Institut européen
European Institute

LUISS
School of Government

Joint Master in Global Economic Governance and Public Affairs

Smart Cities: Empowering Governance, Communities and Ethical Challenges

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2024

To my parents, for always being there no matter what.

To the people in my life for never making me feel alone.

To Rome, Berlin, Nice and to this persevering journey.

To myself and to all that is to come.

Ai miei genitori, per esserci sempre, a prescindere da tutto.

Alle persone della mia vita per non avermi mai fatto sentire sola.

A Roma, Berlino, Nizza e a questo tortuoso viaggio.

A me stessa e a tutto quello che verrà.

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Abstract

Developing an understanding of the current period becomes crucial when reading and interpreting changes for the future. One possible key to interpretation is the discovery and use of new technologies aimed not only at achieving a sustainable transition to the future but also at improving citizens' lives. It is precisely from this concept that the idea of Smart Cities emerges. Grasping the meaning of the term and analysing it, the following analysis aims to demonstrate how, thanks to these new technologies, it is possible to recreate a relationship between institutions and citizens, achieving an improvement in public services as well as urban planning. In the following essay, I will proceed to analyze how this set of strategies can improve governance and enhance the relationship between institutions and citizens. The focus of my analysis will also be to describe the ethical and educational limitations that lurk behind Smart Cities.

Introduction

In an era characterized by rapid technological advancements and sustainability, it becomes crucial to understand the trajectory of the future. The term "Smart City" inherently embodies the essence of intelligent urban design, aimed at optimizing public services and enhancing overall quality of life. This concept encompasses a set of data-driven strategies and innovative governance designed to address the diverse needs of citizens.

The growing importance of Information and Communication Technologies (ICT), social capital, and the environment has made the concept of Smart Cities increasingly relevant and achievable. In recent years, projects and initiatives related to this concept have grown remarkably, as have investments made by companies and institutions.

Central to my analysis is understanding how Smart Cities can be and are the solution to achieving a green transition. Scholars argue that increasing urbanization and the ongoing shift away from small communities towards urban areas and metropolises necessitate this transition, not only due to the current climate crisis but also to improve citizens' lives. In a historical context where the relationship between citizens and institutions has historically been marked by a lack of trust and increasingly absent participation, the premise is to describe how new technologies can serve as a catalyst for change. The

concept of E-Governance, citizen participation, and the involvement of local communities is central within the document. It becomes important to understand how, by leveraging new technologies, administration and bureaucracy management can be improved. In the following pages, I will explore the concept of Smart Cities and its main characteristics. Through the "Smart City Wheel," an analysis will be conducted to understand the criteria by which a city can be considered "Smart" and the steps leading to this transition. Through this exploration, it will also be possible to analyze potential and possible limitations.

Of particular interest to me is analyzing how, through the use of new technologies, projects can be created with the aim of increasing citizen participation and establishing a strong relationship between citizens and administration. The analysis will delve into two specific cases: I-Voting in Estonia, a modern voting method aimed at increasing citizen participation and reducing abstentionism, and Smart Dubai, an initiative promoted by the Dubai government aimed at making the city interconnected and integrated through the use of IoT and artificial intelligence. These elements will be key to understanding how citizen involvement, increased participation in social policies, and the implementation of the concept of e-governance can be considered a substantial and necessary change for the years to come. I will demonstrating how Smart Cities function and how in the near future there will be increasingly more projects aimed at achieving this transition.

In the final chapter of the document, the limitations and criticalities that one might encounter will be analyzed, particularly focusing on the concepts of privacy and data usage. We are living in a historical era characterized by constant stagnation. On one hand, there is the ever-growing monopoly of large IT companies that own and exploit collected data, and on the other hand, there is the necessity and urgency for institutions to defend democracy and citizens' rights. I will analyze what seems to be one of the most important obstacles to overcome, namely access to the internet and therefore the digital divide. Additionally, there will be particular attention to the education of future generations and the re-education of generations born in the analog era, to ensure that everyone can enjoy the same benefits.

In conclusion, Smart Cities represent an ambitious and necessary vision for the future of global urbanization. Through the adoption of advanced technologies, the promotion of sustainability, and the improvement of governance, cities can become more

livable, efficient, and inclusive. However, the success of these initiatives requires continuous effort to address ethical challenges, overcome the digital divide, and ensure that all citizens can benefit from the advantages offered by emerging technologies. The main objective of this analysis is to understand whether Smart Cities truly represent an opportunity for the growth of citizen participation, despite the existing limitations. Only through a balanced and inclusive approach can we build cities that are truly intelligent and sustainable for future generations.

Literature Review

The concept of the Smart City was originally created to provide a functional response to the management of urban environments, increasingly influenced by human pressure generated by growing urbanization, particularly in the last century. (Eleonora Riva Sanseverino, Raffaella Riva Sanseverino, and Enrico Anello, 2018; W. J. Mitchell, 1999). The idea of a "smart city" has thus become not only a technological and infrastructural solution aimed at maximizing efficiency within a city. (Mircea Eremia, Lucian Toma, Mihai Sandulance, 2017; John V. Witer, 2008).

Over time, the meaning of the term itself has undergone a profound transformation, becoming the means by which new technologies are used to improve citizens' lives and initiate an increasingly green transformation. (Stratigea Anastasia, 2012).

To begin with, it is important to note that the field of smart cities is interdisciplinary and draws from a variety of different aspects, including urban planning, computer science, engineering, social sciences, and public policy. (Petar Šolić, Luigi Patrono, Toni Perković, and Vincenzo Stornelli, 2019).

The main line of thought of different authors expresses how Smart Cities and the idea of using new technologies are an innovative and modern concept aimed at a real transformation. (McKinsey Global Institute et al., 2018) The idea is based on harmoniously implementing different IT systems. Jungheum Park and Hyunji Chung (2018), two university professors specializing in cybersecurity, define the concept of Smart City as the "fourth industrial revolution."

Don Tapscott, co-founder of the World Economic Forum's Centre for Strategic Foresight, explains how the use of new technologies can help achieve an 'open government'. A mode through which transparent administration is obtained, reducing the problem of corruption and helping civil society to self-regulate, creating public value and reducing costs due to excessive bureaucracy. (Don Tapscott, 2014)

Of the same line of thought, but more focused on other aspects, are the social actors who instead agree on the need to concretely initiate a green transition and aim for sustainable development. Local administrations, for example, see intelligent technologies as tools to improve service efficiency, reduce environmental impact, and enhance citizens' quality of life. This is the case with the "Green City Accord" project, a movement of European mayors committed to making cities cleaner and healthier. Aiming to improve the quality of life for all Europeans and accelerate the implementation of relevant EU environmental laws (Green City Accord, European Union, 2024).

International organizations such as the World Bank, the United Nations, and the European Union provide financial support, technical assistance, and policy guidance for the development of sustainable Smart Cities. These organisations also facilitate collaboration and the exchange of experiences between cities worldwide. For example, the United Nations Economic Commission for Europe (UNECE) is promoting the "United for Smart Sustainable Cities" (U4SSC) project, a global initiative that provides an international platform for information exchange and partnership creation to guide cities and communities in achieving the United Nations' sustainable development goals. (U4SSC KPI – United for Smart Sustainable Cities (U4SSC)). While non-governmental organizations (NGOs) play a fundamental role in ensuring that smart city projects are inclusive, equitable, and sustainable.

On the other hand, there have been criticisms and concerns. One of the main implications of living in a digital world is the possibility of increased surveillance and loss of privacy. Data can also be used to monitor and track people without their consent (Offiong Bassey, 2023), which represents a real limit to democracy. Architect, professor, and researcher Klaus R. Kunzman, in his book "Smart city: a new paradigm for urban development," discusses how within the concept of "Smart City," there are also negative aspects. In particular, it highlights the dependence on technology and how, within a few

years, future generations will no longer be able to survive without ICT devices. The author compares the use of digital devices to taking drugs, highlighting the addiction (Klaus R. Kunzman, 2018). Additionally, major corporations in the information and communication technology sector will use their power to increase their global dominance and profits. They already have the power to influence and manipulate local and national governments. (Solnit, 2013).

Researchers Jungheum Park and Hyunji Chung express how the "dark side" of smart cities is essentially divided into five sections: Invasion of privacy and human rights, (In)Security of endpoint devices, trade-off of security and usability, digital dependency. (2018) Another factor brought to light is the possibility of increased inequality. While smart city technologies have the potential to improve residents' quality of life, there is a risk that the benefits will not be evenly shared. (Offiong Bassey, 2023) Furthermore, even in developed countries, citizen awareness of smart cities is significantly low. The situation is comparatively worse in developing countries where illiteracy is already a serious problem. In these countries, a significant percentage of the population is not technology savvy. (Navii Joshi, 2019) The fear is that with the growth of the ICT industry, the international gap that would be created with developing countries prioritizing other socio-economic aspects may increase.

As seen in the existing literature, the positive elements that characterize Smart Cities are linked to the very concept of the term, which refers to the use of technologies to improve citizens' quality of life, but not only that. It becomes essential infrastructure when talking about sustainable transition and urban center modernization.

Considering instead the pioneers of the "dark side," we have a line of thought that deals with the ways in which institutions and large companies that currently monopolize them use data. Furthermore, the important lack of digital education and the possible and likely international gap that would be created over time are emphasized. (Don Tapscott, 2014)

As highlighted in the literature, most studies on smart cities have focused more on the technological aspects of the phenomenon, on the private side of smart city partnerships, and on its sustainability aspect. A portion of the research conducted so far seems to pay less attention to the role of public organizations. Not only do they have the

power and duty to lead smart city initiatives, as stated by the EU, OECD, and several other institutions, but they should also harness their potential to improve relations with citizens.

The main objective of this thesis is to fill this gap in the literature, demonstrating through concrete examples and qualitative analysis how the concept of Smart City is essential for improving the functioning of institutions in order to increase citizen participation. The concept of E-Governance represents one of the main attributes, being the perfect synthesis of an improvement in government processes (e-administration); citizen connectivity (e-citizens and e-services); and external interaction building (e-society). (Richard Heeks,2001). In a society that is increasingly hyperconnected, it becomes essential for institutions to do everything possible for citizen involvement. The thesis also aims to understand the negative aspects of Smart Cities by comprehending and analyzing what are the ethical and functional criticisms of it.

Methods Applied

The methodology adopted for this research is based on the analysis of the Smart City Wheel and qualitative in-depth study of two specific case studies, with the aim of demonstrating how the use of the Smart City concept can improve the relationship between e-governance and citizens. The Smart Cities Wheel model developed by Boyd Cohen and Rob Adams in 2012 shows how technology and innovation can help cities become smarter. It visualizes cities following a top-down approach. (Petrova – Antanova; Illieva; 2019)

Over the years, the authors have sought to update the model, with the aim of engaging in the development of an Internet of Mobility (IoM) solution based on blockchain. Reflecting on the use of blockchain to make cities smarter and citizen-oriented, cities can be divided into six main dimensions: smart economy, smart environment, smart governance, smart living, smart mobility, and smart people. The Smart City Wheel is therefore a conceptual model that provides an overview of the various elements that make up a Smart City. (Fig.1) Subsequently, Boyd Cohen and Rob Adams in 2017 also introduced the Gross National Happiness (GNH) index of Bhutan into the measurement systems. In doing so, a Hexagon of Happy Cities was developed by

implementing its parameters, taking into consideration the GNH - Happiness Index. (Petrova – Antanova; Illieva; 2019) (Fig. 2)

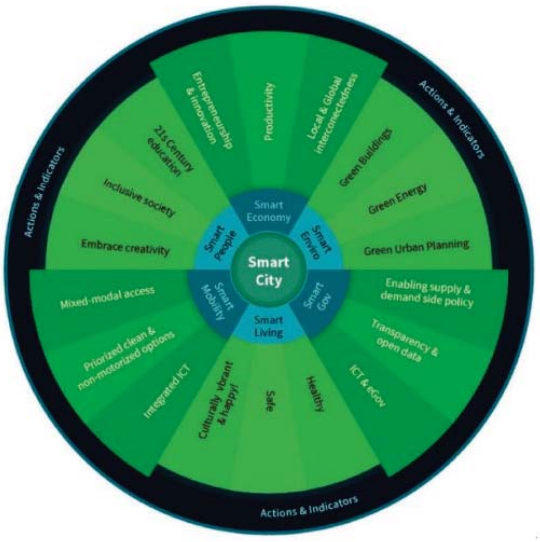

Fig.1 Smart Cities Wheel, Rob Adams and Boyd Cohen, 2012

Fig. 2. Happy Cities Hexagon, Rob Adams and Boyd Cohen, 2017

These elements include, but are not limited to: governance and citizen participation, economy, mobility, environment, technology, infrastructure, and quality of life. Using the Smart City Wheel as a guide, the criteria defining a city as "Smart" will be examined and these criteria can be implemented to enhance citizen engagement and governance. To support my analysis and demonstrate its real effectiveness, I have selected two case studies to delve into how Smart Cities can positively influence the relationship between e-governance institutions.

The first case study is I-Voting in Estonia. It is an electronic voting system implemented in Estonia with the aim of increasing citizen participation in elections and improving the efficiency of the voting process. Through in-depth qualitative analysis, the implications of this system on citizen engagement and electoral process transparency will be explored.

The second case study is Smart Dubai, an initiative of the Dubai government aimed at making the city interconnected and integrated through the use of the Internet of Things (IoT) and artificial intelligence (AI). This case study will be examined to understand how the implementation of innovative technologies can improve public services and strengthen the bond between institutions and citizens.

Data analysis collected during the study will be conducted using a qualitative approach. Reports, case studies, government documents, and other reliable sources will be examined to gather pertinent information. Qualitative analyses will be guided by understanding the specific contexts of the case studies and evaluating their impacts on the relationship between e-governance and citizens.

Through this methodology, the aim is to provide an in-depth understanding of how Smart Cities can be used to enhance governance and empower the relationship between institutions and citizens, while identifying ethical and educational challenges and opportunities arising from such initiatives.

CHAPTER I

Understanding Smart City

Before delving into analyzing how the concept of Smart City and its application can concretely improve e-governance and citizen relations, it is important to understand the origins of this concept and what it represents in practice. To comprehend this, it is crucial to consider the historical and social context in which we find ourselves. Starting from an axiom, we can say that the world has changed more in the last twenty years than in the last hundred. (Rudy Bandiera; 2014) What we are experiencing is defined as the information revolution. (Renzo Davoli; 2014) A revolution in which we have the presence of digital natives and analog natives inhabiting the same social context, a context in which institutions and companies have the duty, but above all the necessity, to undergo a process of total digital transition. All this must be done in an era where evolution is swift, technologies are constantly updated, and the risk of having obsolete systems is very high. Currently, we find ourselves in a period that is referred to by computer scientists, experts, and sociologists as Web 3.0. But let's take a small step back; in 1991, the World Wide Web was born (Barners Lee; 1991), quickly transitioning from the static informational characteristics of Web 1.0 to the interactive experience provided by Web 2.0. The next phase of web evolution, Web 3.0, is already underway. (Riaan Rudman, Rikus Bruwer; 2016)

Web 3.0 is based on applications and services that have made the web increasingly popular in recent years. Search engines provide targeted information, while social networks allow people to connect in a deeper and more meaningful way. The Semantic Web structures information so that machines can understand it like humans, while the 3D Web offers immersive experiences in virtual worlds. Media-centric Web allows search engines to seek similar multimedia objects. (Keshab Nat, Raja Iswarj; 2015)

It is precisely in this array of applications and updates that the concept of Smart City comes into play; these projects use the logic of web 3.0 to optimize efficiency, promote sustainability, and improve the quality of life for citizens. This is achieved through the integration of IoT devices that collect real-time data on the surrounding environment, such as air quality and traffic. Blockchain technology ensures security and

transparency in city transactions, while big data analysis and artificial intelligence are used to extract useful information for managing urban services, such as public transportation and waste management. In addition to this, the technological logic used in Web 3.0 helps to create real and usable E-Governance. The two elements integrate to ensure efficiency, usability, transparency, and speed. All of which guarantee greater citizen participation and better public services.

The concept became very popular in 2015 (as can be seen in Fig.3), thanks to increased awareness of technological advancement and a growing awareness of urban challenges. Additionally, in 2015, the UN's Agenda 2030 was adopted by 193 member states, and one of its goals is precisely the importance of sustainability and resource usage.

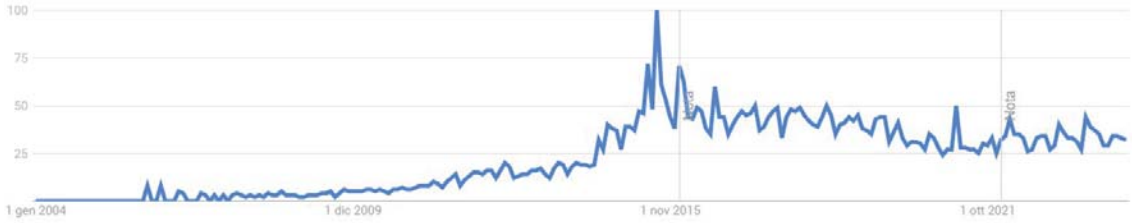

Fig.3 Relative number of hits for Smart Cities searches in Google from 2004 and May 2024

In 2018, Zaheer Allam and Peter Newman discussed the concept of Smart Cities as a true brand. Cities themselves can adopt the concept of a smart city as part of their communication strategy to promote themselves as attractive destinations for investment, tourism, and city life. Demonstrating to be a smart city can enhance the city's reputation and image, attracting businesses, talent, and funds for urban development projects.

1.1 Definition of Smart City

To give a concrete example, being a Smart City is like placing a warranty certificate on an object. In the context of research on Smart Cities, it is essential to provide an initial general definition. This will mark the perspective and research path adopted within the following analysis. Initially, the concept involved the optimal use and management of resources, but over the years and with technological progress, the definition of the concept

itself has evolved. Currently, the definition also encompasses aspects related to citizen participation, social progress, digital governance, and overall increased efficiency.

According to the European Commission, a smart city is: "*A place where traditional networks and services are made more efficient with the use of digital solutions for the benefit of its inhabitants and businesses.*" While according to the Oxford dictionary, it is: "*A city that uses digital technology to enhance the quality of life, efficiency of urban operations, and urban services.*"

The definition that I personally found illuminating was coined by Caragliu, Del Bo, and Nijkamp (2009). They assert that a smart city is a synthesis of physical infrastructure (or physical capital) with the availability and quality of social knowledge and communication infrastructures. This latter type of capital is crucial for urban competitiveness. Digital cities tend to focus on physical infrastructure, while smart cities focus on how such infrastructure is utilized. It goes without saying that the concept of a smart city is still evolving and subject to numerous debates. Although digital innovation remains central to the concept of a smart city, a key question is how it can effectively contribute to improving the welfare of citizens. (Mattia A., 2020) The term has been used to describe cities that are environmentally sustainable, with a concentration of knowledge workers and places with efficiently functioning infrastructures and entrepreneurial economies. (McKensey & Company; 2018) Considering the general definitions described above, we can say that a smart city is characterized by the integration of advanced digital technologies in various urban sectors, including transportation, energy, environment, health, education, and security. In addition to these more structural and logistical aspects, there is the presence of innovative governance that involves citizens in the planning and management of urban resources. Another fundamental aspect is its modernity and adaptability, which is distinguished by its resilience to changes. Smart Cities should be capable of adapting to climate change, economic crises, and health emergencies, thus ensuring flexibility and security. Finally, a smart city is forward-thinking, embracing innovation and continuous evolution. The combination of the public and private aspects of Smart Cities implies a constant commitment to adopting new technologies, researching, and developing creative and innovative solutions to address emerging urban challenges.

1.2 Key characteristics and principles of smart city

Our conceptual basis is the "Smart City Wheel," a fundamental model that allows us to understand how smart cities are divided and organized. Subsequently, we will delve into the various macro-areas outlined by Rob Adams and Boyd Cohen to explore in detail the characteristics and principles that define the concept of a smart city. It is important to emphasize that each aspect is interconnected and must be coordinated with all others. Only in this way does the model make sense and ensures its total application.

1. Smart Environment

The development of a smart environment is essential to ensure the sustainability of cities and the well-being of their inhabitants. Smart cities adopt a series of strategies and technologies to preserve natural resources and reduce the environmental impact of human activities. This first principle analyzes the use of resources and the extent to which sustainable transition has been achieved. (T.V. Kurman, 2020) It consists of three key elements:

- Green Building: Sustainable construction has been discussed since the 1960s and 1970s. The book "Silent Spring" by Rachel Carson (1962) is considered the pioneer in promoting it. Green building encompasses a wide range of practices, techniques, and skills to reduce and ultimately eliminate the impact of buildings on the environment and human health. Key features of these buildings include energy efficiency, the use of sustainable materials, and water recycling.
- Green Energy: Green energy refers to renewable and low-impact energy sources used to power activities within cities. The Johannesburg World Summit on Sustainable Development committed to *"encourage and promote the development of renewable energy sources to accelerate the transition to sustainable consumption and production."* The adoption of green energies reduces greenhouse gas emissions, promotes energy independence, and contributes to the transition to a low-carbon economy. Major sources include wind, hydroelectric, solar, and biomass.
- Green Urban Planning: This refers to city planning that considers principles of environmental sustainability. This includes creating green spaces, promoting sustainable mobility, and conserving natural resources. These elements improve the quality of life for citizens.

2. Smart Governance

With this element, we refer to the possibility, thanks to new technologies and new management methods, of having transparent, effective, and secure governance. This includes:

- Enabling supply & demand side policy: This element is fundamental for citizen engagement through investments, incentives, and initiatives aimed at educating and raising awareness.
- Transparency & open data
- ICT & e-Gov: The integration of Information and Communication Technologies (ICT) with electronic governance (e-Gov) within smart cities promotes innovative and accessible public services through digital platforms, improving administrative efficiency and citizen participation. E-Gov policies promote administrative transparency through public access to government data and enhance the efficiency of decision-making processes.

3. Smart Economy

The development of a dynamic and innovative economy is essential to ensure the growth and prosperity of cities. Smart cities create an environment conducive to innovation and entrepreneurship, leveraging digital technologies to promote economic and social development. It has emerged as part of the framework of smart cities to encourage urban growth, considering that urban populations currently live in a digital society. However, with technological and economic changes driven by globalization, cities are now faced with the challenge of simultaneously supporting productivity and sustainable urban development. (Nurlatifah Diana Binti Pajilani, et Al.; 2021) According to the model, they consist of:

- Entrepreneurship & innovation: Encouraging entrepreneurship and adopting innovative practices are crucial to stimulating sustainable economic growth and fostering the development of resilient and dynamic communities. In this context, we discuss digitalization, new technologies, and collaboration between the public and private sectors.
- Productivity

- Local & Global interconnectedness: The Smart City model promotes a market oriented towards globalization, which, thanks to technology, becomes a connection and growth. It aims to explore knowledge and experiences through international exchanges.

4. Smart People

Smart People is the category that includes projects and initiatives to foster participation and sharing with citizens. It's a democratic collaboration that involves co-designing and ensures access to information. New technologies enable new methods of participation, and citizens develop e-skills that they then apply in everyday life. In a Smart City, people have access to education and employment, society is inclusive, and creativity and innovation flourish from the grassroots level. (G. Mussi; 2019)

- 21st century education: In this context, it refers to a type of digital education, through which both new and old generations will be able to interface with new technologies, becoming capable of controlling, understanding, and utilizing them correctly.
- Inclusive Society
- Embrace creativity: Embracing creativity in a smart city fosters innovation, economic growth, and cultural enrichment. Creative solutions to urban challenges promote sustainability and citizen engagement by celebrating diversity. Through entrepreneurship and creative industries, cities foster job creation and vibrant cultural richness.

5. Smart Mobility

This concept includes a series of practices and services that integrate public transportation, shared mobility, autonomous driving, two-wheeled mobility, and other forms of sustainable transportation. The goal of smart mobility is to create smoother, more accessible, and environmentally friendly transportation systems, while simultaneously reducing the negative impact of urban traffic on people and the environment. It leverages technological innovation to optimize traffic flow, reduce travel times, improve accessibility, and provide citizens with safer, more convenient, and efficient travel options. (Iain Dochertya, Greg Marsdenb, Jillian Anable; 2018)

- Mixed-Modal access
- Prioritize clean & non-motorized options: This refers to the approach of favoring and promoting clean and non-motorized transportation options within an urban mobility

system. This concept is an integral part of the strategy to promote environmental sustainability and reduce pollutant emissions and noise pollution in cities. In this sense, it involves promoting projects such as bike lanes, pedestrian paths, and greater efficiency of public transportation networks.

- Integrated ICT: These elements related to smart mobility must be integrated using ICT technologies: traffic management systems, intelligent sensors, urban mobility applications such as car-sharing and bike-sharing.

6. Smart Living

In this element, it's not just about integrating all the above-described aspects, but it emphasizes the need to make all of this a true way of life.

- Culturally, vibrant & happy
- Safety: The possibility of digital services that improve and simplify the lives of citizens, while ensuring the safe use of data and controlling their management and usage.
- Health: Digital technologies improve access to and the quality of healthcare services in smart cities. This may include telemedicine, remote patient monitoring, wellness apps, and chronic disease management systems, as well as healthcare emergency management systems that use artificial intelligence to predict and respond to the healthcare needs of the population.

In summary, we have described how smart cities are characterized by a series of interconnected dimensions aimed at improving the quality of life for citizens. The individual elements that are part of the Smart Wheel indicate what the evaluation parameters are, as well as the objectives that make a city smart and sustainable. These represent key characteristics and serve as a framework for any public or private project. The entire model aims to promote environmental sustainability, transparency, civic participation, economic and social development, and individual and collective well-being. By integrating digital technologies, innovative strategies, and active citizen participation, smart cities can become models of sustainable and inclusive urban development in the context of increasing global urbanization.

1.3 Major technologies in a Smart City

So far, there has been a detailed description of the theoretical concepts and objectives that a Smart City aims to achieve. It has been emphasized several times that this evolution is made possible through technological progress. Below are briefly outlined the main technologies used in a Smart City and how they are utilized.

IoT (Internet of Things)

Coined in 1999 by the renowned engineer Kevin Ashton, IoT is considered a term used to indicate how a global network can enable communication between human-to-human, human-to-things, and things-to-things, essentially providing a unique identity to each object in the world. (Somayya Madakam, R. Ramaswamy, Siddharth Tripathi, 2015) Simplifying the concept and applying it to a Smart City context, it can be defined as the network of physical devices, vehicles, appliances, and other objects embedded with sensors, software, and network connectivity that enable them to collect and exchange data. These devices can communicate with each other and with other digital systems, allowing for real-time monitoring, control, and automation of a wide range of processes and environments.

Big Data

In their book "Understanding Spatial Big Data Analytics for Regional Science," published in 2016, Chris Kitchin and Tracey P. Lauriault provide a definition of Big Data as follows: "*Big Data are data characterized by a set of properties, including high velocity, vast volume, and variability. These data can be generated in real-time or collected in batch and come from a wide range of sources, including sensors, mobile devices, social media, environmental sensors, financial transactions, health records, and more. Big data require advanced technological solutions for collection, storage, management, analysis, and visualization, and offer opportunities to extract new insights, reveal patterns, and develop forecasts that can inform decisions and actions in multiple contexts*" (Chris Kitchin and Tracey P. Lauriault, 2016). From this definition, it is inferred that these are data with such high volume, velocity, and variety that they surpass the capacities of traditional data management and analysis software tools. Just as defining their size is complex, so is their analysis

Open Data

These data refer to public information released by government agencies and made freely accessible to the public. Examples include crime statistics, levels of city services, and data on urban infrastructure. Many government authorities and leading cities have established dedicated online portals for open data, such as those in the UK and Canada. (data.gov.uk and open.canada.ca).

Blockchain

In recent times, Blockchain has emerged as a transformative technology with the ability to disrupt and evolve multiple domains. As a decentralized and immutable distributed ledger, Blockchain technology is one of the latest entrants into the global ideology of Smart Cities. (Abhirup Khanna et Al., 2021) Thanks to this type of technology, it is possible to provide citizens with greater transparency and significantly reduce tax fraud, in addition to providing a secure register.

Cloud and Edge Computing

From a technological perspective, cloud computing relies on large centralized data centers, which host servers, storage, and high-capacity network infrastructure. These data centers provide virtualized and scalable computing resources via the Internet, allowing users to access them from anywhere and anytime and essentially serve to deliver computing services. Edge computing, on the other hand, relies on local or regional computing devices, known as "edge devices," which are distributed near end-users or where data is generated. These devices can be servers, routers, IoT gateways, or even mobile devices.

Artificial Intelligence

Artificial Intelligence is currently the most popular and successful element, with almost everyone now aware of its potential and risks. In terms of Smart City, artificial intelligence (AI) is employed in cities' public transportation to enhance user experience by providing real-time information via mobile applications on delays, breakdowns, and less congested routes. (Voda and Radu, 2018) This encourages users to modify their choices to minimize future congestion and enables cities to make informed decisions about modifying public transportation routes and schedules. Furthermore, AI is used to

enhance public safety by monitoring public transportation and providing information to law enforcement to reach destinations more quickly and safely. In smart cities, AI also collects data on energy usage and consumer behavior, which is used to make informed decisions on energy management and identify the best locations for businesses. . (Nambiar et al., 2018)

These are just some of the main technological elements that come into play when discussing new technologies and Smart Cities. The complexity of technological ecosystems and services in smart cities requires a holistic approach to networks and communications that supports a range of needs, from monitoring infrastructure to creating infrastructure for digital media businesses, and from home security to monitoring city-scale transportation. (Rodger Lea, 2017)

CHAPTER II

The Role of E-Governance in Smart Cities

In discussions about the digital transformation of institutions, there is often a need to clarify the concept of E-Governance and distinguish this approach from traditional governance. The key issue that this paper aims to address is how Smart City models can integrate institutional digitization to significantly improve the quality of life for citizens. Let's begin by providing a general definition of the concept. E-Governance generally refers to the provision of national or local government information and services via the Internet or other digital means (Relyea, 2002). E-Governance refers to the government's ability to interact electronically with citizens, businesses, and other government entities. Interaction can take the form of obtaining information, processing payments, or performing a range of other activities via the World Wide Web (Abramson & Means, 2001; Bertucci, 2003; Sharma, 2004; Sharma & Gupta, 2002). The concept of E-Governance within a Smart City model becomes fundamental to promoting transparency, accessibility, and facilitating the delivery of services to citizens. In this chapter, we will explore what it encompasses, its relationship with public administration, and how it can ensure greater democracy and citizen participation. As a final element, we will describe what all these elements represent concretely through a practical case study. The case study is the phenomenon of digital voting, which has been present in Estonia for many years, a choice that has made the country progressive and modern, increasing citizen participation.

2.1 Introduction to E-Governance

The phenomenon of Electronic Governance is becoming increasingly widespread, especially concerning administrative management. This result demonstrates how new technologies aim to form new forms of communication and cooperation between the state and citizens. These technologies can serve a variety of purposes: improving the delivery of government services to citizens, enhancing interactions with businesses and industry, empowering citizens through access to information, or more efficient government management. The resulting benefits may include reduced corruption, increased transparency, greater convenience, revenue growth, and/or cost reduction. Similarly, electronic commerce, which allows businesses to interact more efficiently with each other

(B2B) and brings customers closer to businesses (B2C), E-Government aims to make interactions between government and citizens (G2C), government and businesses (G2B), and inter-agency relations (G2G) more user-friendly, convenient, transparent, and cost-effective (T.M. Vinod Kumar, 2015). From this analysis, it emerges that the E-Governance process represents an opportunity for citizens in terms of transparency and accessibility and for businesses in terms of economic security and relationship with institutions. But above all, it represents a turning point for governments and institutions in terms of procedures, citizen relations, bureaucracy, management, and administration. E-Governance is a term that originated long ago, and over the years, it has undergone evolution in tandem with technological advancements. There is emerging a definite pattern of evolution of E-Governance in its functional aspect if one considers its presence in different states of India or the world in chronological order. The United Nations identifies five stages of E-Governance:

• Phase-1(1996–1999): Emerging with Basic Web Presence

• Phase-2(1997–2000): Enhanced with Interactive web

• Phase-3(1998–2003): Interactive graduating to Transaction web

• Phase-4(2000–2005): Integrative and Transformative web

• Phase-5(2005+): Smart City Governance web or well-connected web.

In his book "E-Governance for Smart Cities" (2015), T.M. Vinod Kumar provides a careful analysis of the different phases of E-Governance, highlighting how during the period 1996-1999, municipal, state, and union governments began using the internet to provide information to citizens, primarily through the creation of websites. These websites, although initially resembling digital bulletin boards, allowed for one-way communication to display information related to municipal government. Some of them also offered notification services via email and SMS to selected users. (T.M. Vinod Kumar, 2015) During the period 1997-2000, we witnessed the evolution of interactive websites, which introduced two-way communication and allowed users to interact with the government by submitting comments and filling out online forms. During the period 1998-2003, government websites began to offer more complex transactional functionalities, allowing citizens and businesses to complete entire operations online,

such as vehicle registration renewal. During the period 2000-2005, there was progress in service integration and transformation, with a particular focus on user-centered experience and connection between multiple government agencies. This led to the creation of government portals that offer a wide range of integrated services through a single platform. In summary, over the years, E-Governance has undergone significant evolution, transitioning from static websites to interactive and integrated platforms that offer a wide range of services to citizens and businesses. The project related to the digitization of institutions is extensive and involves the participation of various stakeholders, both public and private. Every two years, the United Nations produces a report that helps provide an overview of the digital government landscape in all 193 member states. The E-Government Survey is based on over two decades of longitudinal research, with a ranking of countries based on the United Nations E-Government Development Index (EGDI), a combination of primary data (collected and owned by the United Nations Department of Economic and Social Affairs) and secondary data from other United Nations agencies. The E-Government Development Index presents the state of e-Government development in United Nations Member States. Along with an assessment of website development models in a country, the E-Government Development Index incorporates access characteristics, such as infrastructure and education levels, to reflect how a country uses information technologies to promote access and inclusion of its population. The EGDI is a composite measure of three important dimensions of e-government, namely: online service delivery, telecommunication connectivity, and human capacity. (United Nation Guideline), below we see a map that demonstrates the distribution of EDGI level.

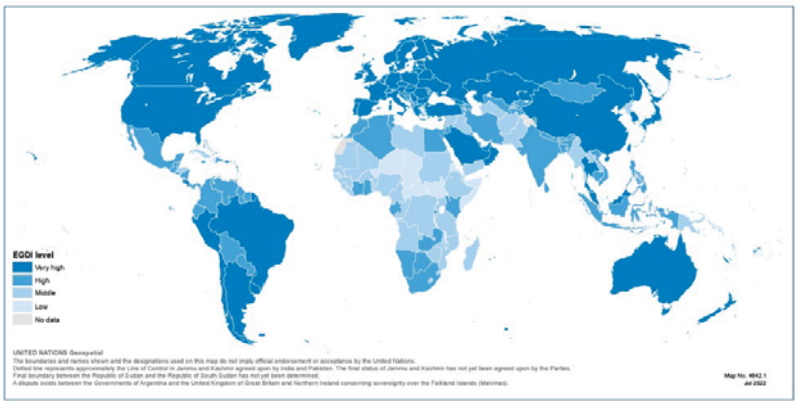

Fig.4: 2022 United Nations E-Government Survey

The 2022 Survey reflects further improvement in global trends in e-government development and the transitioning of many countries from lower to higher EGDI levels. In this edition, 60 countries have very high EGDI values ranging from 0.75 to 1.00,1 in comparison with 57 countries in 2020—a 5.3 per cent increase for this group. A total of 73 countries have high EGDI values of 0.50 to 0.75, and 53 countries are part of the middle EGDI group with values between 0.25 and 0.50. Seven countries (one less than in 2020) have low EGDI values (0.00 to 0.25). (United Nation Survey 2022)

After exploring the definition of E-Governance, analyzing its history, and seeing how internationally it is recognized as a necessary and important process for digital and institutional evolution, we will investigate how it can be a tool for democracy and citizen participation.

2.2 E-Governance as a tool for democracy and citizen participation

According to the United Nations, the primary objective of an e-government is to provide government information and services to citizens using the Internet and the World Wide Web. (Nations, 2005) Currently, almost all countries have some online services available. In a Smart City context, the implementation of E-Governance becomes an essential tool for democracy and for promoting citizen participation. Through the use of information and communication technologies (ICT), governments can make public services more accessible, transparent, and efficient, enabling citizens to interact directly with government institutions. This entire process is referred to as E-Democracy, which is the use of information and communication technologies and strategies by "democratic sectors" within the political processes of local communities, states/regions, nations, and globally. (Robert A. Gehring, Bernd Lutterbeck, 2004) In its preliminary phase, E-Governance was limited to the digitization and storage of enormous volumes of manual documents, but the rapid progress of ICT has ushered in the era of digitization and communication, which has also revolutionized e-Governance administration to achieve multichannel level. (Feroz Khan, Young Yoon, Kim and Woo Park, 2014) From a design and application perspective, practices for E-Governance and E-Democracy are converging in four main areas: online consultations that integrate civil society groups with bureaucracies and legislatures, internal democratization of the public sector itself, user involvement in the design and delivery of public services, and the spread of open-source

collaboration in public organizations. (Chadwick, A. 2003) This whole mechanism must start from small municipalities and small cities because only they have the most direct relationship with citizens and can directly listen to their needs and requirements.

For the past four years, the United Nations has been conducting studies precisely in this regard. The current study on the Local Online Services Index (LOSI) reveals how various information and communication technologies are being used. It highlights challenges such as digital exclusion and summarizes some ongoing trends. LOSI 2022 comprises 86 indicators relating to five criteria: institutional framework, content provision, services provision, participation and engagement, and technology. The institutional framework dimension focuses on municipal e-government strategy, organizational structure, legislation governing access to information and privacy, and open data policy. (UN e-Governance Survey 2022) From this index emerges rankings and analyses, but what is particularly interesting is understanding in which areas of governance digitalization states are most committed and which ones are still complex to achieve.

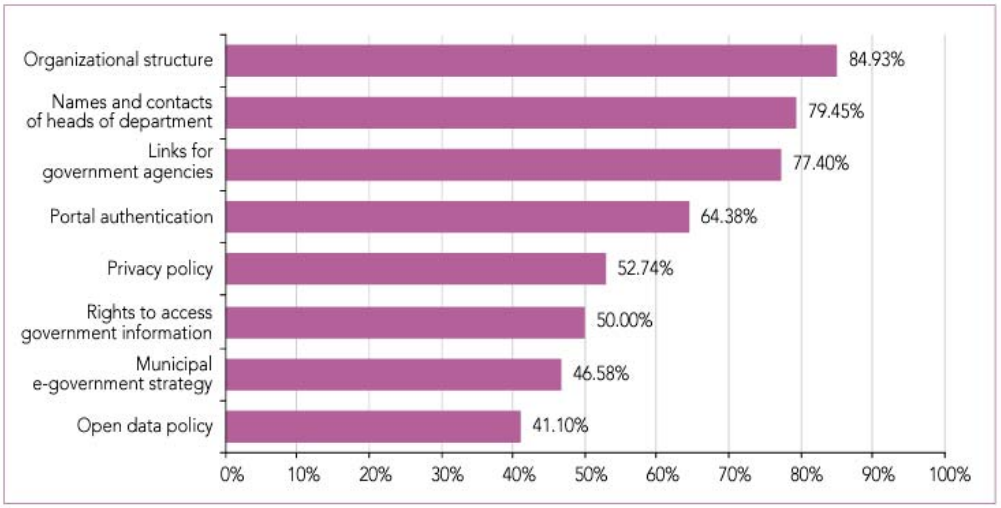

Fig.5 Institutional framework indicators in city portals
(UN E- Governance Survery 2022)

The institutional framework indicators most frequently satisfied are those relatively simple and easy to implement, such as providing clear information on the organizational structure of the municipality (85 percent), providing names and contact information for department heads (79 percent), and providing links to other government

agencies (77 percent). Most municipal portals require authentication (such as digital identification, login credentials, or a mobile key) to access online services and restricted-access areas, demonstrating awareness of cybersecurity. As visible from the graph, there are still several deficiencies in terms of e-government strategy and Open Data Policy (41 percent), fundamental elements for the complete realization of a Smart City.

The ways in which these initiatives and policies help increase levels of citizen participation are manifold, serving to create a true and equal communication between citizen and institution. These tools are used to gather the opinions of citizens and businesses so that their interests are respected and heard. These tools include electronic surveys, online newsletters, emails, feedback forms, and web forums where citizens can express their opinions. They can be used to supplement public forums or meetings. E-participation applications may need to publish on the website, presenting relevant background information, decisions, and other materials to help citizens and businesses understand certain public policy or regulatory issues.

2.3 Case Study: I-Voting in Estonia

E-Voting plays a significant role in the context of Smart Cities and especially in the context of E-Governance, as it represents the ultimate expression for the modernization and efficiency of democratic procedures. The New York Times defines it as: "The model for governments should be Estonia, a country where almost all bureaucratic tasks can be done online." According to surveys conducted by the UN (United Nations), the state of Estonia and in particular the city of Tallinn are ranked highly in various rankings related to the adoption of E-Governance tools. The official website of Estonia (https://e-estonia.com/) states: *"We have built a digital society and we can show you how."*The portal illustrates how Estonia has become the most advanced digital society in the world. After regaining independence, in 1996 Estonia launched a program for the development of national-level IT infrastructure. Its path to digitalization began with services such as e-Banking, and in 2000 the possibility of declaring taxes online was introduced. In 2002, digital identity and digital signature were introduced, followed by e-Voting in 2005. In 2007, Estonia suffered one of the largest cyberattacks ever recorded, leading the country to specialize in cybersecurity and cyber defense. In 2008, blockchain models were introduced to protect citizens' data, followed by the creation of the e-Health

system, which includes comprehensive electronic medical records. Subsequently, further changes were introduced for a complete digital transformation. The e-State system was implemented to inform citizens about the country's green objectives. The e-Residency system was also created, an electronic portal for road administration, and the NIIS x-Road consortium (Nordic Institute for Interoperability Solutions), which provides e-Governance solutions, electronic marriage, and electronic notary services. (https://e-estonia.com/story/) All these elements only reinforce Estonia's position as a leader in terms of digitalization and e-Governance.

As described, in 2005 Estonia introduced e-Voting, an abbreviation for "Internet Voting" or voting online, a system that allows citizens to cast their votes through the internet, also called REV (Remote Eletronic Voting). In practice, voters can access a secure online platform and use their credentials to authenticate and vote in elections or referendums. This system offers greater flexibility and convenience to voters, allowing them to vote from any internet-connected location, thus reducing the need to physically go to polling stations. The reasons that led Estonia to this change were the possibility of making voting accessible to less densely populated areas and the extreme weather conditions that often affect the country. e-Voting represents the most extreme form of digital democracy and fits perfectly into Rob Adams and Boyd Cohen's Smart City Wheel model, specifically under the aspect of Smart Governance.

The success of the initiative was evident from the outset, considering that the first parliamentary elections in Estonia recorded 44% of the votes through I-Voting. How is the security of the vote ensured? First of all, registration is required, and your right to vote must be determined through your own identity card. The vote must then be guaranteed by a digital signature, and subsequently, through the appropriate office, your right to vote is officially validated, and the digital signature is removed to ensure the privacy of the voters. The entire procedure is then sent to central servers that are monitored and recorded for the entire voting period to prevent anyone from tampering with the system. Additionally, for the same reason, there is a possibility to modify it until the deadline.

Thanks to the official website for Estonia's voting, we can see how over the years the percentage of votes cast through digital means has increased dramatically. This demonstrates that the logic of e-Governance works and allows citizens greater efficiency

and transparency, with full control over their actions. Furthermore, according to statistics from the Estonian government at https://www.valimised.ee/en it's possible to see how I-Voting drastically reduces "spoiled ballots," which are votes invalidated due to errors.

Elections	I-voters among eligible voters	I-voters among participating voters	I-votes among advance votes	I-votes cast abroad among I-votes (based on IP-address)	No. of states
Parliamentary elections 2023	32,5%	51,1%	68,9%	7,8%	100
Local elections 2021	25,7%	46,9%	64,6%	4,1%	110
European Parliament elections 2019	17,6%	46,7%	69,4%	5,5%	109
Parliamentary elections 2019	27,9%	43,8%	71,4%	6,3%	143
Local elections 2017	16,9%	31,7%	60,6%	4,1%	115
Parliamentary elections 2015	19,6%	30,5%	59,6%	5,7%	116
European Parliament elections 2014	11,4%	31,3%	59,2%	4,7%	98
Local elections 2013	12,3%	21,2%	50,5%	4,2%	105
Parliamentary elections 2011	15,4%	24,3%	56,4%	3,9%	105
Local elections 2009	9,5%	15,8%	44,0%	2,8%	82
European Parliament elections 2009	6,5%	14,7%	45,4%	3,0%	66
Parliamentary elections 2007	3,4%	5,5%	17,6%	2,0%	51
Local elections 2005	0,9%	1,9%	7,2%	n/a	n/a

Fig.6 Statisics about Internet Voting in Estonia – Valimised WebSite

Through this case study, we can see how digital transformation and the adoption of eVoting in Estonia represent an exemplary model of innovation in the context of Smart Cities and e-Governance. Through a series of progressive and targeted initiatives, Estonia has created an advanced digital ecosystem that offers citizens a wide range of online services, including the ability to vote over the Internet. The introduction of iVoting has

revolutionized how citizens participate in elections and referendums, offering greater flexibility and accessibility to the democratic process. This approach has helped reduce the physical and logistical barriers associated with traditional voting, allowing an increasing number of people to exercise their right to vote conveniently and securely. Estonia has demonstrated that digital transformation can lead to tangible improvements in citizen participation and government efficiency, paving the way for a new era of technology-based democratic governance.

CHAPTER III

Bridging communities:
Citizen participation in Smart City development

Signed on September 25, 2015 by the governments of the 193 member countries of the United Nations and approved by the UN General Assembly, the Agenda consists of 17 Sustainable Development Goals (SDGs) framed within a broader action plan consisting of 169 associated targets or milestones to be achieved in environmental, economic, social, and institutional domains by 2030. The Smart City Wheel model (Rob Adams, Boyd Cohen 2012) perfectly aligns with the objectives of Agenda 2030. Among the many things in common is also the goal of creating a strong community and strengthening the relationship with institutions. In recent years, many countries have seen citizens distancing themselves from policies and public affairs, almost complete disengagement. This phenomenon has resulted from various factors: distrust in institutions, disillusionment with politics, cultural and social changes, challenges posed by the media, and lack of citizen representation. New technologies, in collaboration with public policies and the desire to once again make citizens the protagonists of decisions, can make a difference. The key to making this change is precisely to unite data security, efficiency, transparency, and availability of tools for citizen participation. Possible changes through complete digitalization and the creation of platforms precisely to meet citizens' needs. To do this, it is necessary to increase citizen participation through projects. In this chapter, we will address the importance of citizen involvement in a modern society context as Smart Cities can increase and assist in the creation of projects for citizen participation, and finally, everything will be confirmed and analyzed through a virtuous case study: Smart Dubai.

3.1. Importance of Citizen involvement

The starting model, the Smart City Wheel (Rob Adams, Boyd Cohen 2012), expresses how citizen engagement is essential for the realization of an effective Smart City. Concepts like "Smart Governance" and "Smart People" include this aspect. Citizen engagement means the ability of the public to take part or participate in the processes and activities of nation-states, especially regarding the preparation of public policies and

critical decision-making that influences their daily lives (Campbell and Marshall, 2000). Sometimes, citizen engagement is confused with civic participation; in the former case, it refers to programs that emphasize citizen participation in governance, policy-making, public services, and community initiatives to promote transparency, accountability, and collaboration among governmental institutions, organizations, and the public (Nick Jain, 2024). In the latter case, we see how civic participation is a consequence of this series of implemented programs; we can define participation as the highest form of engagement. There is no formation of the state without a corresponding historical development of the notion of citizenship (International Peace Bundling Advisory Team, 2015). Citizen engagement is equally important as it is necessary for building government and citizen commitment and capacity. The Organization for Economic Cooperation and Development (OECD, 2001) recommends that governments invest adequate time, resources, and effort in building robust legal, policy, and institutional frameworks, thus developing appropriate tools and assessing their performance in engaging citizens in policy formulation. The fundamental element of citizen engagement is precisely to make it part of public policies, giving the opportunity to be part of the decision-making process and understanding it.

In the literature, from a theoretical standpoint, it's possible to explore how citizen participation could be increased. Kaifeng Yang and Sanjay K. Pandey in 2011 conducted a sample analysis to investigate the conditions under which citizen engagement can be enhanced. The model focuses on organizational variables that are more directly influenced by managerial factors, such as political support, leadership, bureaucracy, and hierarchical authority, along with variables related to participants' competence and representativeness.

The conclusion of this research highlights the fundamental importance of public management when discussing citizen participation. It emerged during the research that there are four key variables that demonstrate under what conditions greater participation is possible:

(1) *Support from elected officials*: referring to the degree of support offered by elected officials, such as mayors or members of the city council, towards citizen engagement efforts.

(2) *Bureaucracy*: The presence of a lighter bureaucracy aimed at assisting citizens rather than being an obstacle increases participation.

(3) *Hierarchical authority*: This concept concerns the distribution and exercise of power within an organization, with particular emphasis on levels of hierarchy and submission within the decision-making structure.

(4) *Transformational leadership*: Referring to a leadership style that focuses on motivation, inspiration, and the creation of a shared vision for change.

These variables remain relevant even when controlling for factors such as participants' competence and knowledge. Moreover, it underscores the importance of recognizing the complex relationships between factors influencing participation outcomes, as well as integrating normative, qualitative, and quantitative inquiries for a deeper understanding of the phenomenon. Therefore, in terms of Smart City and E-governance, citizen participation becomes crucial to ensure that policies and decisions truly reflect the needs and aspirations of the community, contributing to the creation of more sustainable, inclusive, and resilient cities. Additionally, it's possible to understand that citizens' need for greater transparency and trust in institutions is achievable through new technologies and innovative digital projects driven by e-Governance and Smart City Development logic. The ultimate goal is to make the citizen the center of discussions and dynamics related to urban management.

3.2. Linking Smart Cities and Citizen Participation

Citizens represent the beating heart of a city and are inseparably linked to its continual existence and prosperity. Therefore, it's imperative that a city's government takes care of its citizens and pays close attention to their needs. (Palik, A. 2019) The connection between Smart Cities and citizen participation becomes fundamental in a context where the concept of e-Governance is part of the Smart City Wheel model. (Rob Adams and Boyd Cohen, 2012) As analyzed earlier, to achieve greater citizen participation, there's a need to increase transparency, streamline bureaucracy, and create a union between institutional decision-making processes and citizens. How could the concept and model of Smart Cities implement this connection? Through the applications and use of new technologies, this process is possible, but not only that. Journalist Robert

G. Hollands in 2008 criticized the approach of Smart Cities, emphasizing that an approach solely based on the use of ICT technologies would not lead to the desired results. The focal point of analysis should instead begin with the people and the human capital of the city. (R.G. Hollands, 2008) The key to making this connection between Smart Cities and citizen participation work lies in the approach and creation of the decision-making process. So far, it has always been top-down, a mode through which the government and institutions make decisions that are then communicated to citizens. This mode has led to a gap in terms of representation, resulting in citizens being alienated from political and institutional dynamics. The use of a decision-making model based on a holistic approach, which involves active citizen participation, is the right key. Achievable through technologies but also and above all through cooperation and collaboration. According to Berntzen and Johannessen (2015), citizens can be involved as:

(1) Democratic participants in the decision-making process to build sustainable local communities where every inhabitant cares for one another.
(2) Primary sources of experience and expertise to develop better solutions and plans.

(3) Data gatherers; citizens can assist in collecting data post-implementation of the smart city using mobile devices or other technologies.

In 2020, Jihane Tadili and Hakima Fasly conducted a survey providing insights into smart city projects and citizen participation in various cities. Key themes explored include citizen participation, city inclusiveness, budget allocated for citizen participation, practices used to enhance citizen participation, and barriers to citizen participation. This survey was administered to smart city experts from various cities around the world (n = 37 respondents), including Amsterdam, Chicago, Boston, Washington, Barcelona, Toronto, Mulhouse, London, Lethbridge, Coimbatore, Casablanca, and Palo Alto.

In general, Fig. 7 demonstrates how citizens are aware of the benefits that a Smart City can bring. More than 60% of respondents express that the benefits of Smart Cities are visible in terms of services for citizens such as education and healthcare, and the option "not important" was not voted by any of the interviewed subjects.

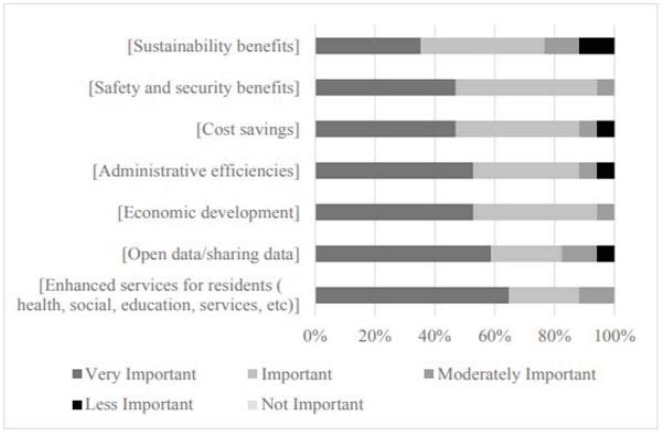

Fig. 7 Ctizen aware of benefits of Smart City - J.Tadili and H. Fasly 2020

Fig. 8 Practices used to enhance citizen participation J.Tadili and H. Fasly 2020

In Fig.8, it is possible to see that the five most indicated elements were: enabling access to city services via smartphones; reporting service issues through mobile apps; being involved in the planning of new public services; participating in political decisions concerning citizens' interests; creation or expansion of public wireless networks. This demonstrates that smart city experts emphasize the important role of citizens in the initial planning phase of public services as co-creators, as well as providers of experiences through issue reporting. (Jihane Tadili & Hakima Fasly, 2020) 47% agree on the idea of providing free digital literacy courses for adults, demonstrating a lack of digital education and a need for greater inclusivity.

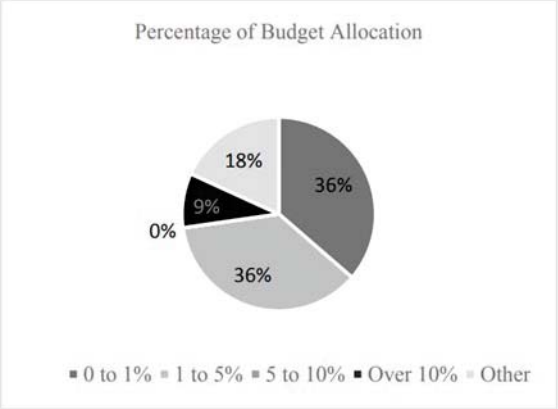

Fig. 9 Budget Allocation - J.Tadili and H. Fasly 2020

In Fig. 9, it can be seen that only 9% of respondents believe that the percentage of public budget allocated to Smart City development is greater than 10%, while 72% of respondents think it is below 10%.

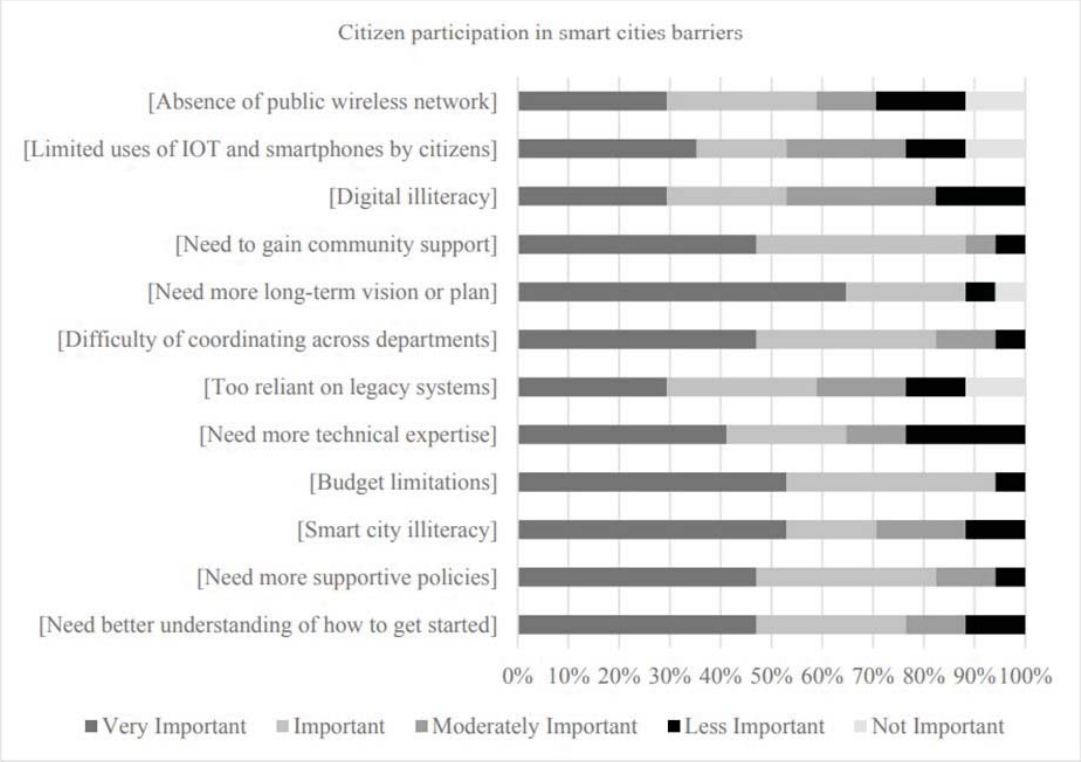

Fig. 10 Citizen participation in smart city barriers- J.Tadili and H. Fasly 2020

In Fig.10, approximately 70% of the surveyed smart city experts reported that the lack of a long-term vision or plan represents the main barrier to citizen participation. More than half (53%) highlighted that digital illiteracy in the context of smart cities and budget

constraints hinder decision-makers from engaging citizens in their projects. (Jihane Tadili & Hakima Fasly, 2020) Additionally, 47% of respondents indicated that the need for a good start, community support, favorable policies, and coordination between departments constitute significant barriers. Almost 35% believe that obtaining community support is not important.

Initially, we have understood the reasons why citizen participation is indissolubly linked with the concept of Smart City, thus confirming the importance of its model and realization. Citizens can democratically participate in the decision-making process to build sustainable local communities, act as the primary source of expertise to develop better solutions, and gather data using mobile devices or other technologies after the implementation of the smart city. Thanks to the analyses conducted by Jihane Tadili & Hakima Fasly, we have delved into how the Smart City is perceived. We can assert that experts are fully aware of their potential and especially their connection with citizen participation. However, there are several significant barriers hindering effective participation. The lack of a long-term vision or plan is seen as the main barrier. Also, digital illiteracy and budget limitations are critical issues, highlighted by more than half of the respondents. It is important to emphasize that participation is achieved through a holistic and integrated approach.

3.3 Case Study: Smart Dubai

Dubai, one of the seven Emirates of the United Arab Emirates (UAE), is an extremely vibrant city with a population of over 3 million people in the Arabian Gulf region. The city has established itself as a robust economy, maintaining significant economic growth over the years. It acts as the primary economic hub of the region with successful economic diversification. Sectors such as trade and logistics, tourism, financial services, retail, and real estate have played important roles in Dubai's economic successes. (United for Smart Sustainable Cities U4SSC, 2019)

The ambition of the UAE is to make Dubai the happiest city in the world, and to achieve this, they have decided to invest, both in the public and private sectors, in Smart City projects. In 2016, the United Arab Emirates introduced the Ministry of Happiness. This was established with the task of directing policy choices towards social well-being and population satisfaction. This is a representation of one of the pillars of the desired

change by the sovereign, which also aims to give a younger and more inclusive image of the country. (Luigi Grassia, 2016) The Smart Dubai initiative was born in 2014 from the approach of Sheikh Mohammad Bin Rashid Al Maktoum, Vice President and Prime Minister of the United Arab Emirates and Ruler of Dubai, to focus the city's united efforts towards innovation and digitalization. Smart Dubai has strategically embraced the Fourth Industrial Revolution (4IR) and has launched three strategies: on Artificial Intelligence (AI), Blockchain, and Internet of Things (IoT). (United for Smart Sustainable Cities U4SSC, 2019) By 2023, the rate of digitalization of government services in Dubai stands at 99.5 percent. Digital transactions represent 87 percent of the total transactions of government services. (Digital Dubai, UAE) Additionally, the Government of Dubai has developed over 120 smartphone applications. Through the portal for initiatives aimed at Smart Dubai (Digital Dubai, UAE), we see:

- *Dubai 10x*: To bring Dubai ten years into the future – in just two years. The goal is to improve the efficiency of public and private services, making them more sustainable and cutting-edge. This is achieved through approaches such as openness to innovation, rapid experimentation, inter-sectoral collaboration, and strategic investments. Since its inception (2017), the initiative has developed 42 projects. Among these: Dewa (https://digital.dewa.gov.ae/), the world's first digital utility using autonomous systems for renewable energy, storage, and digital service delivery; Rahal, a fully customizable platform that helps transform anyone, and any organization, into a learning provider, and many others.
- *Service-One*: A government program introduced in Dubai to improve access to public services through a single digital access point.
- *Desert Rose City*: a future project, namely the creation of a city that will arise in the Al Ruwayyah area along the Dubai-Al Ain road. Its design, shaped like a desert rose flower, will contribute to reducing electricity consumption. It will operate on renewable energy that it will produce autonomously. It will also have a waste recycling plant.

These are just some of the projects planned by the Dubai government. The technology and integrated use of various aspects of Smart City make it the 'Smartest' city in the Middle East and North Africa region. All projects and initiatives undertaken by Smart

Dubai perfectly meet the Smart Wheel model (Rob Adams and Boyd Cohen, 2012), especially: Smart Economy, Smart Governance, and Smart Mobility.

The city is committed to improving the lives of citizens through access to advanced digital services and investment in education and digital skills development. Additionally, Dubai adopts a proactive approach to governance, using data and analysis to improve urban planning and the delivery of public services. The government is also committed to improving urban mobility through the implementation of innovative and sustainable solutions, such as autonomous vehicles and electric transportation, to reduce traffic congestion and air pollution.

The project I would like to point out for its innovation in terms of new technologies and holistic approach is the DSO – Dubai Silicon Oasis. (https://www.dso.ae/) It is a technological area, founded in 2004 with the aim of creating an environment conducive to innovation and technology, promoting the development of a diversified and sustainable technological ecosystem. The DSO project includes the development of modern infrastructure, such as offices, research laboratories, commercial and residential spaces, as well as services and support programs for technology companies. The goal is to attract technology companies, startups, and world-renowned research institutes, creating a technologically significant hub internationally and contributing to the economic diversification of Dubai. (https://www.dso.ae/) Furthermore, it is considered a qualified free zone for the purposes of the United Arab Emirates Corporate Tax Law (Federal Decree-Law No. 47 of 2022 on the taxation of companies and businesses and its amendments). This allows companies operating in the free zone to benefit from a corporate tax rate of 0% on eligible income. The creation of this city within the city aims to express the maximum of technological innovation, sustainability, and attract new investors, these elements are fundamental within the logic of the Smart City.

Dubai is emerging as a benchmark for innovation and development in the Arabian Gulf region. With projects like Smart Dubai and Dubai Silicon Oasis, the city is adopting advanced technologies and smart city strategies to improve the lives of its residents and promote diversified economic growth. With proactive governance and a constant commitment to innovation, Dubai is shaping a smarter and more sustainable future, which could serve as an example for other cities worldwid

CHAPTER IV

Ethics and Limitations of Smart Cities

Throughout the paper, the concept of new technologies and the model of smart cities has been analyzed to show how they can concretely improve the quality of ours lives. This analysis has widely demonstrated how much the world has changed in the last twenty years, especially from the perspective of new digital infrastructures and innovation. It is logical to ask what the main limitations of a Smart City model are. The main obstacle is certainly the issue of privacy and surveillance. The extensive collection of data through sensors, cameras, and other devices can jeopardize citizens' privacy, raising questions about who has access to such information and how it is used (Kunzmann, K.R. 2019). This raises ethical concerns regarding the right to privacy and the protection of personal data. The lack of privacy can lead to discrimination and social sorting, creating a fundamentally unequal society (Ekhoff D., Wagner I., 2017). The increasingly frequent cyberattacks resulting in the loss and theft of significant amounts of data create concern for both citizens and institutions. According to data collected by the Eurobarometer (2023) regarding digitalization, only half (50%) of Europeans believe that digital rights are well protected in Europe, while more than one in three (36%) believe that the EU does not adequately protect their rights in the digital environment. Three in ten people believe that more needs to be done (Eurobarometer Survey, 2023). In addition to this, it has emerged what the top three concerns of EU citizens are, namely:

Fig. 11 – Eurobarometer survey 2023

The protection of users from cyberattacks emerged as the top concern (30%), followed by the improvement of high-speed internet availability (27%) and protection from misinformation and illegal content (26%)" (Eurobarometer Survey, 2023). It is essential to ensure that decisions are made with transparency in mind and that citizens

should be informed about how their data is being used. Throughout the paper, it has been highlighted how we are currently in a society where, on the one hand, digital natives navigate new technologies without issues while digital immigrants face various difficulties in this regard. The lack of understanding of new technologies can become a significant obstacle in terms of digitalization and accessibility. In addition to this, there is the digital divide, which refers to the disparity in access to and use of information and communication technologies (ICT) among different communities, socioeconomic groups, or geographical regions. This division may concern physical access to technological tools, such as computers, high-speed internet connections, and mobile devices, as well as the digital skills required to effectively use such tools (Servon L. J.,2008). During the course of this final chapter, I want to analyze the concepts of privacy and consent, the digital divide both in terms of knowledge and access possibilities, and finally the issues related to the lack of education in the use of technologies, the power, and the value of data. We can therefore say that smart cities pose a series of ethical challenges that must be addressed responsibly and thoughtfully to ensure that technologies are used ethically and respectfully of human rights.

4.1 Privacy Concerns

Research on privacy has exploded in recent decades with the use of new technologies. Several international organizations and institutions (e.g., Camenisch, Fischer-Hübner, & Rannenberg, 2011; Gartner, 2012; OECD, 2011) have identified privacy as a key challenge in terms of policy, regulation, and legislation in the 21st century. Currently, two important paradoxes exist: the "privacy paradox," which describes how despite clear concerns expressed about one's privacy, there is a simultaneous lack of appropriate secure behaviors, such as sharing one's data on social media. The other is the "control paradox," which is the feeling of concern about not knowing how data is being used by other parties (Van Zoonen, 2016). First of all, it is necessary to analyze what is meant by data. Legally, there are definitions of sensitive data; according to the EU General Data Protection Regulation (GDPR), sensitive data are special categories of information, such as health, biometric, sexual/political orientation, and ethnic origin data. The same regulation imposes strict restrictions on the processing of such data, requiring explicit consent or specific legal bases for processing and imposes higher standards of data security and protection. Socially, health, financial, and work-related data are the ones

that cause the greatest concern, while those related to geolocation, social media, and online purchases are less relevant to the collective imagination (Van Zoonen, 2016). Prabhakar, Pankanti, and Jain (2003) argue that people find the use of data from iris scans much less acceptable than the use of data from facial recognition systems, especially concerning people's perception of invasion of their privacy but also physical space (Eurobarometer, 2011). Currently, there is no research that has examined how people feel about the collection of impersonal data on, for example, traffic flows or air quality, but there is little reason to expect people to be concerned about this. These data reveal nothing about individual individuals and therefore are likely to fall outside the scope of privacy concerns. It is clear that when people have to decide whether to consent to the use of their data, they conduct a cost-benefit analysis. For example, we will be much more inclined to give our data to obtain a significant discount in a store than for the creation of a loyalty card for a supermarket. Moreover, Mahy and Morris (2008), for example, found that acceptance of monitoring personal communications by the United States government was high immediately after the September 11attacks but decreased after about six months. The European Union is adopting various solutions for data protection and management to ensure security. One of these initiatives is the Digital Services Act (DSA). The regulation focuses on data management, recognizing it as a fundamental value for the digital economy. Its main objective is to prevent illegal and harmful activities online, as well as the spread of misinformation. It ensures user safety, protects fundamental rights, and creates a fair and open online platform environment (Digital Strategy Act – European Commission). From February 17, 2024, DSA rules apply to all platforms. These regulations focus on five main points (EU – Digital Strategy Act):

1. Improvement of reporting procedures

2. Greater transparency in content moderation

3. Control and transparency over personalized content

4. Prohibition of targeted advertising to minors

5. Protection of children and integrity of elections

In the context of Smart Cities, data is used to collect information and serves as the foundation for a wide range of services and initiatives designed to improve urban quality

of life. The sectors in which these data are used are multiple; looking at the Smart City Wheel [Fig.1] (Rob Adams and Boyd Cohen, 2012), for example, they can be used in terms of Smart Governance to collect data for the creation of Open Data databases. In terms of Smart Mobility, for traffic and transportation management through the collection of sensors installed on the streets, through the collection of data from waste bin sensors, waste collection operations can be managed, ensuring a Smart Environment logic, not to mention the main concept, namely the active involvement of citizens through digital platforms and accessibility logics.

In summary, data in smart cities is used to optimize resources, improve public services, promote environmental sustainability, and engage citizens in the decision-making process. One of the elements of concern linking the concept of privacy to the concept of Smart City is based precisely on the ways in which data is used. Monitoring and surveillance, for example, can be perceived as invasions of privacy. Furthermore, the use of data to create a personalized experience raises doubts about the collection of the data itself; there is a feeling of being "listened to," as is often heard in reference to one's own devices. Finally, the increasingly growing concern about hacker attacks raises concerns in terms of data and consent. The solution lies in the need for a shared data regulation and collection system among nations, a regulation already present in legal matters but which needs to be reviewed and adapted based on the evolution of technologies. Smart Cities, despite the benefits they bring, raise important questions concerning citizens' privacy, transparency, and security. These concerns reflect citizens' growing awareness of privacy and the need to balance the advantages of smart technologies with the protection of individual rights.

4.2 Addressing the Digital Divide

Smart Cities are based on technology and applications that require an Internet connection to function. It seems logical to consider it essential in a society that is part of the fourth industrial revolution, but unfortunately, it is not yet the case. The European Commission provides us with a definition of the digital divide, which is the gap in the population between those who effectively know and use computer tools and those who are left out due to economic, social, cultural, and environmental reasons (European Commission, 2024). Access and digital skills are and will continue to be crucial for

interacting with our societies, our services, and an increasingly digital global economy. They are no longer just an option for some but a necessity for everyone. (World Economic Forum, 2024)

The graph shows that the number of people using the Internet is 5.4 billion, while according to the latest estimates on the world population by the United Nations (2023), there are 8 billion inhabitants. This means that there is still a significant percentage of people who do not have access to the Internet. This not only causes delays in terms of socioeconomic development but also various inequalities that are difficult to bridge.

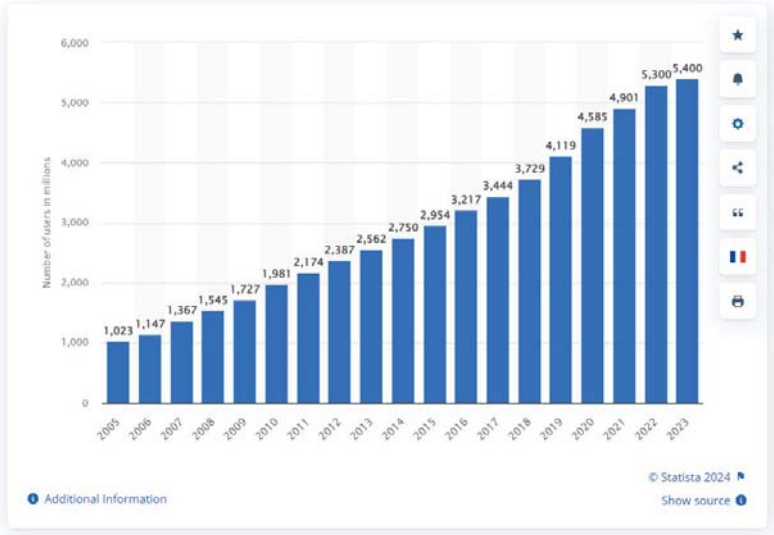

Fig. 12 Numbers of internet users worldwide from 2005 to 2023 express in millions (Statista, 2024)

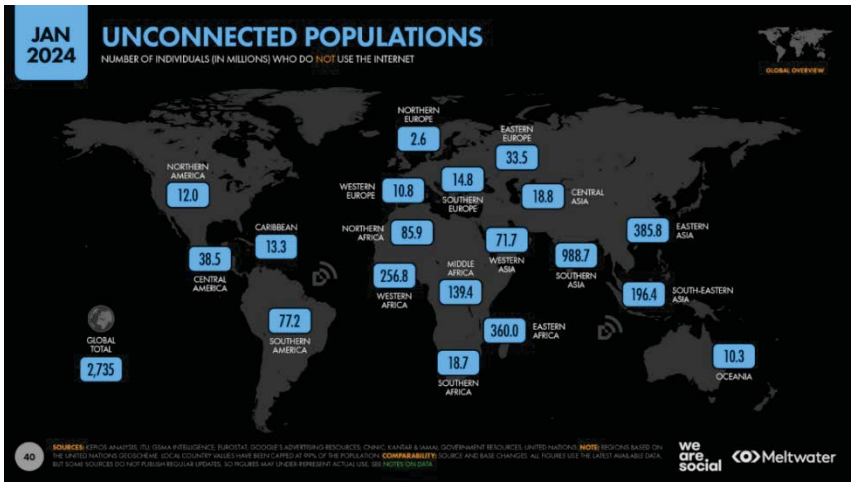

Fig. 13 Unconnected population- Data Reportal, 2024

Thanks to this map, we can see that at the beginning of 2024, India has the largest offline population in the world, with over 680 million people offline. China has the second-largest offline population, with 336 million people offline. Overall, more than 1 billion people are offline only in China and India. The offline populations are highest in South Asia and East, Central, and West Africa, but the situation is also concerning in South America, with over 77 million people not using the Internet (Simone Kamp, 2024). Therefore, we understand that the digital divide is a real problem from a global perspective.

Thanks to the DESI, or Digital Economy and Society Index, an index developed by the European Commission to monitor and assess the digital progress of EU member states, we can evaluate various aspects of digitalization.

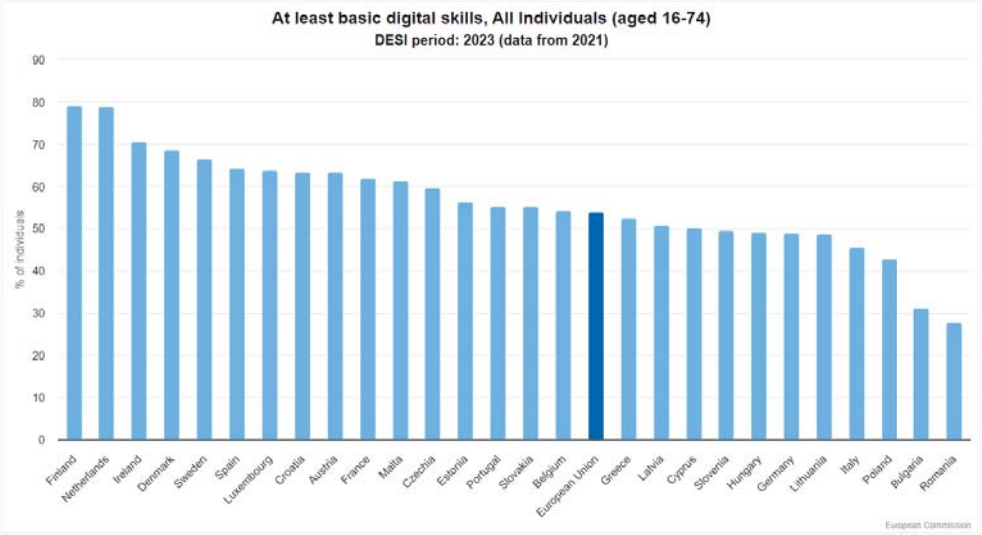

Fig. 14 Basic digital skill, all 1individuals (DESI index 2023)

From Fig.14, we can see that countries located in Northern Europe have a higher basic digital skill, peaking at almost 80% for Finland and the Netherlands. The situation becomes concerning when we see that the European Union average hovers around just over 50% of the population. All these data demonstrate how far we still are from the goal set by the UN for the 2030 Agenda, which talks about global and equitable accessibility.

Addressing the digital divide requires various strategies. It is crucial to expand high-speed Internet access in underserved areas, particularly rural and low-income areas. Implementing affordable pricing models and subsidies for low-income families ensures

they can afford access to the Internet and digital devices. Policies and regulations promoting digital inclusion and privacy protection are needed. Finally, collaborating with private companies to invest in technological infrastructure and digital literacy initiatives is crucial. The digital divide poses a significant challenge for smart cities, as a portion of the population risks being excluded from the benefits offered by advanced technologies. To address this issue, smart cities must invest in digital infrastructure, ensure access to affordable technology devices, and promote digital literacy. Additionally, inclusive policies and public-private collaborations are essential to ensure that all citizens can participate in and benefit from technological innovations, thereby reducing digital inequalities

.4.3 Educational and Awareness

Currently, we find ourselves within an evolving social context defined as Web 3.0, which refers to a futuristic vision of the evolution of the World Wide Web characterized by increased artificial intelligence, data interconnection, and decentralization. Paul Gilster, in his book "Digital Literacy" (Wiley, 1997), explores how this latest transformation is unfolding and how individuals can adapt to the changing landscape of the web. Gilster emphasizes the importance of developing critical thinking skills and basic competencies to thrive in an interactive environment vastly different from passive media such as television or print. The issue of digital education is one of the crucial themes of our time, as more and more aspects of daily and professional life are permeated by digital technology, especially within the logic and model of Smart Cities. How can we expect to ensure complete security and privacy if basic digital skills are insufficient? (Reference Fig. 13) The process of digitization does not occur uniformly and can generate significant disparities. Individuals who are still digitally illiterate or lack digital literacy have been excluded from the digital world (Orrick, 2011; Seale, 2009; van Dijk, 2006). The lack of skills and knowledge on how to manage and use ICT represents a fundamental obstacle to improving digital literacy. Disparities in ICT use for a wide variety of activities have raised concerns about the digital literacy gap, which can widen the inequality between information-rich and information-poor individuals (Seale, 2009; Selwyn, 2006; van Dijk, 2006). Growing concern exists about digital illiteracy, especially among older generations and less developed communities (Lee S.H., 2014). Lack of familiarity with technology can result in difficulties in using digital devices and interpreting online

information, leading to exclusion from full participation in the digital society. One in three people lack even the most basic digital skills, and even for those who possess them, teachers have very little training available to improve their pedagogical practices for effectively using technology. Moreover, gender disparities in digital skills remain unacceptably high. Women and girls are 25% less likely than men to know how to use digital technology for basic purposes (UN Summit 2023).

In the educational context, there is an urgent need to integrate digital literacy into school curricula. Students must acquire fundamental digital skills to be ready to face the modern world of work and digital citizenship. In a study regarding the approach to digital literacy, five disciplines are identified, namely: information literacy, computer literacy, media literacy, communication literacy, and technological literacy, which mainly refer to a heterogeneous set of skills (Chetty, K., Qigui, L., Gcora, N., Josie, J., Wenwei, L. & Fang, C., 2018). In the context of this study, a discipline refers to a branch of knowledge and proved to be a more appropriate term to describe the required skills. To effectively address the issue of digital literacy, it is essential to adopt an integrated approach involving various strategies and stakeholders. To solve the problem of lack of digital education and technology awareness, education and training are necessary. Investing in educational programs aimed at promoting digital skills in all age groups is important. These programs should be integrated into school curricula and should also include ongoing training initiatives for adults to ensure that everyone has the opportunity to acquire the necessary skills to navigate effectively in the digital world. Secondly, it is essential to ensure universal access to technology. This can be achieved through targeted public policies and investments in telecommunication infrastructure to ensure that everyone has access to digital devices and reliable Internet connections. Collaboration and partnerships are crucial for effectively addressing digital literacy, promoting the sharing of knowledge, resources, and best practices among governments, international organizations, the private sector, and civil society. Policies and programs have already been created by international organizations (e.g., UN, UNESCO, EU commission), but the problem with these is that they seem to be too ambitious and lacking short-term objectives aimed at bridging the significant gap that already exists among different countries. Additionally, it is necessary to promote media literacy awareness, educating people about the importance of critically evaluating online information, recognizing fake

news, and adopting online security practices to protect their digital privacy. Technological innovation plays a key role in combating digital literacy, with the development of technological solutions that simplify the digital experience and make information more accessible to all. This can include the use of assistive technologies and digital accessibility tools. The rapid evolution of technology requires a constant commitment to keeping digital skills updated. Promoting continuous education and awareness about the challenges and opportunities of the digital world is essential to ensure that everyone can fully and safely participate in the continually evolving digital society. Digital skills also enable participation in social networks for the creation and sharing of knowledge, and the capacity supports a wide range of professional computing skills (UNESCO, 2011). All these described elements are fundamental to achieve a complete digital transition but also for the concrete realization of cities based on a Smart City Wheel model [Table 1], thus ensuring a real improvement in citizens' lives.

Conclusion

The main concept from which this analysis started concerns the need to understand whether the Smart City model can represent a possibility in terms of increasing citizen participation. As described, the concept of a Smart City represents a revolutionary approach to urban development, integrating advanced digital technologies with urban management and governance, and not only that, it also aims to implement e-Governance services. The ultimate goal is to improve citizens' quality of life, promote sustainability, and stimulate economic growth. At the core of the Smart City concept is the integration of Information and Communication Technologies (ICT) and the Internet of Things (IoT). These technologies enable real-time data collection and analysis.The socio-historical context in which we find ourselves is part of this digital revolution, often referred to as Web 3.0. This highlights rapid technological advancements and the transition towards a more interconnected, data-driven society. This context also involves the integration of generations born in the digital era and generations defined as 'analog'.

The literature in this field demonstrates how various authors generally agree on the potential offered by a Smart City model, but, on the other hand, express concerns and the need to establish technological and personal limitations. For this reason, the analysis continued by taking as an analytical element the Smart City Wheel model, developed by Rob Adams and Boyd Cohen, which provides a comprehensive framework for understanding the various dimensions of a Smart City. These dimensions include Smart Environment, Smart Governance, Smart Economy, Smart People, Smart Mobility, and Smart Living. Each dimension is interconnected and essential for the holistic development of a city. For example, a Smart Environment focuses on sustainable urban planning and green energy, while Smart Governance emphasizes transparency, open data, and citizen participation, and a type of Smart Economy promotes innovation and a more sustainable form of economic and entrepreneurial development.

A fundamental element of the paper was to understand the connection between a Smart City model and its direct link to a more digitally-oriented governance. I have gleaned that E-Governance represents a cornerstone of the Smart City model, promoting transparent, efficient, and accessible public services. By leveraging digital platforms, governments can enhance their interactions with citizens, businesses, and other

governmental entities. The evolution of E-Governance has progressed from simple web presence to integrative and transformative web services, culminating in the sophisticated systems seen in modern Smart Cities. Citizen participation is crucial for the success of Smart City initiatives. Involving citizens in the decision-making process ensures that public policies and urban development projects reflect the needs and aspirations of the community. What emerges once again is a shared opinion of the potential of the model and ideas but a limited application of the latter with results that make processes longer and more costly.

Case studies of Estonia and Dubai provide valuable insights into the practical implementation of Smart City and E-Governance principles. Estonia's efforts in electronic voting and comprehensive digital services demonstrate the potential of E-Governance to enhance democratic participation and government efficiency. The country exemplifies how the power of digitalization can truly break down bureaucratic barriers, ensuring transparency and efficiency. Despite the complex historical context related to Estonia's past, in a short time, thanks to investments focused in the digital sector, it has managed to become an investment hub and a role model to follow. Similarly, the ambitious Smart Dubai initiative shows how strategic investments in digital infrastructure, AI, blockchain, and IoT can transform urban life and promote sustainable development. Not only that, but the city of Dubai demonstrates how it is possible to increase the value of a city through the services offered and the speed at which they can be accessed. Dubai and the United Arab Emirates in general demonstrate how in a short time, a total transformation is possible not only technologically but also economically.

While the benefits of Smart Cities are substantial, they also raise significant ethical concerns, particularly regarding privacy and surveillance. The extensive data collection necessary for Smart Cities' operation can lead to potential privacy invasions and misuse of personal information. Additionally, the digital divide poses a major challenge; parts of the world lack access to the internet, leading to complete exclusion of segments of the population from the benefits not only of technology but also of the Smart City model. Digital literacy and accessibility to the internet are the greatest obstacles to overcome to prevent deepening the gap between developing and industrialized countries. To address these concerns, it is essential to implement robust regulations for data protection and ensure transparency on how data is collected and used. Efforts must also

be made to bridge the digital divide by expanding internet access, promoting digital literacy, and ensuring that all citizens can participate in the digital economy. This process must be carried out internationally with short- and long-term goals and on a large scale.

Looking to the future, the development of Smart Cities will continue to evolve, driven by technological advancements and the growing demand for sustainable and efficient urban life. The ongoing migration to more developed urban centers is a persistent trend, and addressing it while ensuring accessibility and stability is key to making various mechanisms work. The integration of AI, blockchain, and other emerging technologies will further enhance the capabilities of Smart Cities, enabling smarter and more adaptive urban management systems.

Returning to the initial question upon which the entire paper is based, I would say that yes, the Smart City model is an opportunity to increase citizen participation in the social and political dynamics of different countries, but it faces several increasingly complex obstacles. The success of these initiatives will depend on the ability to create inclusive and fair digital environments. This implies not only investing in technology but also promoting a culture of innovation and collaboration among all stakeholders, including governments, businesses, and citizens. By focusing on citizen participation, transparent governance, and sustainable practices, cities can create environments that are not only smarter but also more resilient and adaptable to future challenges. Additionally, it is important to focus on promoting and educating people about the Smart City model and utilizing technologies to ensure that the majority of the population can benefit; technology should represent an opportunity to aid, not an obstacle. The ultimate goal of Smart Cities and E-Governance is to improve the quality of life for all citizens, ensuring that urban development is both sustainable and inclusive. Looking ahead, it is crucial to continue exploring innovative solutions, promoting public-private partnerships, and engaging citizens in the process of shaping the cities of the future. Through these efforts, we can build a more connected, efficient, and equitable world, where technology serves as a catalyst for positive change and social progress

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