, 2017	Marketing, the global tech industry, digital transformation	–	–	+

The (+) means that the definition includes that dimension.

Smart City Characteristics

Europe's smart cities exhibit several distinguishing characteristics that define their transformative potential. Various characteristics contribute to the innovative and sustainable nature of smart cities.

Citizen participation stands out as a critical characteristic of smart cities. Empowering citizens through digital technologies and platforms enables them to actively participate in the decision-making processes, which fosters a sense of ownership and promotes inclusiveness. Citizen participation is essential for ensuring that smart city initiatives align with residents' requirements and aspirations.

The second crucial trait of smart cities is sustainability, which highlights the challenges of maintaining urban sustainability and underscores the importance of smart cities to address the environmental, social, and economic dimensions. Smart cities embrace sustainable practices, such as energy-efficient infrastructure, renewable energy sources, advanced waste management systems, and green spaces. The ultimate goal is to decrease carbon emissions, enhance resource efficiency, and establish urban areas that are livable and resilient (Cugurullo, 2013: 188).

The integration of ICT infrastructure is a key characteristic of smart cities, highlighting the significance of digital technologies in promoting e-government services, promoting transparency, and encouraging public involvement. The ICT infrastructure comprises high-speed internet connectivity, advanced utility systems, networked sensor systems, and intelligent transportation systems. These technological advancements have enabled the development of various smart city applications and services, such as smart mobility, advanced energy management, and enhanced governance (Anthopoulos, 2017: 215).

Integrating nature and sustainability is a noteworthy characteristic of smart cities. It underscores the importance of environmen-

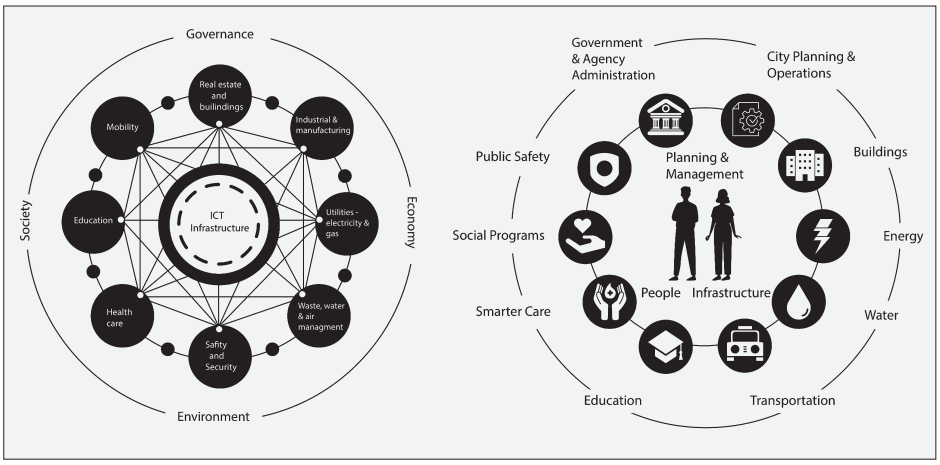

FIG. 2 TECHNOLOGICAL AND HUMAN ASPECTS OF SMART CITIES

tal factors in smart city initiatives. Smart cities aim to establish a harmonious balance between urban development and the natural environment by incorporating green spaces, promoting biodiversity, and implementing sustainable practices such as urban farming, green structures, and water conservation measures. By prioritizing nature and sustainability, smart cities strive to enhance the quality of life for residents while minimizing the negative impact of urbanization on the environment (Bulkeley et al., 2015: 129).

Safety and security are essential features of smart cities. To ensure the safety of residents and infrastructure, the implementation of advanced security systems and surveillance technologies in smart cities is critical for ensuring public safety and maintaining a secure environment. Smart cities employ a range of technologies, including CCTV cameras, sensors, and data analytics, to monitor public spaces and respond effectively to emergencies. By deploying intelligent security systems, smart cities can enhance their overall safety and security, fostering confidence among residents and attracting businesses and investors (Anthopoulos, 2017: 226).

Economic resilience and competitiveness are crucial objectives of smart cities. It is imperative to recognize the importance of economic growth and innovation in smart city strategies. Smart cities prioritize entrepreneurship, expand knowledge-based industries, and attract investments. By fostering a business-friendly environment, smart cities aim to enhance economic resilience, create job opportunities, and improve the quality of life for residents. Additionally, by promoting innovation and establishing an environment conducive to economic development, smart cities position themselves as attractive locations for businesses, talent, and investment (Giffinger et al., 2007: 14).

Accessibility and mobility also play a crucial role in smart cities. This includes the incorporation of intelligent transportation systems, intelligent traffic management, and the provision of efficient and accessible public transportation services. Increasing mobility options contributes to the reduction of traffic congestion, improvement of air quality, and enhancement of the city's overall livability. By prioritizing accessibility and mobility, smart cities endeavor to develop transportation networks that are accessible and convenient for all residents.

In conclusion, the analysis of smart city characteristics reveals the multidimensional nature of smart cities, which includes elements such as nature integration, cultural vitality, safety and security, economic resilience, and accessibility. These characteristics illustrate the holistic approach smart cities adopt to create sustainable, habitable, and innovative urban environments (Fig. 2).

Smart cities in Europe represent a harmonious blend of technological innovation and human well-being. These urban centers leverage digital solutions to enhance efficiency, resource management, and environmental sustainability. On the technological front, smart cities deploy interconnected devices according to IoT) for real-time data collection, optimize energy grids, and create responsive urban infrastructure. Cloud computing, data analytics, and AI drive informed decision-making. However, the true essence lies in the human aspects. Smart cities prioritize the citizens' quality of life, ensuring equitable access to services, safety, and community engagement. Inclusivity, privacy, and ethical considerations are paramount. Ultimately, smart cities thrive when technology serves humanity, creating vibrant, resilient, and people-centric urban ecosystems.

TABLE II THE SELECTED CITIES MAIN OBJECTIVES

Cities	London	Paris	Barcelona	Milan
Population	**9,541,000**	**11,142,000**	**5,658,000**	**3,149,000**
Strategy (year)	2019-2050	2020 and beyond	2015-2019	2020-2030
Objectives / Goals	– Open Data & Transparency – Technology Innovation – Efficiency & Resources Management – Collaboration & Engagement	– Open city – Connected city – Sustainable city	– Inclusive city – Productive city – Self-sufficient city – Smart and innovative city – City of communities and public spaces	– Sustainable Mobility – Equity, security, social cohesion – Environmental quality – Innovation and economic efficiency

SELECTION OF CITIES

We considered selecting cities that align with our research objectives, such as London, Paris, Barcelona, and Milan, due to their unique characteristics. Four cities were selected to

ensure a sufficient spread across various factors, including their geographic location, population size, maturity of their smart city program, and data availability, as well as their capacity to contribute to the project.

A literature review has provided an overview of the existing research on urban topics. By analyzing previous studies, we realized that London, Paris, Barcelona, and Milan are well-documented in various fields. There is individual research for each selected smart city regarding their strategies. We wanted to compare four large-sized smart cities in the following four domains: Smart People, Smart Economy, Smart Environment, and ICT.

Barcelona prioritizes inclusivity, economic vitality, resource efficiency, and technological innovation. **Paris** emphasizes transparency, connectivity, environmental balance, and resilience. **London** actively involves citizens, leverages technology, optimizes resources, and fosters collaboration, and **Milan** strives for sustainable mobility, social cohesion, environmental quality, and economic efficiency. These cities exemplify diverse paths toward smart urban development, emphasizing technology, transparency, and citizen engagement (Table II).

Results

• Smart City London Strategy – London has been proactively implementing various strategies and initiatives to become a smart city. The city's smart city strategy encompasses a wide range of technologies and initiatives aimed at improving the quality of life, connectivity, and sustainability. In order for London to continue its development, priority must be given to the following areas: open data and transparency, technology and innovation, efficiency and resource management, and collaboration and engagement. The ultimate objective of Smart City London is to enhance the quality of life for all Londoners, which includes the implementation of programs that promote accessibility and safety, such as smart healthcare systems, energy-efficient smart homes, smart waste management systems, and smart public locations (Urenio, 2015).

The birth of London's Queen Elizabeth's Olympic Park followed the 2012 Olympic Games, leaving behind a lasting legacy that celebrates the Games while serving as a one-of-a-kind centerpiece for East London (Fig. 1).

• Smart City Paris Strategy – Paris has established critical strategies and goals to become a smart city. Initially, the city prioritizes sustainable mobility by promoting eco-friendly modes of transportation and expanding the infrastructure for cycling. Secondly, Paris is investing in digital infrastructure, such as enhanced connectivity, the implementation of IoT devices, and a smart grid for effective energy management. Thirdly, citizen engagement is essential, and Paris has implemented participatory feedback and idea-sharing platforms. The city is committed to improving verdant spaces and air quality. Finally, Paris fosters innovation through specialized centers and incubators, thereby driving technological advancements for a sustainable, connected, and livable urban environment (Choose Paris Region. n.d.; Fig. 3). Modifying the urban landscape of cities like Paris or Barcelona, which had developed prior to the invention of the automobile, is a relatively straightforward task when compared to the significant challenge of transforming the transportation-oriented infrastructure of North American or Australian cities. In these municipalities, the automobile remains the predominant mode of transportation.

Fig. 3 Place de la nation, Paris, one of seven transformed squares

• Smart City Barcelona Strategy – Barcelona has implemented a variety of strategies for smart city development, with the aim of promoting sustainable urban expansion while also improving transportation, energy use, and social innovation. To achieve these goals, the city has sought to encourage the adoption of successful foreign solutions by catalyzing the efforts of organizations, entrepreneurs, and investors. One such project is the "Social Innovation for Communities" initiative. In addition, the Barcelona City Council has worked to establish alliances between private and public parties, which fall under the category of "private and public parties". These activities are part of the broader scope of Barcelona's smart city strategy (Ferrer, 2017: 71; Fig. 4).

• Smart City Milan Strategy – The seven categories that form the basis of the Smart City Milan strategy are as follows: positioning Mi-

FIG. 4 BARCELONA'S CAR-FREE SMART CITY

lan as a global city, implementing sustainable urban mobility solutions, promoting social inclusion and diversity, focusing on well-being in the city, fostering the creation of enterprises, simplifying administrative processes, and promoting social inclusion and diversity. Additionally, the city has adopted environmental and energy policies. These pillars serve as the foundation for the city's efforts to leverage innovation and technology to drive economic growth, enhance social inclusion and access to services, improve the quality of life for inhabitants, and ensure an equitable distribution of resources, including technical and everyday life support systems (Milan Strategy for Smart City, 2019: 6; Fig. 5). The implementation of the project was undertaken in collaboration with Milan's Mobility and Environment Agency (AMAT), Bloomberg Associates, the National Association of City Transportation Officials (NACTO), and the Global Designing Cities Initiative. The temporary nature of the interventions permits cities to act promptly and trial solutions that can be rescinded if necessary.

SMART PEOPLE

• London has formulated a comprehensive strategy for converting the city into a smart one, with a focus on the well-being of its citizens. This plan acknowledges that intelligent cities should prioritize the needs and aspirations of their citizens, and accordingly emphasize their participation and engagement. Consequently, it fosters various initiatives, such as the provision of digital platforms for citizen feedback and collaboration, the launch of citizen-led innovation programs to tap into unique insights, and the establishment of a framework for citizen data rights to ensure transparency and control. The aim of this approach is to create a city that is inclusive and responsive to the diverse requirements and expectations of its residents by involving them in the development of smart city solutions (Greater London Authority, 2013).

• Smart City Paris concentrates its initiatives on its citizens: Participatory budgeting: The city of Paris has implemented "Madame Mayor, I have an idea", a participatory budgeting program that enables citizens to propose and vote on ideas for public spending. Paris has implemented several initiatives to engage citizens in co-creating urban services, such as the "City of Data" platform, which invites citizens to contribute their data to help improve the city's services. Paris has also launched several platforms and applications that enable citizens to provide feedback on public services and share ideas for enhancing the city. It has organized hackathons, which are collaborative events where citizens collaborate to develop innovative solutions to urban problems. Smart City Paris seeks to engage its residents in the decision-making process and co-create solutions to enhance the city's services and quality of life.

• Smart City Barcelona seeks to focus on "smart people" by promoting social innovation and citizen participation. The city's "Social Innovation for Communities" project is an example of this strategy, encouraging citizens to develop and implement creative solutions to urban problems. The project has resulted in the establishment of community gardens, cultural initiatives, and other community-led initiatives that support social cohesion and empowerment. Barcelona has also launched several platforms for citizen participation, including a platform for citizen feedback and complaints and a participatory budgeting process. These initiatives demonstrate Barcelona's dedication to involving citizens in the design and implementation of smart city solutions, resulting in a more inclusive and participatory urban environment (Bigulova, 2015).

• Smart city Milan's initiatives include digital education, social innovation, citizen engagement, and inclusion. Smart City Milan prioritizes smart people by promoting quality of life, well-being, and inclusivity. Milan encourages education, innovation, digital skills development, and citizen participation to foster smart growth and individual success. The city encourages social innovation to resolve urban challenges by engaging citizens in collaborative initiatives, and through participatory platforms, Milan actively involves citizens in decision-making processes the city also prioritizes inclusivity and accessibility, ensuring that all citizens have access to the benefits of technology. These initiatives demonstrate Milan's dedication to empower-

ing its citizens and positioning them at the center of the smart city transformation (Milan Strategy for Smart City, 2019).

Smart Economy

• Smart City London's_Strategy for Establishing a Smart Economy Focuses on Collaboration, Digital Skills Development, and Attracting Foreign Direct Investment. Critical sectors, such as fintech and digital health, are expected to drive growth in the smart economy. The city plans to leverage its assets, including a skilled labor force, a thriving tech startup community, and world-class universities, to foster innovation and economic growth. The strategy aims to establish London as a global leader in the smart economy while supporting entrepreneurs, small and medium-sized enterprises (SMEs), and key industries through collaboration, innovation, and digital skills development (Greater London Authority, 2013).

• Smart City Paris prioritizes the smart economy by employing a number of strategies. It establishes innovation hubs such as Station F, thereby encouraging entrepreneurship and facilitating the development of startups. Incubators and accelerators provide assistance and resources to startups. The city invests in digital infrastructure, such as high-speed connectivity and Internet of Things (IoT) networks. By making data accessible to businesses, open data initiatives foster innovation and economic growth. Collaboration with industry stakeholders, including both large corporations and small and medium-sized enterprises, helps to facilitate knowledge sharing and co-creation. By implementing these strategies, Paris fosters innovation, entrepreneurship, and the development of a flourishing smart economy.

• Smart City Barcelona's strategic approach places a strong emphasis on the development of a smart economy. The city has implemented various strategies to foster entrepreneurship and innovation, encourage digital transformation across sectors, and promote industry-academia-government partnerships. These initiatives aim to establish Barcelona as a hub for innovation, investment, high-quality jobs, and digital economic development. Smart City Barcelona's economic proposal is an inclusive, mission-oriented technology and innovation strategy that seeks to harness the power of technology to drive a sustainable, smart economy. This approach places digital issues at the center of the economy, with the aim of minimizing social and economic inequities, ensuring technology and data sovereignty, promoting access to knowledge, defending digital rights, and providing citizens with informational self-determination (Barcelona Cat, 2017).

Fig. 5 Milan's open squares initiatives use paint and planters, benches, and ping-pong tables to reclaim public space for enjoyment

• Smart City Milan is committed to the development of a smart economy by fostering innovation, promoting sustainable practices, advancing digitalization, and supporting local businesses. To achieve this objective, the municipality has undertaken various projects and initiatives, such as the Smart Waste Management system, the Sharing Mobility Platform, and the creation of a Smart Energy Grid. These initiatives aim to integrate digital technology and promote environmentally responsible urban development. Furthermore, the city's collaborative approach, citizen participation, and focus on innovation seek to build a vibrant and inclusive smart economy, thereby stimulating economic growth while promoting sustainability and enhancing the quality of life for its residents (Sharing Cities, 2022).

Smart Environment

• Smart City London's strategy for creating a smart environment will be achieved through sustainable infrastructure, clean transportation, green spaces, climate change adaptation, data-driven environmental management, citizen participation, and a circular economy. This includes the adoption of renewable energy, promotion of electric vehicles, preservation of green spaces, increase in climate resilience, utilization of data for environmental decision-making, engagement of citizens, and transition to a circular economy. These initiatives showcase London's commitment to integrating technology, sustainability, and citizen participation to enhance environmental quality, mitigate the effects of climate change, and create a resilient and sustainable urban ecosystem (Greater London Authority, 2013).

• Smart City Paris prioritizes the creation of a smart and sustainable environment through various initiatives. The city promotes sustainable transportation options, such as expanding bicycle infrastructure, promoting electric vehicles, and utilizing renewable energy sources for public transportation. Car-sharing and ride-sharing services are encouraged to reduce individual vehicle usage. To enhance its urban environment, Smart City Paris is developing additional green spaces, such as parks and gardens, and supporting urban agriculture initiatives to increase local food production and improve air quality. The municipality is committed to reducing greenhouse gas emissions through energy efficiency measures in buildings and promoting renewable energy sources, such as solar and wind power. To minimize waste generation and optimize waste management processes, Smart City Paris implements waste reduction strategies, such as composting programs and circular economy practices. The city is also implementing intelligent water management systems to conserve water, reduce pollution, and ensure that residents have access to pure drinking water. These initiatives contribute to the creation of a sustainable, environmentally friendly, and livable urban environment in Smart City Paris (Choose Paris Region. n.d.).

• Smart City Barcelona prioritizes the creation of a smart environment by decreasing energy consumption, enhancing waste management, and encouraging the use of renewable energy sources. Barcelona has taken numerous steps to enhance energy efficiency, waste management, and green spaces, and also has adopted a smart waste management system that optimizes waste collection routes using sensors and data analytics. Barcelona has undertaken initiatives to expand parks, develop green corridors, and promote urban agriculture. These initiatives contribute to improved air quality and livability in general. The city has implemented numerous initiatives to expand parks, create green corridors, and improve urban agriculture, all of which have contributed to an improvement in air quality and overall livability. Overall, Barcelona's smart city strategy utilizes technology and innovation to create a sustainable and eco-friendly urban environment (Smith, n.d.).

• Smart City Milan is committed to establishing a digital infrastructure through various undertakings. The city is focused on promoting sustainable mobility, including bike-sharing programs, electric car-sharing, and improved public transportation. By upgrading public buildings and encouraging private building owners to adopt energy-efficient measures, energy efficiency is fostered. The city has implemented a smart waste management system leveraging sensors and data analytics to optimize waste collection and recycling. Furthermore, Milan prioritizes the development of green spaces and urban revitalization initiatives, and sensor-based environmental monitoring aids in identifying areas for improvement. These strategies reflect Milan's dedication to creating a sustainable and high-quality urban environment (Milan Strategy for Smart City, 2019).

ICT AND TECHNOLOGY SECTOR

• Smart City London is an excellent example of leveraging Information and Communication Technology (ICT) to improve urban living. Through initiatives such as IoT integration, real-time data analytics, and smart infrastructure, London is enhancing transportation efficiency, optimizing energy consumption, and encouraging citizen participation. It is paving the way for a connected and sustainable future. People in London are among the first to try out new technologies. For instance, the City of London installed "smart" recycling bins that functioned as Wi-Fi connections and featured digital panels that displayed information regarding the city. Moreover, the London Datastore, which was one of the first platforms to make public data open and accessible, has attracted the attention of London's developer community and has led to the creation of a large number of apps that improve the city's overall efficiency (Smart London Plan, 2013: 42).

• Smart City Paris is becoming a smart city because of substantial progress in the information and communications technology industry. Utilizing cutting-edge technologies like the Internet of Things (IoT), Big Data, and Artificial Intelligence, Paris has set out to improve the quality of life of its residents, as well as the city's overall sustainability and urban services. This includes projects like intelligent transportation systems, smart energy grids, and data-driven governance, all of which will position Paris as a significant worldwide center for urban development and innovation. An Internet of Things (IoT) infrastructure has been developed in Paris to improve the city's public transportation system and the flow of passengers through it, and it has devised plans for a comprehensive overhaul of the transportation system to be carried out via Grand Paris Express. Finally, one of the initiatives that will be carried out as part of this plan is the installation of a fully automated subway system made possible by Big Data (Top 10 Smart Cities in the World, 2022).

• Smart City Barcelona has made significant contributions to the advancement of information and communications technology (ICT)

Table III Comparison of the selected cities

	London	Paris	Barcelona	Milan
Population	9,541,000	11,142,000	5,658,000	3,149,000
Smart people	– Prioritizes citizen engagement and participation. – Takes into account the needs of its habitants. – Developed initiatives or feedback and collaboration platforms. – Citizen-led innovation programs. – A framework for citizen data rights.	– A program of participatory budgeting allowing citizens to propose and vote on ideas for public expenditures. – Co-creation of urban services. – Contribution of citizen data to improve municipal services. – Platforms and applications to facilitate citizen feedback and idea sharing.	– Promotes social innovation and citizen participation. – Encourages citizens to create and implement solutions to urban issues. – The" Social Innovation for Communities" project promotes social cohesion and empowerment. – Creates a more inclusive and participatory urban environment.	– Digital education programs to enhance digital literacy and proficiency. – Social innovation. – Citizen engagement. – Collaborative initiatives that foster social innovation.
Smart economy	– Seeks to establish a smart economy by fostering collaboration between sectors. – It promotes development in crucial sectors such as digital health. – To promote innovation and economic growth in the smart economy, the plan prioritizes collaboration, innovation, and digital skills development.	– It prioritizes the growth of a digital economy. – It prioritizes collaboration and innovation to promote economic growth. – Open data initiatives promote economic development. – Committed to the growth of a thriving smart economy.	– It emphasizes the development of a digital economy. – The "22@Barcelona" district brings together enterprises and research institutions for economic development. – It concentrates on digitally transforming traditional industries by integrating technology to boost productivity and competitiveness.	– It encourages innovation. – Promotes sustainable practices and promotes digitalization. – Committed to becoming carbon neutral by 2030.
Smart environment	– Sustainable infrastructure, clean transportation, green spaces. – Adaptation to climate change. – Data-driven environmental management. – Citizen participation and a circular economy. – Citizen participation to improve environmental quality.	– It prioritizes a sensible environment. – Sustainable modes of transportation. – Expands bicycle infrastructure. – Utilizes renewable energy for public transportation. – Smart water management system for water conservation.	– Taking action against air and noise pollution through monitoring, analysis, and targeted measures to enhance air quality and reduce noise levels. – It seeks to create an eco-friendlier and more sustainable urban environment.	– It emphasizes the development of a digital environment. – Bike-sharing programs, car-sharing with electric vehicles, and improved public transportation. – Emphasis on developing green spaces. – Committed to a sustainable and high-quality environment.
ICT and technology sector	It utilizes IoT, Big Data, and AI for sustainability, transportation, urban services enhancement.	Smart City Paris utilizes IoT, Big Data, and AI for sustainability, transportation, and urban services enhancement.	Smart City Barcelona prioritizes privacy, data security, and participatory governance with the Decidim platform for citizen engagement.	Smart City Milan embraces ICT for transportation, energy, waste management, and citizen empowerment through digital platforms.

and technology. To improve both its efficiency and its environmental friendliness, the city has installed things like intelligent street lighting, smart parking systems, and integrated sensor networks. The dedication of Barcelona to the use of digital technology has resulted in an improvement in public services, an increase in connection, and the empowerment of individuals to actively engage in shaping the city's future. In the last five years, Barcelona's smart city practices have evolved, and the widespread use of smartphones has brought technology into the residents' lives in a more direct manner. They disseminate instantaneous information regarding employment, housing, administration, mobility, health services, and utilities. The city prioritizes privacy, data sovereignty, and data security as fundamental aspects of its approach. Its primary goal is to promote participatory governance and ensure that the smart city serves its citizens according to their preferences. Regarding this, the city has developed a digital platform called Decidim (We Decide), enabling direct citizen participation in suggesting ideas, engaging in debates, and voting (Anon, 2022).

• Smart City Milan is a vibrant metropolis in Italy that has recognized the potential of information and communications technology (ICT) and technology to improve city life. Milan has improved its transportation, energy, and waste management systems thanks to its cutting-edge infrastructure, smart Internet of Things (IoT) technology, and data-driven governance. As a result of its efforts to cultivate innovation centers, encourage startup companies, and empower citizens through digital platforms, it has become an example of the progression of technological innovation. Smart City Milan has implemented several noteworthy Information and Communication Technology (ICT) initiatives. It has prioritized enhancing mobility via smart traffic management and real-time transportation data. The city has also implemented smart infrastructures, energy monitoring, and the use of renewable energy. Priority has been placed on data-driven governance, with open data initiatives and citizen engagement platforms facilitating participatory decision-making. The city of Milan has implemented sophisticated infrastructure and services, including intelligent lighting and waste management. In addition, the city encourages innovation and supports ICT businesses through collaboration and resources. These initiatives have transformed Milan into a

smart city that is connected, sustainable, and centered on its citizens (Milan Strategy for Smart City, 2019).

The summary of the selected cities are shown in Table III.

Smart People:

– London values citizen engagement and participation, taking into account the needs of its inhabitants, and promotes smart governance through various initiatives, such as the London Office of Technology and Innovation.
– In Paris, smart people actively engage, collaborate, and embrace digital literacy, playing a pivotal role in shaping the city's transformation into a technologically advanced and inclusive Smart City.
– Barcelona prioritizes privacy, data security, and participatory governance with the Decidim platform, which enables citizens to have a greater say in decision-making processes.
– Milan embraces ICT for transportation, energy, waste management, and citizen empowerment through various digital platforms, such as the city's smart parking system.

Smart Economy:

– London aims to promote the growth of a digital economy and encourage innovation, with initiatives such as the London Tech Investment Organisation and the London Co-Investment Fund.
– Paris leverages IoT, Big Data, and AI for sustainability, transportation, and urban services enhancement, and encourages innovation through programs like the Paris Innovation and Digital Initiative.
– Barcelona focuses on digitally transforming traditional industries by integrating technology to boost productivity and competitiveness, with initiatives such as the Barcelona Industry 4.0 Cluster.
– Milan embraces ICT for transportation, energy, waste management, and citizen empowerment through various digital platforms, such as the city's smart energy management system.

Smart Environment:

– London emphasizes sustainable practices and promotes digitalization, with initiatives such as the London Environment Strategy and the London Green Summit.
– Paris utilizes renewable energy for public transportation and has a smart water management system for water conservation, as part of its efforts to promote sustainability and combat climate change.
– Barcelona prioritizes a sensible environment, expands bicycle infrastructure, and takes action against air and noise pollution, with initiatives such as the Barcelona Sustainable Urban Mobility Plan.
– Milan embraces ICT for transportation, energy, waste management, and citizen empowerment through various digital platforms, such as the city's smart waste management system.

CONCLUSION

The smart city strategy of London prioritizes initiatives that don't neglect open data, technology and innovation, efficiency and resource management, and collaboration and engagement to improve the quality of life. Through smart healthcare systems, energy-efficient smart residences, smart waste management systems, and smart public locations, the city intends to increase accessibility, safety, and sustainability. Smart city Paris has established a comprehensive smart city strategy prioritizing sustainable transportation, digital infrastructure, citizen engagement, verdant spaces, and innovation. The city invests in digital connectivity and energy management, encourages citizen participation, enhances air quality, and fosters innovation through specialized centers and incubators. The objective of Paris is to create a sustainable, interconnected, and habitable urban environment. Through various approaches, Barcelona's smart city strategy prioritizes sustainability, efficiency, and quality of life. Citizen engagement, open data principles, sustainable mobility, intelligent infrastructure, and social innovation initiatives are city priorities. Barcelona aspires to use technology and citizen participation to propel urban development and enhance the well-being of its residents. Milan's smart city strategy emphasizes using technology and data-driven approaches to create a sustainable and efficient urban environment. The city emphasizes open data, sustainable mobility, energy efficiency, intelligent waste management, and intelligent infrastructure. Milan intends to foster innovation, collaboration, and sustainability to improve the quality of life and realize its smart city objectives. In their smart city initiatives, London, Paris, and Barcelona share similar priorities and strategies. By instituting sustainable transportation, green spaces, waste management, and renewable energy solutions, they all aim to create a smart environment. By involving citizens in decision-making and solution co-creation, London and Milan prioritize inclusive development.

Paris and Barcelona emphasize participatory processes, with Paris emphasizing citizen feedback and hackathons and Barcelona emphasizing social innovation and community-led initiatives. All three cities are committed to involving their residents in the intelligent city transition.

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Tables I-III	Authors

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