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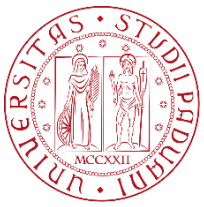

Smart Cities in the European Union: Policies, Practices, and the Case of Barcelona

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ABSTRACT

As cities navigate challenges related to climate change, digital transformation, and inclusive governance, the smart city paradigm has become a key framework for fostering innovation, sustainability, and citizen participation. In this context, the Europeanization process has significantly shaped urban policies and governance structures, as the European Union (EU) plays a crucial role by providing strategic frameworks, financial resources, and governance models that influence local policymaking. However, despite extensive research on multi-level governance and smart cities, the Europeanization of urban governance in smart cities remains underexplored.

This dissertation examines the Europeanization of smart urban governance, using Barcelona as a case study. It explores how EU smart city policies, projects, and governance principles have influenced the city's governance structures and decision-making. The research analyzes the governance models, institutional structures, and EU engagement strategies of three municipal administrations: Xavier Trias (2011–2015), Ada Colau (2015–2023), and Jaume Collboni (2023–present). Additionally, it explores Barcelona's participation in the EU-funded NetZeroCities project as an example of Europeanized multi-level governance, illustrating how EU frameworks facilitate collaboration among local, regional, and supranational actors.

By bridging the gap between Europeanization studies and smart city governance, this research enhances the understanding of the EU's role in urban transformation and the governance mechanisms that shape smart city development in Europe.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

AHA Budapest	Affordable Housing for All – Budapest
AI	Artificial Intelligence
AMB	Àrea Metropolitana de Barcelona
API	Application Programming Interface
BCC	Barcelona Climate Commitment
BeC	Barcelona en Comú
BR	Barcelona Regional
BSC	Barcelona Smart City
BSC-CNS	Barcelona Supercomputing Center – Centre Nacional de Supercomputació
CCC	Climate City Contract
CEAP	Climate Emergency Action Plan
CEF	Connecting Europe Facility
CF	Cohesion Fund
CiU	Convergència i Unió
COP21	Conference of the Parties
D-CENT	Decentralized Citizens ENgagement Technologies
DECODE	DEvelop COmpetences in Digital Era
DIGITAL	Digital Europe Program
EAFRD	Agricultural Fund for Rural Development
EC	European Commission
EGDIP	European Green Deal Investment Plan

EIB	European Investment Bank
EIF4SCC	European Interoperability Framework for Smart Cities and Communities
EIPs	European Innovation Partnerships
EIP-SCC	European Innovation Partnership on Smart Cities and Smart Communities
EIT	European Institute of Innovation and Technology
EMFF	European Maritime and Fisheries Fund
EPA	Environmental Protection Agency
ERDF	European Regional Development Fund
ESF	European Social Fund
ESIF	European Structural and Investments Funds
ETPs	European Technology Platforms
EU	European Union
EUI	European Urban Initiative
EUKN	European Urban Knowledge Network
GDP	Gross Domestic Product
GHG	Greenhouse gas
HLG	High Level Group
IBM	International Business Machine Corporation
ICT	Information and Communication Technology
ICUB	Institut de Cultura de Barcelona
IMI	Municipal Institute of Information Technology
IoT	Internet of Things

IR	International Relations
IT	Information Technology
JRC	Joint Research Centre
JTM	Just Transition Mechanism
LEED	Leadership in Energy and Environmental Design
MDO	Municipal Data Office
MEL	Monitoring, Evaluation, and Learning
MES	Mobility, E-Government, Smart Cities Government Measure
MLG	Multi-Level Governance
MS	Member States
MWC	Mobile World Capital Barcelona
NEB	New European Bauhaus
NGO	Non-governmental organization
PAH	Plataforma de Afectados por la Hipoteca
PAM	Municipal Action Plan
PCPs	Public-Common Partnerships
PMO	Project Management Office
PPPs	Public-Private Partnerships
PSC	Partit dels Socialistes de Catalunya
R&I	Research & Innovation
RFSC	European Reference Framework for Sustainable Cities
S3	Smart Specialization Strategies
SC	Smart City

SCEWC	Smart City Expo World Congress
SCIS	Smart Cities Information System
SEAPs	Sustainable Energy Action Plans
SET-Plan	Strategic Energy Technology Plan
SF	Structural Funds
SME	Small & Medium enterprises
UAE	United Arab Emirates
UDG	Urban Development Group
UE	European Union
UIAs	Urban Innovative Actions
UK	United Kingdom
ULL	Urban Living Lab
UN	United Nations

INTRODUCTION

"*The future of the world's population is urban*" (*World Urbanization Prospects: The 2018 Revision*, 2019, pp.1). As the *World Urbanization Prospects 2018* states, by 2050 around two-thirds of the world's population will live in urban areas. The increasing importance of cities is therefore evident: they offer environments where entrepreneurship and technological innovation can thrive, and they also function as development hubs where the proximity of commerce, government, and transportation creates the infrastructure needed for sharing knowledge and information (*World Urbanization Prospects: The 2018 Revision*, 2019). As hubs of economic activity and innovation, cities must also address issues such as climate change, digital transformation, and inclusive governance. In this sense, collaborations and relationships among different stakeholders are fundamental to solving modern cities' "wicked problems" (Kooiman, 2003).

Against this backdrop, the paradigm of *smart cities* has emerged as a key framework that can address the problems above. Although the literature does not provide an official definition of the concept, one comprehensive explanation can be given by Caragliu et al. (2011), who "*believe a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance"* (Caragliu et al., 2011, pp.50).

Throughout the years, academic and research institutions, together with IT (information technology) firms started to become interested in the smart city paradigm and began experimenting with new technologies in urban territories to improve local services and the quality of life of citizens. In addition, the European Union provided a significant boost to the development of smart cities in its territories (Nesti, 2018, pp.19). Since the launch of the Europe 2020 strategy, which sought to foster "smart, sustainable, and inclusive growth," the EU has increasingly supported urban transformation through initiatives such as the Smart Cities and Communities Initiative, the European Innovation Partnership on Smart Cities and Communities (EIP-SCC), and more recently, the European Green Deal and Horizon Europe. However, while significant literature exists on multi-level governance (MLG), smart governance, and collaborative governance in smart cities, the concept of Europeanization in relation to urban governance, and particularly smart cities,

has received limited scholarly attention. The literature predominantly focuses on Europeanization processes at the national level or within specific policy sectors, rather than on how cities internalize and adapt to EU norms and frameworks in their smart governance strategies (Wiktorska-Święcka, 2015).

This gap highlights the need for further exploration of how the Europeanization process influences smart city development at the municipal level. For this reason, this dissertation seeks to address this gap by exploring the Europeanization of smart urban governance in Barcelona. The research question is the following: *Has the city of Barcelona become Europeanized in the context of smart European urban governance? If so, how? Which factors can help explain the Europeanization process?*

To answer this question, I provide a theoretical framework based on Europeanization literature, EU prescriptions on smart urban governance, and principles outlined in the *Integrated Urban Governance - The Way Forward.* (2011) document published by Metropolis, the World Association of the Major Metropolises, in collaboration with Berlin's Senate Department for Urban Development. The case study of Barcelona serves as a ground for investigation, since the city has actively engaged with EU programs and policies in its smart city trajectory. Specifically, the research explores the governance strategies adopted by three municipal administrations: Xavier Trias (2011-2015), Ada Colau (2015-2023), and Jaume Collboni (2023-present). Additionally, the study explores Barcelona's participation in the NetZeroCities project, assessing it as a case of Europeanized multi-level governance in climate-smart urban transformation.

The inspiration for this research stems from personal and academic experiences, particularly my Erasmus exchange in Barcelona and my enrollment in the Global Cities course taught by Professor Bàrbara Pons Giner at the Universitat Pompeu Fabra, and my academic studies in European Policies at the Università degli Studi di Padova. These experiences deepened my interest in urban governance, exposing me to the complexities of smart city policies, multi-stakeholder collaboration, and the role of supranational institutions in shaping urban development. At the same time, during my time in Barcelona, I was able to observe how the city has positioned itself as a global leader in smart city initiatives, from open data platforms to sustainability projects aligned with EU objectives.

This dissertation is structured as follows. The first chapter investigates the concept of smart cities, their evolution, and their defining characteristics highlighting technological, human, and governance dimensions. It explores the historical development of urbanization and the factors that led to the emergence of smart city initiatives, and it additionally analyzes key frameworks such as the Smart Cities Ranking by the University of Technology of Vienna. The chapter finally addresses challenges and opportunities related to smart cities, emphasizing their role in sustainable and urban transformation.

The second chapter examines the European Union's role in advancing smart cities through various policies, initiatives, and funding mechanisms. It examines the historical evolution of EU urban policies, from early regional development programs to the integration of smart city concepts. Key EU frameworks, such as the Europe 2020, Horizon 2020, and the European Green Deal are analyzed to understand their impact on urban innovation and governance. The chapter also explores the NetZeroCities project, focusing on its Climate City Contract, funding mechanisms, and multi-level cooperation.

The third chapter explores the Europeanization of urban governance, focusing on how EU policies influence local governance structures, analyzing top-down, bottom-up, and horizontal interactions. It also integrates EU smart urban governance principles and Börzel's classification of governance transformation, thus presenting the theoretical framework and methodology for assessing Barcelona's Europeanization process.

The fourth chapter examines Barcelona's transformation into a smart city, analyzing its historical urban development and key smart city initiatives. It then explores the strategies of the Trias, Colau, and Collboni administrations, highlighting their governance model, policy priorities, and engagement with EU frameworks and projects. The chapter further investigates the city's involvement in the NetZeroCities project, particularly its Climate City Contract and multi-level governance approach.

The fifth chapter analyzes the Europeanization of Barcelona's smart urban governance by comparing the Trias, Colau, and Collboni administrations. Using the theoretical framework from Chapter 3, it assesses their participation in EU projects, alignment with EU smart governance principles, and depth of governance transformation.

CHAPTER 1 - UNDERSTANDING SMART CITIES

1.1 Definitions and Main Characteristics of a Smart City

1.1.1 The Origin of the City and its Development throughout History

The interpretation of the urban phenomenon, the origin and nature of the city, as well as the reasons why human beings came to realize the convenience of agglomerating in confined spaces is very much still under debate. Cities are many things altogether and for this reason it is complicated to define and understand their origins and transformation throughout history. Cities are at the center of economic trade, systems of production, communication routes, the job market, and cultural, political, and religious relations.

Trying to clear up this extremely complex phenomenon, it can be stated that the basis for the foundation of the city can be found in three main reasons: defense, trade, and politics. Regarding the first purpose, cities were created because of the need of the population to agglomerate and defend itself: fortified cities and castles to control the territory used to be built, such as villages born from pre-existing Roman colonies, strongholds, and military ports. The second reason relates to the trade of goods and services, where the city was a defined and easily accessible place for the local population and external traders to reach. This is why in the beginning, urban centers were market towns and livestock fairs. The last motive relates to the necessity of exerting dominance on external surroundings, coordinating the relations between the city and other social aggregations, but especially of regulating the coexistence of the internal population[1].

According to Pill (2021), cities can also be understood as defined territories with clear boundaries, which help delineate the powers and responsibilities of various government levels and ensure citizen representation in decision-making. Moreover, they can also be seen as dynamic spaces where economic and social organization take shape, where people live and negotiate processes of change. With the rise of democracy, rooted in the Ancient

[1] https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://memotef.web.uniroma1.it/sites/default/files/citta.pdf&ved=2ahUKEwjjnan89bOLAxUagf0HHRV6MO4QFnoECBYQAQ&usg=AOvVaw2iBnaWws0qWIYU9BvYHBOe

Greek “polis” or city-state, cities became central hubs for political participation and engagement. As Pill (2021) stated, they form the place for politics and public policy, and are the arena for political transformation. In fact, cities have been fundamental as were the birthplace of citizenship rights and responsibilities, as well as political participation given the need to manage the complexity of social relations that city life requires. They also serve people’s interests, therefore how, by whom and for whom cities are governed by matters: the direct impact and high visibility of policy decisions at the urban level offer valuable insights into how politics influence societal development. As a result, cities are shaped by societal structures, reflecting how a society functions through the spaces it creates, while also influencing society by bringing people together and providing a platform for political expression (Pill, 2021).

While urbanization unfolds differently across various contexts, it is a global phenomenon influenced by interconnected global, national, and local urban processes. In fact, viewing cities as a means of organization economic and social space highlights how they evolve in response to shifts in the economy and society (Pill, 2021, pp. 11).

During the second half of the XIX century, the urban phenomenon reached considerable importance. Cities emerged in areas where industries found optimal locations close to accessible natural resources. In addition, a large flow of people started to move from the countryside to major centers. From this point onward, cities and their populations experienced continuous growth, driven by advancements in production organization and technology, the development of transportation modes and networks, and surplus agricultural production (Pill, 2021, pp.11). This event was a direct result of the second Industrial Revolution: growing productive systems based on agglomeration and the emergence of economies of scale made cities the perfect place in which transportation cost could be saved and inputs sourcing could be carried out. In addition, the Industrial Revolution was a pivotal phenomenon because the more cities used to grow and the more specialized and different tasks and duties they carried out, the more people saw a chance to move there to find better job opportunities and an improvement in living standards, which led to their demographic and physical expansion[2]

[2] https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://memotef.web.uniroma1.it/sites/default/files/citta.pdf&ved=2ahUKEwjjnan89bOLAxUagf0HHRV6MO4QFnoECBYQAQ&usg=AOvVaw2iBnaWws0qWIYU9BvYHBOe

Regarding the Old Continent, during the XX century several events caused urban growth to slow down, such as the two World Wars, emigration and the economic crisis. Sometimes the rural-to-urban migration was even reversed and industrial conurbations that specialized in industries like mining or textiles were strongly affected. At the same time and even though economic growth wavered, the quality of life in cities saw considerable improvements: intra-urban transport was enhanced due to the invention of automobiles and subways, security increased and social housing was developed, which helped solve the problem of crowding (Hohenberg, 2004, pp. 3043-3044). This was a consequence of Keynesian policy measures implemented by governments, whose spending encouraged demand to secure employment and tried to ensure social stability by enabling the majority of the population access to affordable housing, health, education, and social welfare (Pill, 2021, pp.13).

In the second half of the XX century, a major event occurred worldwide: globalization. *"Globalization describes the growing interdependence of the world's economies, culture, and populations, brought about by cross-border trade in goods and services, technology, and flows of investment, people and information"* (Peterson Institute for International Economics, 2018). From an economic perspective, production costs in industrialized countries arose and corporations started to relocate their production to areas where labor and land were cheaper. In addition, easier global communications and cheap transportation opened up new locations for capital investment worldwide. Regarding the role of the state, governments and labor forces were expected to adopt greater flexibility in regulations and contracts, allowing corporations to make unrestricted decisions regarding production locations and methods. Moreover, the power of capital was strengthened because of globalization (Pill, 2021, pp. 13). This phenomenon largely affected cities in many ways: from an economic point of view, cities found themselves in competition with each other to attract international funds, as capital "circulates" searching for the most profitable locations in which to be invested. In addition, it reinforced inequality between cities, as the rise of global cities[3] able to attract the headquarters of

[3] A global city is a city that exerts a strong influence on the global economic, cultural, and political landscape. They are centers of international finance, business, and trade, and they often serve as hubs for transportation and communication networks. In addition, they are known for their ability to attract talent from around the world.

large corporations leads to uneven development patterns, which the state may or may not mitigate (Pill, 2021, pp. 15).

Another event that characterized the second half of the last century was the emergence of *mega-cities*. They usually exceed ten million inhabitants and if in 1970 there were only three, in 1990 they grew to ten, and in 2014 they got to 28. With the exception of Tokyo and its 37 million residents, they are mostly located in developing countries on continents such as Africa, Asia, and Latin America (Mc.Storti, 2023). Some examples of mega-cities are Delhi, Shanghai, Mexico City, and São Paulo, which have an urban area of around 20 million residents. It is expected that by 2030, mega-cities will be around 40, inhabited by more than 630 million people and that 96% of the urban growth will occur in less developed regions of South Asia, Africa, and the Far East. Three countries (India, China, and Nigeria will represent 35% of the global urbanization (Ansa, 2022). The current urban trends and the phenomenon of globalization make it clear that cities hold political, economic and social power. Cities attract investments and funds, and as a consequence they attract people. The more people are gathered, the easier ideas and knowledge spread and innovation can grow, and so on creating a cycle that ends up with the enlargement of urban areas due to the desire of people to move there (Cingolani, 2021).

This bears several costs, such as sustainability and inequalities. It is said that 75% of global emissions are produced in cities (Menotti, 2018), which generates pollution, but also creates high levels of congestion. Regarding inequalities, the concentration of people creates discomforts regarding house rents and essential services, which automatically get more expensive (30% of absolute poverty is found in cities), but also higher rates of criminality can be registered (Cingolani, 2021). In addition, inequalities can be found within the same city, for example over a third of the population of Bangladesh lives in Greater Dhaka, known for having high levels of poverty, and major housing shortages. Thus, people with more wealth can choose in which part of the city to live, while poorer residents have reduced opportunities for urban growth and change (Pill, 2021, pp. 21). So, if on one hand cities seem to be a necessary condition for progress by offering a place for development and innovation, they also find themselves as a defined place where both the wealthy and non-wealthy, the winners and losers of globalization are gathered (Menotti, 2018).

The city level is where public policy challenges, such as housing affordability, access to economic opportunities, and the provision of public service, have a direct impact on individual and community well-being (Pill, 2021, pp. 24). For this reason, the need to find smart solutions to balance environmental protection, economic growth, and social inclusion in the management of cities become not only clear but a necessity in order to improve the life of its inhabitants and to mitigate the negative aspects that cities tend to generate.

1.1.2 The Rise of the Concept of Smart City and its Characteristics

According to the *World Urbanization Prospects 2018* by the United Nations (UN), *"the world's population has gone through a process of rapid urbanization since 1950"* (*World Urbanization Prospects: The 2018 Revision*, 2019, pp.5): if in 1950 around 70% of the population lived in rural settlements, in 2018 most of the world's population, around 55%, switched to reside in urban areas. But it does not end here: in fact, the trend is expected to steadily increase, given that by 2050 more than 70% of the population is likely to live in urban areas. This rapid and radical urban transformation must be addressed with a strategic and sustainable vision that the current political class is called to implement. If more and more people worldwide are choosing cities to settle in, the need to transform these urban agglomerates into *smart* areas is essential to ensure the most comfortable and sustainable life for everyone. It is in this context that the term "*Smart City*" (SC) arises. What transpires from the research and the literature is that there is no universal definition of the term. In fact, several scholars have tried to generate their own classifications, sometimes remarking on one characteristic more than the others according to which one they think is most important and explanatory. The phenomenon of smart cities includes several multidisciplinary areas such as economics, politics, the environment, technology, and urbanization: the complexity of trying to describe the phenomenon is evident.

The Smart City concept emerged from the intersection of at least three theoretical referents, developed between the end of the '90s and the early 2000s (Nesti, 2018, pp. 12). The first strand of literature refers to authors such as Castells (1996), Eger (1997), and Komninos (2002; 2008) and their representations of urban contexts in terms of

"*information cities*," "*digital cities*," and "*intelligent cities*". They mainly addressed the use of Information Technology (IT) for the provision of city services and as the main drivers of economic and social development. In fact, one article written by Caves and Walshok (1997) referred to the concept of "*smart communities*" as communities developed through the use of communication technologies and based on the collaboration between the government, industry, educators, and citizens aimed at promoting economic development and increasing the quality of life of the population (Nesti, 2018, pp. 12).

A second strand of literature relates to the Smart Growth Planning movement, which spread in the United States at the end of the '90s. The movement aimed at the creation of "compact", walkable cities that pushed for the use of alternative transportation and promoted the integration of different land uses within neighborhoods. To recognize the importance of this new movement, in 2002 the American EPA (Environmental Protection Agency) established the National Smart Growth Award, together with indicating the ten principles to follow to achieve smart growth. Among them there were the protection of green areas, the promotion of citizens' participation in decisions related to the development of the territory, and a mixed-use of urban territory that combines residential, commercial, and leisure areas (Nesti, 2018, pp. 13).

The third strand can be traced back to the work of Landry (2000) on *creative cities*, to Florida (2002) on the *creative class*, and on Plumb, Leverman, McGray (2007), and Campbell (2008) on *learning cities*. These authors highlight the importance of actively engaging citizens by leveraging their skills and expertise to develop innovative solutions for urban challenges and stimulate local economic growth. For example, Landry (2000) states that local administrations should promote citizens' participation in the creation and dissemination of new ideas, fostering an environment leading to creative "city-making". Florida (2002) focuses on the contribution of "talented" citizens for regional economic growth. Campbell (2008) analyzes the processes of institutional learning through which cities acquire, use, and share knowledge in order to become more competitive. Overall, the concept of a smart city is derived from the intersection of these three theories. First, the use of technologies in "intelligent cities" to improve communication and interaction between people. Second, strong attention to planning for intelligent growth and urban development that considers the quality of life of inhabitants and a participative aspect.

Third, a focus on knowledge, creativity, and human and social capital (Nesti, 2018, pp. 14).

Regarding definitions of what a Smart City is, one literature review carried out by Nam and Pardo (2011) aims to group the interpretation of Smart City according to the main factor they take into consideration. Therefore, the study presents several definitions with a technological, human, or institutional orientation.

Regarding the first group, the technological dimension of the definitions is related to the use of ICT (information and communication technology), modern information, and technological infrastructure to improve the quality of life of the population. Washburn et al. (2010) highlighted the importance of smart computing technologies, namely "*a new generation* of *integrated hardware, software, and network technologies that provide IT systems with real-time awareness of the real world (…)*" (quoted by Nam and Pardo, 2011, pp. 6). They need to be applied to critical infrastructure components and services, where the technological components can be explained through the framework of the smart city development pyramid by Al-Hader et al. (2010): smart interface (dashboard, common operational platform, integrated web services), smart control systems (automatic control network), and smart database resources (database server). In more detail, one of the most simple and explicative definitions can be attributed to Su (2011), who states that "*Smart City is the product of digital city combined with the Internet of Things*" (Su et al., 2011). Thanks to this definition the concept of Internet of Things (Iot) is introduced, a term that is constantly repeated in the literature regarding Smart City due to its importance. As claimed by Zou (2018), the Internet of Things corresponds to a set of electronic and photonic devices which can communicate with each other without human intervention (Zou et al. 2018). They can collect transportation-data (flows, congestion, road conditions) and use cloud computing services to optimize transportation services (Jimenez, 2018, pp. 123). Another interesting technology implemented in smart cities is Artificial intelligence (AI), which also plays a major role, especially in combination with IoT. AI is a branch of computer science dedicated to simulating human intelligence processes and a data-driven system that enables a computer or software to execute tasks or make judgments (Herath & Mittal, 2022, pp. 2). In general, AI has been used in smart cities practices in recent years, since it promotes efficiency and improves the quality of life by combining contemporary machine vision, robotics and other technologies (Herath

& Mittal, 2022, pp. 3). Some experts even state that IoT and AI need to be used in combination, as IoT provides a platform to collect data, AI then uses this data to make decisions, which are later communicated using IoT, and that leads to a need of collecting more data (Ilyas, 2023, pp. 3). In this case it is interesting to bring to the table the definition claimed by the International Business Machine Corporation (IBM), one of the most famous American informatics firms. The firm affirms that technology and data collection can improve the quality of life, sustainability and the efficiency of city operations of a city. Moving on to other interesting definitions, one is owned by Dameri, (quoted by Kozłowski & Suwar, 2021), "*a smart city is a well-defined geographical area, in which advanced technologies such as ICT, logistics, energy production, and so on, cooperate to create benefits for citizens in terms of prosperity, inclusion and participation, environmental quality and intelligent development*" (Dameri, 2013). Again, Nam and Pardo (2011), who strongly remark the fundamental part that ICT play in a Smart City: according to them, information can be used in all physical infrastructure to improve many aspects of a city, ranging from mobility, energy, the quality of air and water, as well as collecting and sharing data to improve collaboration across different entities. It follows that a city must own specific technological tools in order to properly function: according to Anthopoulos and Fitsilis (2010), the tools can be network requirements such as fiber optic channels and wi-fi networks, public access points like wireless hotspots, and service-oriented information systems.

Moving on to the second group of definitions found by Nam and Pardo (2011) the spotlight here is to be given to the human aspect of a city. As Lindskog (2004) explained (quoted by Nam & Pardo, 2011), IT infrastructure and applications are prerequisites to define a smart city, however if no real engagement and willingness to collaborate and cooperate between citizens, social organizations, private sector and the public institutions, a city cannot be considered as smart. As claimed by Kourtit et al, (quoted by Moura & De Abreu E Silva, 2019), *"Smart cities have high productivity as they have a relatively high share of highly educated people, knowledge-intensive jobs, output-oriented planning systems, creative activities, and sustainability-oriented initiatives"* (Kourtit et al, 2012). It follows that a major importance must be given to creativity, social learning and education. Specifically, what is remarked by many scholars is the necessity for people to be able to use technology (ICs, IoT) in order to take advantage of it. If a smart city

revolves around the massive implementation of these devices and the population does not have the ability to use them, a city cannot count on its inhabitants in maximizing its smart potential. Education is also important, as it is considered to be a driver for urban growth. In fact, a smart city is seen as a city that is able to create a more skilled workforce and to attract more educated people, businesses and organizations, making it as appealing as possible, which is significant for the development of a smart city's capability. Regarding this fact, one research conducted by Berry and Glaeser (2005) states that the most rapid urban growth rates have occurred in cities in which a high share of educated labor force is present. In particular, they take into consideration the relation between human capital and urban development, therefore assuming that innovation is driven by entrepreneurs who innovate in industries that require an increasingly more skilled labor force. Moving on, social inclusion of various urban residents in public services is also a prominent condition, with the goal of reducing urban and educational inequalities: as stated by Angelidou (2015), the issue of accessibility should be fully taken care of when developing smart city policies, in order to avoid spatial polarization and digital disparities.

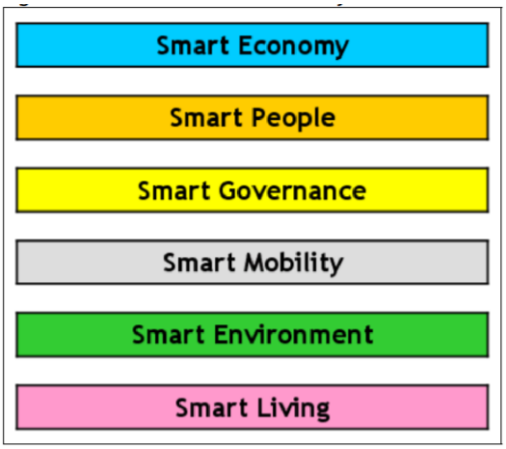
The last group of definitions according to Nam and Pardo (2011) are the institutional ones. As we have understood so far, the concept of smart city comprises heterogeneous elements altogether, therefore strong government support and efficient governance policies are mandatory for a city to maximize its full *smart* potential. The term "*governance*", in fact, is repeatedly quoted in many definitions in smart city literature, highlighting the importance of having trusted collaborative relationships among different political, social, and economic actors. One of the most comprehensive definitions developed is the one of Caragliu, A., Del Bo, C., and Nijkamp, P. (2011). in *Smart Cities in Europe*, who "*believe a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance*" (Caragliu et al., 2011, pp.50). The role of the government should be to facilitate the interconnection among citizens, communities and businesses to enhance growth and innovation, but also boosting collaboration across governmental departments and with communities in order to manage resources more efficiently and to make citizens aware of decisions and policies that affect their lives (Nam & Pardo, 2011).

Regarding this aspect, risks that can arise are related to transparency and accountability, but also as said by Klijn and Skelcher (2007) to democratic legitimacy (quoted by Nesti & Graziano, 2019, pp. 4). Nesti and Graziano (2019), raise the problem of governance dynamics in smart cities, especially because most of the time local governments find themselves interacting with many non-public actors. Generally, they tend to be strong economic players, therefore the danger is that citizens are only considered as users and not party of a political community (Nesti & Graziano, 2019, pp. 4), or the government ends up captured by corporate interests (Hollands, 2008). The solution in this case is to create a governance that is citizen-centric, aimed at carrying out operations that see citizens as the ultimate beneficiaries of any policies. Nam and Pardo (2011) conclude that the "construction" of a smart city can be done following a top-down or bottom-up approach, but the most vital aspect is that the involvement of every sector of the community is crucial.

1.1.3 The Study "Smart Cities – Ranking of European medium-sized cities by the University of Technology of Vienna

After explaining the various characteristics of a smart city and reporting several definitions from the literature, space must be given to the specific sectors of a city that can be considered as *smart* to concretely comprehend the phenomenon in real life. The study *Smart Cities – Ranking of European medium-sized cities* conducted at the University of Technology of Vienna by Giffinger in 2007 is extremely helpful in investigating this topic. The primary goal of the study is to assess and rank European medium-sized cities, which are typically underrepresented in global smart city rankings, based on their level of "*smartness*". The population of the cities range between 100.000 and 500.000 residents, as it is considered to be the perfect size to have significant urban challenges but small enough to manage the integration of smart solutions effectively. A total of 70 cities were evaluated from various countries and to achieve the goal of comparison, Giffinger identified six characteristics that can show that a city is smart: Smart Economy, Smart People, Smart Governance, Smart Mobility, Smart Environment, Smart Living (see Figure 1.1).

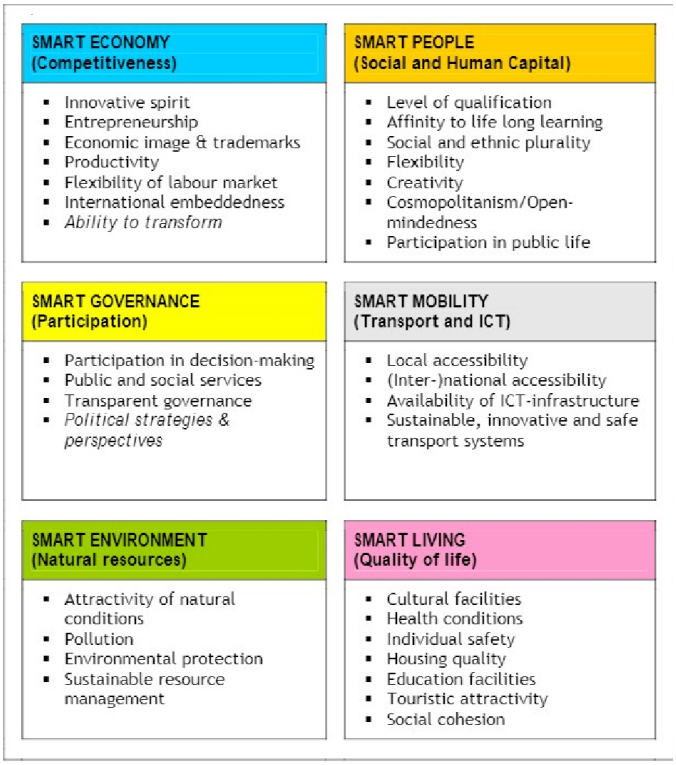
Figure 1.1: Characteristics of a Smart City



Source: Giffinger et al., 2007, pp. 11

According to the authors, to define a smart city it is necessary to adopt a hierarchy structure where every level is described by the results of the lower one, thus these six characteristics are further broken down into 31 relevant factors (Figure 1.2) that define them: the association of these characteristics and factors creates the general frame of indicators that will be used to measure the smartness of each city.

Figure 1.2: Characteristics and factors of a Smart City



Source: Giffinger et al., 2007, pp. 12

Starting with *Smart Economy*, this dimension focuses on an innovative spirit and entrepreneurship, not forgetting about the flexibility of the labor market and productivity. In general, we can say the ability to transform. *Smart People* highlights the participation in public life, creativity and a high level of qualification, but also the importance of presenting a social and ethnic plurality. Moving to the third dimension, *Smart Governance* points to participation in decision-making, the existence of a transparent governance and the development of political strategies and perspectives. *Smart Mobility* is the fourth component, and it relates to sustainable, innovative and safe-transport systems and the availability of ICT-infrastructure, but also local and international accessibility. The fifth dimension is *Smart Environment*, that focuses on a sustainable resource management, a strong environmental protection and to reduce and limit pollution. The last dimension is *Smart Living*, which is a consequence of an interweaving of multiple aspects of living standards such as culture and education facilities, health conditions, individual safety, housing quality, touristic attractivity and social cohesion.

In conclusion, what can be taken away from this analysis is that while the definitions of a smart city vary, they converge on three key dimensions: technology, people, and governance. A smart city is not solely about technological innovation but also focuses on improving the quality of life through citizen participation and efficient governance. The study carried out by the University of Technology of Vienna is a helpful resource to better comprehend which dimensions are to tackle through the development and implementation of *smart* policies in order to make a city as smart as possible. Giffinger's framework highlights the importance of not only technological infrastructure but also social and environmental sustainability, active citizen participation, and efficient urban management. By doing so, it demonstrates that the interplay of these factors is essential for true urban intelligence.

1.2 Evolutions of Smart Cities overtime

1.2.1 Innovation and Territory Dynamics: The Triple Helix, Quadruple Helix, and Florida's Three Ts

In the last decades, the phenomenon of urbanization has caused several negative externalities both in developed and emerging countries. These issues are related to natural problems such as pollution, traffic, lack of resources, issues in waste management, or organizational difficulties like the inefficiency of public services, or citizens' problems in getting access to goods and services of the State. The ability to contain all the externalities caused by urbanization is strictly connected to the process of technological, economic, and social innovation. Regarding the latter, in the last decades, a strong connection between innovation and the territory has been highlighted.

One of the first theories that conceptualized this relationship is the one of the Triple Helix elaborated in the 1990s by Etzkowitz and Lydesdorff (1998). As the authors state, "*a triple helix of overlapping, yet relatively independent institutional spheres is required to capture contemporary innovation processes*" (Etzkowitz & Leydesdorff, 1998, pp.3). The main idea of this model is that the "ecosystems of innovation" in cities are developed thanks to the relationship between three types of agents: universities, the industrial sectors, and government. First, universities, act as a "magnet" to stimulate scientific and technological knowledge. Second, industries, are fundamental in order to boost the economic growth of a territory. Third, the government has an active role in the management and land use policies (Taratori et al., 2021, pp. 8). The Triple Helix thesis asserts that innovation and economic development depend on the increasing role of universities and the integration of elements from academia, industry, and government. This hybridization fosters new institutional and social frameworks for producing, transferring, and applying knowledge (Ranga & Etzkowitz, 2013, pp. 238). Over the past two decades, a significant body of literature on the Triple Helix model has emerged, which can generally be examined from two complementary perspectives. One of them is the (neo-) institutional perspective, which analyzes the increasing prominence of the university among innovation actors through national and regional case studies and

through a comparative analysis. This perspective makes a differentiation between three main configurations in the positioning of the university, industry, and government institutional spheres relative to each other. The first is considered as a *statist* configuration, where the government plays the lead role, driving academia and industry but at the same time limiting their capacity to develop transformative transformations. The second is a *laissez-faire* configuration, characterized by industry as being the driving force, and the other two spheres being support structures with limited roles in innovation. Third, a *balanced* configuration is specific to the transition to a *Knowledge Society*, where the universities and other knowledge institutions work in partnership with industry and government, sometimes even taking the lead (Ranga & Etzkowitz, 2013, pp. 239). The balanced configuration provides the most valuable insights into innovation, as the most conducive environments for innovation emerge at the intersections of the three spheres. This dynamic process continuously reshapes the relationships between universities, industry, and government in an ongoing transition, fostering innovation through the development of new technologies, enterprises, and collaborative models (Ranga & Etzkowitz, 2013, pp. 240). In this case, a smart city functions as an innovative ecosystem, leveraging social and economic development through the integration of university, industry, and government. This synergy fosters creative renewal within the knowledge economy and society (Dameri et al., 2016, pp.1-2).

Building on the Triple Helix model, Carayannis and Campbell (2009) proposed the "Quadruple Helix Innovation System Framework". This approach introduces a "fourth helix", which they define as the "media-based and culture-based public", expanding the innovation ecosystem beyond academia, industry, and government by including civil society as the fourth actor in the innovation eco-system. The media-based public plays a crucial role in disseminating knowledge within a nation-state, while the culture-based public—through its values, experiences, traditions, and visions—contributes to fostering knowledge in the knowledge society (Carayannis & Campbell, 2009, pp. 217–227). For this reason, this model recognizes that knowledge and innovation are not only driven by the interactions between universities, industry and government, but are also deeply influenced by societal needs, cultural values, and citizen engagement. In this sense, the Framework puts innovation users at its heart and pushes for the development of innovations that are pertinent for the users (civil society), putting the community as part

of the innovation processes (Carayannis & Rakhmatullin, 2014, pp. 219). Therefore, the Quadruple Helix concept functions as an architectural innovation framework that integrates four sectoral perspectives—government, university, and industry from a top-down approach, alongside civil society from a bottom-up perspective—ensuring a dynamically balanced engagement (Carayannis & Rakhmatullin, 2014, pp. 220). As Höglund and Linton (2018) argued, the fourth helix model represents an integral part of society, with its primary role being to respond to citizens' needs.

The Quadruple Helix model is quite similar to another theory that conceptualized the relationship between innovation and territory, which is the one of the *Creative Class* elaborated by Richard Florida (2002). According to the author, "*Creative people power regional economic growth and these people prefer places that are innovative, diverse, and tolerant*" (Florida, 2003, pp. 8). The "*creative class*", how Florida addresses these people, generally tends to move away from traditional corporate communities to places he calls "creative centers". These centers, consequently, have high concentrations of creative economic outcomes, in the form of innovations and high-tech industry growth, and provide an integrated ecosystem where all forms of creativity – artistic and cultural, technological and economic, can flourish. Creative people, in the end, move to these areas because they look for abundant high-quality experiences, an openness to diversity, and above all the chance to validate their identities as creative people. Therefore, this process leads to strong migratory trends and an emerging new economic geography (Florida, 2003, pp. 9). Florida (2003) states that the foundation of the new economic geography of creativity and its impact on economic outcomes is based on the 3*Ts* of economic development: *technology*, *talent*, and *tolerance*. Creative individuals and the broader creative class tend to thrive in locations that encompass all three factors. Each element is essential but insufficient on its own, as only when combined they can attract creative talent, drive innovation, and foster economic growth. Tolerance is seen as openness, inclusiveness, and diversity to all ethnicities and races. People from different backgrounds are therefore welcomed and valued. Talent is defined as the provision of educational opportunities, high-quality urban amenities, and career prospects. Lastly, technology is shaped by both the level of innovation and the concentration of high-tech industries in a region (Florida, 2003, pp. 10). Overall, cities must cultivate environments that foster innovation, talent attraction, and cultural vibrancy to become hubs of creative

and economic dynamism (Florida, 2003). The creative class, in this sense, is made up of talented people, who produce wellness and wealth for the community (Nesti, 2018, pp.13).

These theories collectively laid the groundwork for the emergence of smart cities, where digital technologies, participatory governance, and sustainable urban development converge to enhance efficiency, inclusivity, and economic growth.

1.2.2 Tracing the Development of the Smart City Projects Worldwide

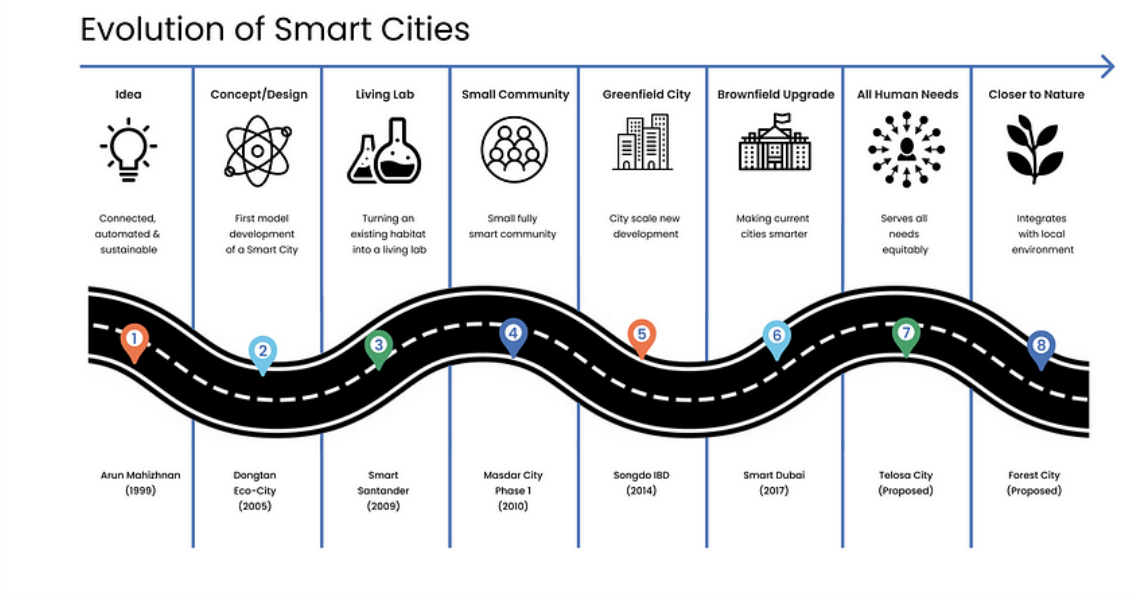
After the concept of Smart City started to appear and develop among scholars, these new ideas were quickly translated into real life. Soon, the desire to apply these concepts found its way to reality (Figure 1.3) since smart city projects arose as research projects developed by academic institutions or with research-driven objectives (Batra, 2023), but also in collaboration with information technology industries that started to experiment with "*smart*" interventions in several cities (Nesti, 2018, pp.18) worldwide.

For example, in 2006 Cisco initiated the *Smart+Connected Communities* initiative in Seul, San Francisco, Amsterdam, and in 2011 in Barcelona, where partnerships with local administrations allowed for the use of ICTs in the reduction of CO2 emissions. In 2008, IBM launched the *Smarter Planet* project, whose vision was based on the three "I" (Instrumentation, Interconnectedness and Intelligence). The idea behind this was to solve society's issues through new technologies and "smart systems". The year after, IBM launched the *Smarter Cities* campaign aimed at enhancing the management of cities, especially in the transportation, education, health, and energy sectors, to save resources and improve the quality of life of inhabitants thanks to technology. According to IBM, ICTs are fundamental to enhancing economic growth and local innovation. In the same year, the IBM Institute for Business Value published "*A Vision of Smarter Cities*" (Dirks & Keeling, 2009), recognizing the growing political and economic significance of cities in response to the declining centrality of nation-states, the rise of multi-level governance, and the increasing role of capital cities as economic and financial hubs. Lastly, in 2013 Microsoft launched *CityNext*, aimed at providing innovative digital services to manage highways, parking lots, traffic, healthcare, and energy efficiency as well as enabling citizens to report any malfunctions through the use of cloud, big data, mobile devices, and

social media. Barcelona figured as a city partner, together with other 270 governments around the world (Nesti, 2018, pp. 18). According to Nesti (2018), from these firms' perspective, smart citizens are people who are connected to the city through their devices, utilize the services they provide, and actively contribute to their development and implementation through an open-source approach.

In addition to IT firms, European institutions played a key role in the practical application of the smart city concept. Specifically, in 2010 the EU launched the "*Europe 2020*" strategy. The strategy aimed at adopting a vision of smart, sustainable, and inclusive growth. Regarding the concept of smart growth, the Commission pushed for the use of knowledge and innovation in order to stimulate growth and address challenges of the European and global society. In 2011, the *Smart Cities and Communities Initiative* was launched, aimed at financing proposals for the deployment of integrated sustainable energy technologies in urban areas and measures for the application of new technologies in the context of IoT and integrated personal mobility. Another initiative developed by the EU is the creation of the European Innovation Partnership on Smart Cities and Smart Communities (EIP-SCC), launched in 2012, and its Marketplace of the European Innovation Partnership on Smart Cities and Communities (EIP-SCC Marketplace), where representatives from cities, economic actors, and experts can share ideas over the enhancement of smart policies (Nesti, 2018, pp. 19).

Figure 1.3: Evolution of Smart Cities



Source: Batra, 2023

The first ever model development of a Smart City must be connected to Dongtan Eco-City. This project was born in 2005 and was claimed to be the world's first purpose-built eco-city located near the east end of Chongming, the world's largest alluvial island near the Yangtze River, in Shanghai. Dongtan was an ambitious joint project involving the multinational engineering firm Arup and Chinese developers, and was originally developed as a futuristic model to accommodate spillovers from supercities and accommodate China's emerging middle class (McGirk, 2020). The project was designed inspired by an "integrated urbanism" approach that contemplated the environment, social and economic aspects to create sustainable communities. The Chinese municipal government intended transforming Chongming into an ecological island to serve as national model for sustainability, energy efficiency, and environmental awareness. Initially, the project consisted of a town made up of three villages with the aim of growing into a collection of towns connected by bike routes and public transport corridors. In addition, it was presented as one of the main highlights of the 2010 World Expo hosted by the city of Shanghai, whose theme was "Better City, Better Life" (Cheng & Hu, 2009, pp.3). However, the project stalled in 2006 mainly because of political issues, since Shanghai's top bureaucrat was arrested for graft. Moreover, Dongtang's planners didn't

manage to comply with a government land use policy which required the local authorities to reclaim the same amount of property for any farmland used for development (McGirk, 2020b). In general, Cheng and Hu (2009) identified several challenges that prevented the project from taking off: development costs for businesses were high, living and the housing costs in an eco-city were expensive for the population given the presence of renewable energies or electrical vehicles, the absence of an involvement of several actors and stakeholders from the beginning and throughout the planning process.

With time, Smart City projects developed worldwide could be differentiated into greenfield projects and brownfield projects. The former relates to new construction, namely building Smart Cities from scratch. The latter focuses on the reconstruction and redevelopment of cities, which over time have been increasing internationally showing a faster transition from the concept of Smart City to its development. Regarding greenfield projects, one of them is the design of Masdar City, a project under construction since 2007 located in the desert near Abu Dhabi, planned to be one of the world's first sustainable communities. Masdar is a 6 million square meter sustainable city designed to use low carbon technologies, with the aim of achieving a car-free, zero waste and carbon neutral community, and accommodating 50.000 people. The entire city was developed jointly by the Abu Dhabi government and the architectural firm Foster + Partners, with a total of 22 billion dollars for its construction (Manghnani & Bajaj, 2014, pp. 1). Nowadays, not all the things envisioned are present. First, it was originally set to be completed by 2016 and later 2020, but now the target date is not known yet. In addition, right now only 15.000 people live and work in the city but only one-third are residents and only one-fourth of the city has been built up so far (Associate Press, 2023). Critics and actors involved in the making of the project debate over the success or failure of the city: on one hand, the associate director for sustainability Chris Wan stated that the project will just develop naturally. On the other hand, critics affirm that Masdar is more of a research hub and office park rather than a place with residential areas or a city that presents cultural offerings (Associate Press, 2023). Another greenfield project was the Songdo IBD project, the first major developer-led effort to build a smart city from scratch. Songdo is located on the southwest coastline of Incheon, approximately 50km away from the South Korean capital of Seoul and is directly accessible from Incheon International Airport due to the 21km long Incheon Bridge (Park, 2024). The project was built because

of former President Lee Myung-Bak's desire to promote low-carbon and sustainable growth as main avenue for development in the country. In addition, because of the economic crisis of 2008, the government wanted to focus on developing the country's own infrastructure by highlighting the importance of green investments. Songdo, in fact, has been a huge part of this move towards sustainable growth, since 40 percent of its area is dedicated to outdoor activities, in contrast to the capital Seoul or other South Korean metropolises. The district occupies 1500 acres of land, is the largest private real estate development in history, offers 27 kilometers of bicycle lanes, waterways and parks, and most of the buildings obtained the LEED accreditation[4]. Because the city was built from scratch, developers had the opportunity to invest in technologies that still have to make their way into "normal" cities. One example is Songdo's smart trash disposal system: the trash is collected inside the buildings thanks to a network of underground tubes and is connected to a sorting facility, where it is processed and aimed to be converted into energy. Moreover, the city's infrastructure contains sensors that monitor and regulate temperature, energy consumption or even traffic, by interacting with residents on a one-to-one basis (Lobo, n.d.). A major problem encountered, common to the other projects analyzed before, is the one of attracting people to the city. Now only 80.000 citizens have decided to move there and less than 20 percent of the commercial space present in the district has been occupied. However, developers of Songdo have found a way to attract more people and speed up the population process: invest heavily in top-quality international education. Now four international universities have campuses in the district (University of Utah and George Mason University among them), with the hope that by offering a skilled workforce provided by the universities, businesses may soon follow and give a chance to the city. The hope is that the city will eventually host 300.000 people, as originally planned (Lobo, n.d.).

Moving on to brownfield projects, one initiative that stands out is Smart Dubai. The plan is an example of a large-scale Smart City project that has made substantial advance in implementing smart solutions (Batra, 2023). Dubai is one of the seven Emirates that constitute the United Arab Emirates (UAE), with a population of over 3 million people.

[4] LEED (Leadership in Energy and Environmental Design) is the world's most widely used green building rating system. LEED certification provides a framework for healthy, highly efficient, and cost-saving green buildings, which offer environmental, social and governance benefits (U.S. Green Building Council).

With highly competitive industries including tourism, commerce and logistics, real estate, financial services and education, the city is a thriving regional economic center (Bishr et al. n.d., pp.1). Regarding sustainability and development, Dubai has already achieved world-class leading city status regarding 11 SDG indicators, among them housing, access to basic services, access to transport, inclusive and sustainable urbanization. Already in 2014, the Smart Dubai Initiative was launched by His Highness Sheikh Mohammad Bin Rashid Al Maktoum with the vision of "To become the happiest city on earth". Among the implementations taken place figure the use of massive IoT systems, data analytics and artificial intelligence applications. Three years later, in 2017 a new 5-year smart city strategy was launched, which focused on six dimensions: living, environment, mobility, economy, people, governance. These scopes of actions are familiar, as they correspond to the six dimensions encountered by Giffinger in his study carried out by the Technology University of Vienna to comprehend smart cities characteristics. In addition, the strategy involves four cross-sectoral initiatives such as creating internal government efficiency, using shared and open data, creating seamless city experiences and a paperless city. The latter is one of the most effective strategies, launched to digitize internal and external government transactions, making them completely paper-free. It is stated that this strategy helped save more than AED 725 million, 7.7 million hours of labor and 20.350 trees. Another remarkable initiative carried out is the Dubai Blockchain Strategy, making the city the first city government to run all applicable transactions on blockchain, entailing use cases benefiting from smart controls and automation and third-party eliminations. By doing so, Dubai is also committed on attracting talent to the region for the development of the needed technology (Bishr et al. n.d., pp.2). Regarding seamless smart services, one interesting initiative was the launch of *DubaiNow*, the central app that provides access to several government and private sector services including bills, housing, residency, health, education. Since its launch, the app has processed 11,47 million transactions. Another initiative is UAE PASS, the first secure national digital identity platform that allows residents to access services and digitally sign documents and transactions. Regarding Artificial Intelligence, Smart Dubai launched the AI Lab, in order to identify and develop use cases for AI implementation across all industry sectors. Thanks to this program, 100 possible cases of AI development within the Dubai government were identified (Digital Dubai, 2020). Concerning data, two main and complementary initiatives were Dubai Data

and Dubai Pulse: the former aims to achieve efficient and safe data governance and data sharing at city level, while the latter serves as a new digital backbone created through a public-private partnership (Bishr et al. n.d., pp.2).

In addition to greenfield and brownfield projects, there are other two proposed projects regarding smart cities that have been known so far: Forest City and Telosa City. Forest City was one of China's largest property developer Country Garden's mega-projects. The endeavor was carried out under the Belt and Road Initiative in 2016[5] with a budget of 100 billion dollars, when the Chinese property boom was massive. Country Garden decided to build a housing complex in Johor, in southern Malaysia, with bars, restaurants and sporting facilities such as a golf course and waterpark. The initial plan was to host nearly one million people, but in 2022 only 15% of the project had been built and only 1% of the total development was occupied (Marsh, 2023). Forest City was built "for all mankind" (Marsh, 2023), but in reality, it was meant to offer second homes abroad for Chinese citizens leaving out local Malaysians. In addition, the city's isolated location put off potential tenants from acquiring a house. Political reasons also played a role in the current situation, since in 2018 Malaysia's former prime minister Mahathir Mohamad restricted visas for Chinese buyers, let alone the current unstable political and economic environment of Malaysia's government that deterred people from moving there or buying a new property. Regarding Telosa City, the project was only announced in 2021. The ambitious idea came from the American billionaire and former Walmart's president Marc Lore, who aspires to build a city using sustainable and eco-friendly structures in the American West desert. The aim is to host until 5 million people by 2050, with at least 50.000 residents already in 2030. The name Telosa comes from the Greek telos, which means "the highest purpose" and is explicative of Lore's hopes, since the development team stated that the defining values of the city are openness, inclusivity and fairness, believing that it will set a global standard for current and future urban living (Burman, 2024). Concretely, the plan consists of a city made of 36 districts, where residents can reach their work, schools and services in a maximum of 15 minutes, according to the

[5] China's Belt and Road Initiative (BRI) is a strategy initiated by the People's Republic of China that seeks to connect Asia with Africa and Europe via land and maritime networks with the aim of improving regional integration, increasing trade and stimulating economic growth (European Bank for Reconstruction and Development).

concept of the 15-minutes city[6] developed by Carlos Moreno. A giant public green area will cross the city offering residents easy access to nature, while futuristic skyscrapers, community parks, driverless cars and ariel vehicles will surround the town. In addition, the city will run on renewable energy, vehicles powered by fossil fuels will be banned in favor of soft mobility, through the implementation of scooters, bikes and autonomous electric vehicles. The biggest challenge in this case will be to make water supply sustainable in a desert environment. In this sense, Telosa plans to conserve, clean and re-use water on site with high efficiency, thus reducing the environmental impact (Ingenio, 2024). An interesting aspect of this project is the driving principle behind the city, which is *equitism*: basically, a foundation managed by residents will own all the lands of the city and this will enable the city to finance itself, directly benefiting its inhabitants. Anyone could obtain a license to build or sell a house and residents would share the ownership of the land through a community fund (Ingenio, 2024). For the completion of the project, around 400 billion dollars in funding will be need, taken from sources like private investors, federal and state grants and economic development subsidies (Burman, 2024). In conclusion, in the past years several smart city projects have been going under way. Since the development of the concept of technological innovation and its relation to the territory, to the rise of the concept of smart city per se, many different projects started to be carried out all around the world with the aim of bringing innovation to cities. The difference between greenfield and brownfield projects highlights the varied approaches to urban innovation. The former have the benefit of being built from scratch, thus offering the opportunity to integrate all types of technologies. Songdo, Masdar and Telosa City are great examples of this, given their chance of incorporating sustainable and inclusive services for all citizens aiming to make the city as green as possible. However, the biggest challenge they face relates to a sense of community that is lacking, as sometimes these cities give a "cold" and impersonal feel that can end up making the city a "ghost town", as the example of the Forest City in Malaysia clearly shows. In contrast, brownfield projects redevelop existing cities by upgrading them with modern and smart technologies. If on one hand it can involve more complex implementation, its benefit is that it enhances livability without losing the soul of the city. Smart Dubai is explicative of how diverse

[6] Theorized by the urban planner Carlos Moreno, the 15-minutes city model is an urban planning proposal, with the aim of reducing dependence on car use. Individuals should always be able to reach the set of venues they visit the most within a 15-minute travel distance, either by bike or foot (Sony).

projects implemented by the administration have led to several improvements in the daily life of the citizens, from the digitalization of government transactions to safe data sharing, and to AI development. Ultimately, both approaches undoubtedly contribute to the future of smart and sustainable cities, but they also present certain challenges that the administrations are called to address. Striking a balance between technological advancement and human-centric design is key to the long-term success of urban design.

1.3 Challenges and Opportunities in Smart City Development

1.3.1 Navigating the Challenges of Smart City Development

Smart cities, given their implementation of advanced technologies such as the Internet of Things (IoT), artificial intelligence (AI) and big data, are undoubtedly redesigning urban environments with the aim of improving the life of citizens. In this sense, many ICT firms, in particular Smarter Cities by IBM, have spread the idea that the adoption of technology is a necessary step to solve urban problems (Söderström et al., 2014 in Nesti, 2018). Vanolo (2013, pp. 889) refers to this narrative as "*smartmentality*", namely a new urban identity that combines themes of technological development, public-private partnerships, and environmental protection to promote a neoliberal approach to local development, driven by the attraction of private investment. Also Hollands (2008) agrees that the emphasis on technological determinism in the smart city narrative has masked a broader ideological shift, moving the focus from social well-being to economic competitiveness, positioning the urban environment as a tool for business interests. As explained before, Songdo, Masdar, and the Forest City are a great example of this, highlighting the supposed development of smart city initiatives only guided by technology firms and where citizens don't have any type of involvement (Hollands, 2015 in Nesti, 2018). Other critics related to the smart city paradigm are concerned with the social impact of using technologies and any increase of inequalities in the access to services by "smart" or "not smart" citizens, therefore socially polarizing the city (Hollands, 2015 in Nesti, 2018). Moreover, regarding governance, according to Luque-Ayala, Marvin (2015), the nature of the relationships between local governments and businesses should be further

examined to prevent the former from being captured by the latter. Additionally, according to Hollands (2015) and Angelidou (2016), the effects of smart strategies on civic participation must be considered. It remains unclear whether, and to what extent, the collaborative approach that characterizes smart city governance fosters genuine inclusion and citizen empowerment.

Sánchez-Corcuera et al. (2019) dedicated a section of their research to the individualization of all the issues that can arise in the development, implementation and management of smart cities, and divided it into two parts. In the first part, the research presents a literature review of the different challenges and taxonomies of challenges, while in the second the authors reviewed challenges that arise in a specific domain like government, or traffic, sustainability and so on. In the first section, Monzon (2015), one of the authors analyzed by Sánchez, identified challenges according to the geographical position in which a city is located. Then he categorized them based on the following taxonomy of governance, economy, mobility, environment, people and living. According to him, European cities need more flexible governance models while the economy should become more resilient to downturns. Then he moves to mobility and states that a city should aim to create a more sustainable and efficient system to avoid urban sprawl and reduce the need for a car, therefore reducing CO2 emissions. He also highlighted the supply of housing, health conditions and crime rate situations as living challenges to be faced. Regarding South and East Mediterranean cities, he criticized their lack of resources such as fresh water, food supply and poverty. Security and high levels of violence are additional problems, while government instability and corruption still figure as serious issues. Concerning education, Monzon highlights that Southern communities present a lower amount of smartphone users compared with other European cities, let alone more technology-illiterate people. This can delay the integration of ICT in cities, raising issues in the implementation of technology that makes a city smart. Yin et al. (2015) reviewed in their study three major challenges, such as city traffic, citizen behavior and city planning. Regarding city traffic, the authors explained that there are many different data sources implemented in cities (like GPS and GIST), and it can be difficult for algorithms to use them all effectively. Concerning city planning, the issue in this case is how to use data to direct urban development and construction, since there is not a designated function for doing so. Moving on to another study, Chourabi et al. (2012) identified and separated

several challenges into eight categories, highlighting challenges inside each of them. The first problems relate to managerial and organizational challenges, including managers' attitude and behaviors, lack of alignment of organizational goals or multiple and conflicting goals, resistance to change. Regarding the government, issues that can arise have to do with collaboration and participation, accountability and transparency, while concerning the policy context, the main issue is linked to the integration of the ICT with political and institutional components as each one has its own agenda. In this context, also Van den Bergh and Viaene (2015) identified challenges related to municipal administration, like establishing an internal coordination mechanism for SC, having an expert team lead Smart City growth and a motivated workforce that has a forward-thinking attitude. So did Pierce and Andersson (2017), who presented a taxonomy of challenges focusing on municipal decision making. Among them figure a weak collaboration with external stakeholders, financial issues like the presence of limited funds for SC initiatives, governance issues concerning outdated rules and regulations, a poor awareness given by a lack of knowledge and experience in SC-related technologies, and finally issues regarding privacy of big data of citizens. In addition, Chourabi et al. (2012) identified challenges related to the economy, such as lack of innovation, entrepreneurship and productivity. Then regarding people and communities, a poor education or digital divides and accessibility figure as main challenges. Issues regarding the natural environment are also threats, including all the challenges related to sustainability of the introduction of the ICT. In conclusion, they identified challenges concerning technology and built infrastructure, especially around the use of IT (unclear vision of IT management, lack of knowledge).

The second part of the study of Sánchez-Corcuera et al. (2019) concentrates on domain-specific challenges. The research presented twelve domains and for each of these domains, several challenges are recorded. Table 1.1 lists the domains individuated and their challenges.

In this part I am going to present some of what I think are the most important domains such as environment, energy, waste management, sustainability, citizens, education, IoT, and government. The environment is one of the first domains analyzed and one issue that comes up is the creation of green public spaces. In this case, the risks are related to gentrification of a neighborhood given by the increase of housing costs and displacement

of residents. For this reason, when an administration wants to create new green spaces, social sustainability also needs to be considered in addition to ecological sustainability. Another issue goes back to the contamination of former industrial areas that have been now adapted for living, causing health problems to the population. A major environmental challenge is to secure these places for safe living by monitoring and assessing the risks of emerging pollutants. In general, an urban-ecology viewpoint must be adopted.

Table 1.1: Literature review of domain-specific challenges

Domain	Challenge
Agriculture	Include farming inside cities
Citizen	Engaging citizens in decision-making processes
	Engaging citizens as co-creators
	Engaging citizens as ICT users
Education	New education necessities
	Continuous education for all citizens
Energy	Achieve lower energy consumption
	Micro-grids regulation and technical challenges
Environment	Taking into account an urban-ecology viewpoint
	Re-adapting contaminated areas for new urban spaces
	Protect the social sustainability alongside the ecological sustainability
Government	E-government challenges
	IoT-based governance challenges
Healthcare	Health monitoring challenges
Internet of Things	Taxonomies of challenges related to IoT
	Resilience among interdependent infrastructure
	Challenges with autonomous IoT wearable devices
Security	Data storage–related privacy
	Security threads
Sustainability	Sustainable growth of cities taking the ICT into account
Traffic	Technical issues with Traffic Management Systems
	Challenges related to the smartness of roads
Waste management	Lack of resources to implement a waste management system
	Not having e-waste recycling culture

IoT: Internet of Things; ICT: Information and Communication Technologies.

Source: Sanchez et al., 2019, pp. 24

Energy is another domain considered, given that energy efficiency is a major challenge to face. The ideal solution is to reduce energy intensity, therefore aiming for sustainable growth. In addition, regarding micro-grids, their regulation which prevents the proper usage of them and technical challenges figures as issues to solve.

Waste management is another challenging domain, especially in underdeveloped countries. In this case, Joshi and Ahmed (2016), brought to the attention the case of India in which the problem of electronic waste is still striking because of a lack of infrastructure and eco-awareness among the population. Moreover, there is no organized planned segregation of waste in any households and at community bin level, or an available transportation system that is efficient.

Sustainability is the last domain, which mainly focuses on ICTs. In general, the need is to pay attention to the downsides of their implementation, as sometimes they may deteriorate the ecosystems, but also increase the knowledge of these tools to make adequate ICT requests.

Moving on to citizen-related domains, the first domain presented by Sánchez-Corcuera et al. (2019), is the one of citizen itself. What is striking in this sense is that the engagement of citizens in decision-making processes is pivotal, since in this way the city can satisfy the needs of the population through their feedback. Simonofski et al. (2018), identified three ways in which citizens can be involved in the city: democratic participants, co-creators and ICT users. By co-creators, the citizens become crucial stakeholders to develop ideas and tools and are also provided with open data in order to create new services for the city.

Education is another domain, and in this case, it is essential that education itself adapts to introduce new topics about new technologies in smart learning environments. It is also necessary that grown-up people approach these new technologies and platforms in order to take part in the decision-making process of their cities.

Moving on to single domains, a fundamental one is the IoT one. In this case, a smart city based on IoT presupposes that all devices in a city are connected, ranging from critical infrastructure like electric grids, to healthcare, to home automation. Basically, they are all connected to a single global network and in case of failures of a single infrastructure, the whole network could be brought down. For this reason, what the study by Sánchez-Corcuera et al. (2019) suggests is that it is essential to incorporate resilience mechanisms of IoT architectures to ensure resilience among interdependent infrastructure. IoT architectures touches another important domain, the one of government, which presents issues related to the use of IoT itself. Some of them concern investment in ICT, but also challenges regarding security and privacy to safely implement a smart government.

Another domain is security: Elmaghraby and Losavio (2014), highlighted the major issue related to privacy with stored data, such as location, contact lists and messages. The GPS (Global Positioning System) that indicates a location, in fact, can provide information about daily itinerary or home addresses. In addition, Zhang et al. (2017), added three security challenges. Among them there is crowdsensing which is based on the use of sensing devices of residents, then false data injections, and the need for new policies of data privacy, availability and management. The problem of security and privacy is also identified and studied by Ahmed (2020), who clearly stated that *"Smart cities can't be considered smart unless these can provide the required level of security"* (Ahmed, 2020, pp. 3). The general security and privacy requirements involve around ensuring availability, integrity, access control, confidentiality and privacy. The smart city itself sets peculiar security requirements, since it is a system of interlinked systems that share data with each other. Because of this, the issue is that if any device running a software faces different vulnerabilities, these ones increase rapidly when the device joins a network. A smart city consists of millions of devices and for this reason even one single device can make the whole collection vulnerable. In this case, the problem is made worse in smart cities by the physically scattered sensors in public areas as well as the system's multiple interdependencies and complexity, which leave it open to several types of cyberattacks. Ahmed (2020) suggests two measures to take to keep smart city sensors secure from intruders: first, they should be located in areas where access is restricted and are out of reach of unauthorized personnel. Second, if a sensor is deployed in the network, it should be authenticated to check if it is authorized to collect and send data in that network. For this purpose, an authentication scheme could ensure that only authorized devices with proper credentials can take part in communication with an access point. Seattle (WA) is a great example of how a city tried to tackle security and privacy problems. The city developed Open Data and Privacy Programs that ensure that city departments, making their data accessible to the public, repeatedly check for privacy, security and quality considerations. To do this, the Seattle administration is guided by Privacy Principles adopted by the City Counsel in 2015 and supported by annual progress reports evaluating existing policies and procedures (The Future of Privacy Forum, 2018). In addition, the city created a list of surveillance technologies currently in use and made it public with their correspondent Surveillance Impact Reports (Sánchez-Corcuera et al.,

2019, pp. 19). The last domain is the government. In this case, issues that can arise relate to e-government and IoT based governance. For example, as stated before, security and privacy problems can arise in order to implement a smart government.

1.3.2 Opportunities for Smart City Development for the Future

The development of smart cities presents a multitude of opportunities to transform urban environments into more sustainable, efficient, and livable spaces. Smart cities of a new era can be considered as developing ecosystems where technological solutions help with dialogue with residents, optimize urban infrastructure and substantially improve the quality of life of citizens (Nowodziński, 2023). For this reason, Nowodziński (2023) put emphasis on the concept of *systems*, since cities figure as systems who need high quality management, and therefore planning, organization and control. The difficulty lies here, because modern cities are complex, multi-element organisms whose management requires high levels of interdisciplinary knowledge and skills. Thankfully, after many trials and projects of smart cities developed and implemented like Dongtan Eco-City in China and the Forest City in Malaysia, municipal leaders, bureaucrats, and experts are realizing that technology is not the only factor that makes a city smart. SC strategies start with people, as citizens need to be included and should play a proactive role in the creation and development of projects for their cities. Regarding actual plans, smart city projects should efficiently respond to real challenges of our century, without compromising sustainable development and while improving the quality of life of their citizens (Nowodziński, 2023). Our century has witnessed the rapid evolution of technology, therefore of the digital transformation of our society. Algorithms and data are great development opportunities of the XXI century: in fact, the acquisition, collection, analysis, processing and use of data, let alone the use of algorithms is becoming an essential competence of countries and cities (Nowodziński, 2023). By leveraging these advancements, SC aim to optimize various areas of a city such as resource management, improve public services and enhance the quality of life for residents. Key opportunities lie in areas such as smart transportation, where public transit and traffic mitigation can be

improved by autonomous vehicles and real-time traffic management that aim at reducing congestion and emissions. In addition, installing IoT sensors on existing physical infrastructure can help technicians perform predictive maintenance or fix problems before they turn into breakdowns. Waste management and energy management systems can also use real-time data to promote conservation and reduce environmental impacts, especially energy management with smart grids and renewable energy (Nowodziński, 2023). Switching to citizens-related opportunities, healthcare and safety figure as fundamental areas in which ICT can be implemented. ICT can help services in clinics and hospitals, however more research is needed to improve performance and accuracy before introducing these new technologies in this domain (Sánchez-Corcuera et al., 2019, pp. 29). In addition, AI-driven surveillance and emergency response systems can enhance public safety, enabling faster and more effective interventions. Looking to the future, the opportunities for smart city development are set to expand as technology advances and urban challenges increase. Future smart cities will increasingly rely on integrated, real-time data systems to make cities not only more efficient but also adaptable to evolving needs, such as climate resilience, sustainable energy use, and equitable access to resources. I believe there is a strong potential around future urban design, since smart city development not only solves today's urban problems, but also sets the foundation for cities that are sustainable and technologically advanced for future generations.

CHAPTER 2 – EUROPEAN PROJECTS ADVANCING SMART CITIES

2.1 The evolution of the EU framework regarding urban development

The European Union has long been a key driver of urban development policy, reflecting its recognition of cities as engines of economic growth, cultural heritage, and innovation. Particularly, the concept of city-region has become an increasingly influential idea. In fact, the argument that cities are the economic drivers of regions has become gradually significant among national governments, let alone the idea that urban and regional economies are strongly intertwined (Parkinson, 2005, pp. 2)

From the beginning, the European Community was established with the goal of achieving political integration through economic integration. However, it was clear that this ambition was being hindered by the strong differences between the poorest and richest regions of the EU. Consequently, in 1975 the European Regional Development Fund (ERDF) was created, with 5% of the Community budget dedicated to regional development. This was the first recognition of a territorial dimension to EU policy. Later, the Single European Act laid the foundation for a true EU cohesion policy aimed at mitigating the impact of the Single Market on less developed regions. When it came into effect in 1987, regional policy accounted for nearly 20% of the total EU budget. However, at that time any urban dimensions to EU policy were not present yet. In 1990, though, the *Urban Pilot Projects* were created. Set up under Article 10 of the ERDF, they were limited programs with modest resources and were the first attempt by the EU to focus on cities. Some years later, in 1993, the Council reformed the Structural Funds[7] (SF) by allocating 33% of the total budget to regional territorial differences. As concerns for regional areas increased, so did concerns for cities (Parkinson, 2005, pp. 5-6).

[7] Structural Funds (SF) are the EU's basic instruments for supporting social and economic development in EU Member States.

2.1.1 The URBAN Community Initiative

In 1994, the European Parliament requested and authorized the creation of *URBAN Community Initiative*[8], a plan that focused on urban regeneration and cohesion in deprived neighborhoods. In more detail, it addressed problems of isolation, poverty and exclusion of inhabitants through interventions that improved the ensemble of their physical and social circumstances. The first round of the initiative ran from 1994 to 1999, and 118 European urban areas received around 900 million in EU funding. The funds were used to regenerate inner city areas, historic city centers, and peripheral areas such as districts at the periphery of urban agglomerations on large social housing estates (Parkinson, 2005, pp. 8). Given the success that *URBAN* generated, a second round of the same initiative then called *URBAN II* continued with the effort and commitment to support European cities in their research for the best strategies for urban development and regeneration. The second round ran from 2000 to 2006 and intended to invest in the formulation and implementation of innovative strategies for sustainable economic and social regeneration. The aim of the initiative was tackling urban areas characterized by high levels of unemployment, poverty and delinquency and low levels of economic activity and education (European Commission, 2000). Thanks to the support of this European initiative, a total of €730 million was invested in the social and economic regeneration of 70 urban areas across Europe (De Santiago Rodríguez, 2017, pp. 28). These can be considered the first EU actions solely focusing on cities.

2.1.2 From the Lille Action Program to the Bristol Accord

In fact, it can be stated that since 2000 Member States started to openly collaborate to promote an urban agenda, both among them and with the Commission. This was carried

[8] Community initiative concerning urban areas (URBAN), 1994-1999 | Program | REG | CORDIS | European Commission. (n.d.). CORDIS | European Commission. https://cordis.europa.eu/programme/id/REG-URBAN/it

out by a permanent working group called *UDG*[9] (Urban Development Group), and the result of their work can be seen in the approval of several programs, such as the *Lille Action Program* in 2000, a multi-annual program of cooperation and urban policy within the European Union (De Santiago Rodríguez, 2017, pp. 33). Thanks to the Lille Agenda, Ministers of the EU countries reiterated their willingness to promote a common and integrated approach in urban policy to achieve sustainable development. To do so, they set four basic goals:

- To help Member States, the Commission and cities give a more concrete form to the main policy objectives established at the European level in order to address the issues that cities face.
- To create a reference framework for national and Community policies in the urban field.
- To assist the Commission in completing and strengthening community activities that benefit cities and enhancing their coordination.
- To support and strengthen dialogue and research on urban matters.

In addition to these goals, the program also included nine key priorities. Among them, of great importance were to encourage partnerships between the public and private sectors, to foster the use of new informational and communication technologies, to disseminate best practices, and boost networking, and to support community life in the disadvantaged neighborhoods. If these were shared priorities among Member States, it was accepted that the importance attributed to them would differ depending on the Member state or urban region because of national laws, local conditions, and the progress of a national urban policy (Parkinson, 2005, pp.11).

In December of 2005, the EU Ministers adopted the Bristol Accord with the aim of promoting sustainable communities across Europe. The Accord emerged from a meeting in Bristol during the UK's presidency and outlined key principles and actions to address urban challenges, improve quality of life, and ensure environmental, social and economic sustainability in cities. In the first part, the Accord presented a definition of sustainable

[9] The UDG includes the 27 Member States, Norway, Switzerland and the EU candidates, but also the EU Commission and the EU Parliament, the Committee of the Regions (CoR), the European Economic and Social Committee (EESC), the European Investment Bank (EIB), the European Environment Agency (EEA), the European association of cities (such as EUROCITIES), and other stakeholders (such as URBACT and EUKN).

communities, namely "*places where people want to live and work, now and in the future*" (Office of the Deputy Prime Minister, 2005, pp.6). Then, it gives the example of eight specific characteristics that a sustainable community should present, like "active, inclusive and safe", or "well run, connected and served", and "environmentally sensitive". In the second part of the Bristol Accord, the document presented an agreement to compile Good Practices Case Studies. In this case, all EU countries agreed to submit such case studies to the European Urban Knowledge Network (EUKN)[10], according to an agreed template. In addition, the Accord encouraged EU countries to increase collaboration among governments, local authorities, businesses, and civil society (Evans, 2011, pp. 13).

2.1.3 The Urban mainstreaming and the 2007-2013 programming period

At the end of the 2000-2006 programming period[11], the initiative URBAN was not launched again, but the Commission proposed to integrate urban plans into the Operational Programs[12] of Member States for the period 2007-2013, a process known as "*mainstreaming*", making it a non-mandatory provision. Through this innovation, all urban areas in the EU could become potential beneficiaries of EU Cohesion Policy (Charles, 2014), but paradoxically the success of a methodology at the European level, and the intention to integrate it more closely in the Member States through mainstreaming, led to its practical disappearance, thus losing the exemplary character and the visibility that the URBAN initiative had had at the European level. More concretely, after the beginning of the new 2007-2013 programming period, of the 316 Operational Programs of the ERDF, only 178 actually incorporated a certain type of urban dimension. Therefore, not only very few Member States anticipated programs that were a following of the Community initiative URBAN, but also major differences were detected between

[10] The EUKN is the only independent, Member State-driven network in the field of European urban policy, research and practice.
[11] Programming is one of the essential elements of the functioning of the Structural Funds and it involves the preparation of multi-annual development plans. It relates to the Cohesion Policy framework, which is established for a period of 7 years (ex. 2000-2006 programming period).
[12] An Operational Program (OP) is a document presented by each Member State and approved by the Commission. It sets out the strategic priorities each Member State lays down in its Partnership Agreement and it benefits from resources of one or more Structural Funds.

the Members of the "old" and the new Member States from the East, where Structural Funds investments had a strong sectoral nature (De Santiago Rodríguez, 2017, pp. 30). Despite this, 2007 marked a significant milestone for the urban dimension at the European level. In fact, The Treaty of Lisbon[13] added territorial cohesion to economic and social cohesion, as a shared competence between the EU and the Member States, which has since then become a cornerstone of EU Cohesion Policy[14]. In addition, in the same year and during the Informal Meeting of Ministers responsible for Territorial Cohesion and Urban Development in Leipzig, two documents that represent great achievements for urban and territorial development at the European level were approved: the *Leipzig Charter on Sustainable European Cities*, and the *Territorial Agenda of the EU*. The former, on one hand, pushed to make a greater use of integrated urban development policies, understood as those that coordinate the spatial, sectoral and temporal aspects of key urban policy areas, such as social cohesion and quality of life, the creation and consolidation of high-quality public spaces, the promotion of energy efficiency, etc. On the other hand, it suggested that Member States pay special attention to the most disadvantaged neighborhoods in the overall global context of cities. Overall, the *Leipzig Charter* was fundamental because of two reasons: first, the concept of integrated urban development, with a strong green conception, was formulated as a prerequisite for the successful achievement of sustainable cities. Second, because it pushed to focus more on poor neighborhoods, aligning with policies and methodology introduced by the Community program *URBAN* (De Santiago Rodríguez, 2017, pp. 33). The *Territorial Agenda for the EU*, on the other hand, tried to deepen the concept of territorial cohesion by achieving greater coherence between community and national policies with a territorial impact, and promoting territorial cooperation in Europe.

[13] The Treaty of Lisbon was signed in 2007 but came into force in 2009. It provided for a strengthening of the legislative and budgetary powers of the European Parliament; the redefinition and extension of qualified majority voting in the Council; the formal recognition of the European Council as an institution and the creation of the post of President of the Council; the creation of the post of High Representative of the Union for Foreign Affairs and Security Policy; a strengthening of the role of national parliaments; and the new Citizens' Initiative.

[14] Cohesion Policy is the EU's main investment policy which targets all regions and cities in the European Union to support job creation, business competitiveness, economic growth, sustainable development, improvements to citizens' quality of life. It is delivered through several Structural Funds, like European Social Fund Plus (ESF+), Just Transition Fund (JTF)… The Cohesion Policy framework is established for a period of 7 years.

One year later, during the Informal Meeting of Ministers responsible for Urban Development in Marseille, the Declaration of Marseille was approved. Here, not only the goals of the Leipzig Charter were confirmed, but also the European Reference Framework for Sustainable Cities (RFSC) was developed. For the first time, a reference framework on sustainable and integrated urban development with a common system of indicators for all European cities was designed: the instrument was made up of a checklist to examine urban strategies and projects from a sustainable urban perspective, a system of indicators, and a series of tools to visualize the results (De Santiago Rodríguez, 2017, pp. 34).

2.1.4 From the Toledo Declaration to the creation of the Urban Agenda for the EU

In 2010, during the Spanish Presidency of the European Council, the Declaration of Toledo was ratified. The Ministers committed to encourage and promote several actions, such as strengthening the urban dimension in the Cohesion Policy or to continuing promoting research, dissemination of knowledge on urban topics and their coordination. However, the third part of the Declaration was of particular importance, since it presented a more strategic trait. In fact, it emphasizes the need to consolidate a European Urban Agenda (De Santiago Rodríguez, 2017, pp. 37), a goal that was gradually becoming more and more felt among Member States, aware of the fact that its development should be based not only on the activities of Member States themselves, but also incorporated in the work of the Commission and should include all the initiatives carried out by other European institutions. This finally happened in 2014, when the Commission published a communication called "*The Urban Dimension of EU Policies – Key Features of an EU Urban Agenda*"[15] which finally opened a process of public consultation on the definition, scope and content of the Urban Agenda (De Santiago Rodríguez, 2017, pp. 41).
During the 2015 Latvian Presidency, the Declaration of Riga was agreed, which marked the definitive step in the construction of the EU Urban Agenda, consolidating the common understanding of the national governments of the Member States, the Commission and other European institutions on the subject. One year later, in 2016 the *Pact of Amsterdam*

[15] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52014DC0490

was finally approved. The Pact defined the "*Urban Agenda for the EU*" as a series of actions of Member States, the Commission, cities and other actors with the aim of strengthening the urban dimension of European policies. The most significant part of the Agenda are the three key pillars of policymaking and implementation:

- **Better Regulation**: an improved regulation at the EU level, through a more efficient and coherent implementation of policies, legislation and normative instruments already existing in the EU;
- **Better Funding**: an improved financing, by identifying and improving the existing sources of funding;
- **Better Knowledge**: the improvement of knowledge bases and exchange of experiences and good practices.

In more detail, the Agenda presents twelve priority themes, namely themes that are critical to urban development, grouped into three overarching goals: economic, environmental and social. Some of these are circular economy, digital transition, housing, urban mobility, jobs and skills in the local economy (European Commission, n.d.-a). The implementation of the Agenda is based on partnerships between city governments, EU Member States, the European Commission (EC) and other stakeholders, that would create action plans to address specific urban issues. Overall, despite the already existence of interesting European initiatives, the Urban Agenda marked the consolidation of a common European urban policy, improving it from an operational perspective. In this regard, the cross-sectoral coordination effort requested from the European Commission itself stands out, as well as the implementation of a new multilevel governance, open to the participation of cities, the main direct beneficiaries of cohesion funds earmarked for urban development (De Santiago Rodríguez, 2017, pp. 44).

2.2 Analysis of key European initiatives and projects, their objectives and their funding mechanisms

The evolution of EU smart city policies mirrors the broader shift in its urban development framework, moving towards integrated, technology-driven solutions for sustainable and inclusive urban growth. By addressing urban challenges through digitalization and citizen-centric approaches, smart city initiatives play a crucial role in shaping the future of Europe's cities.

Regarding the EU's approach to the creation and implementation of smart policies, it can be stated that the Union usually acts through a top-down approach, in which public government bodies play a leading role, seek cooperation with economic and private actors and use large amounts of its own public funds (Ferrero, 2015). The structure is divided into multiple stages, involving actors at EU-wide, national, regional, and local levels. The structure resembles a cascade one (Yao, 2015, pp.2387):

- **strategy level**: supported by a broad framework than inspires action (ex. *Europe 2020*)
- **research level**: made up of research institutions and departments that can also provide financial support (ex. *Horizon 2020*)
- **platform level**: where research results and practical applications converge to provide cooperation opportunities for stakeholders such as city governments, research departments, enterprises (ex. *European Innovation Partnership on Smart Cities and Communities EIP-SCC*)
- **project level**: the actual implementation of the smart city project (ex. STEP-UP)

The European Commission offers a clear definition of what a Smart City is, namely *"(...) 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*" (European Commission, n.d.-b). In addition, it clarifies that "*a smart city goes beyond the use of digital technologies for better resource use and less emissions*". In fact, as pointed out in the previous chapter, smart cities' definitions intersect different areas, and so continues to explain the EC, which states that "*it means smarter urban transport networks, upgraded water supply and waste disposal facilities and more efficient ways to light and heat buildings, (...) a more interactive and responsive city administration, safer public spaces*

and meeting the needs of an ageing population (European Commission, n.d.-b). However, the European Union's definition of a smart city did not emerge immediately but developed gradually, shaped by practical projects, emerging challenges, and technological advancements. Initially, the term itself was not explicitly defined, but related projects and initiatives laid the groundwork for its formal recognition and definition.

The official launch of European policies regarding smart cities, albeit not explicitly, dates back to the early 2000s when the EU focused on urban sustainability, energy efficiency, and digital innovation without clearly framing these efforts as "smart cities" initiatives. Plans like the *Strategic Energy Technology Plan (SET-Plan)* and programs under the *Covenant of Mayors* (2008) aimed to address urban challenges, preparing the basis for what would later be identified as smart city components. Regarding the European Strategic Energy and Technology Plan (SET Plan), the initiative was launched in 2007 by the European Commission and aimed at supporting the EU in reaching its 2030[16] and 2050[17] climate neutrality goals, in addition to boosting Europe's position as leader in the areas of clean energy and energy efficiency technologies on a global scale. Moreover, this policy tool emerged as the primary framework for creating synergies between national and European Research & Innovation (R&I) funding and priorities in Europe, facilitating collaboration between EU nations, businesses, and research institutions by coordinating national R&I activities in developing low-carbon energy among EU countries, and aligning national R&I programs with its own agenda (EERA, 2024). On the other hand, the Covenant of Mayors was a first-of-its-kind bottom-up approach launched the following year that focused on energy and climate action. The program still brings together a multitude of cities all over the EU and is aimed at endorsing and supporting local authorities' efforts in the implementation of sustainable energy policies, including the reduction of CO2 emissions, energy efficiency and the use of renewable energy. Currently, two thirds of the EU population is covered by this initiative.

[16] The EU adopted a set of Commission proposals to make the EU's climate, energy, transport and taxation policies fit for reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels.

[17] The EU aims to be climate-neutral by 2050, an economy with net-zero greenhouse gas emissions.

2.2.1 Europe 2020

Significant progress appeared in 2010, when the European Commission launched *Europe 2020* which replaced the Lisbon Strategy (2000-2010)[18]. This strategy had the goal to guide the EU's economic, social and environmental policies for the decade leading up to 2020, but also acted as leading framework under which initiatives and projects for smart cities would be created and carried out. From the preface of the plan written by former EC president José Manuel Barroso, what mostly stands out is how at that point the EU had reached a crucial point for its future, especially due to the consequences of the 2008 financial crisis. The possibility of renewing itself was therefore to be seized, and Europe 2020 was the tool through which "*smart, sustainable and inclusive growth*" would be developed. As just stated, the strategy put forward three mutually reinforcing priorities (Barroso, 2010, pp. 3):

- **Smart growth**, by developing an economy based on knowledge and innovation.
- **Sustainable growth**, by promoting a more resource efficient, greener and more competitive economy.
- **Inclusive growth**, by fostering a high-employment economy delivering social and territorial cohesion.

To achieve the intended objectives, the EU set up a set of financial instruments and grants like the *European Structural and Investments Funds (ESIF),* used for the Cohesion Policy which are composed of:

- The *European Regional Development Fund (ERDF)* that supports the regional and local development through co-financing of investments in areas such as research, development and innovation, ICT, energy, transport infrastructure and sustainable urban development;
- The *European Social Fund (ESF)*, aimed at promoting the employment, education and training, social inclusion, as well as improving the efficiency of public administration;

[18] The Lisbon Strategy's aim was to make the EU "the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion", by 2010.

- The *Cohesion Fund (CF)* that supports projects in the energy sector, relating to energy efficiency and the use of renewable energy;
- The *Agricultural Fund for Rural Development (EAFRD)* and the *European Maritime and Fisheries Fund (EMFF)* respectively for the development of the agriculture and fisheries sector.

Horizon 2020[19] was another major financing tool, the EU's primary and biggest Research and Innovation funding program during the 2014-2020 period with a budget of €80 billion. It also acted as a general framework of action, being its main pillars Excellent Science, Industrial Leadership, Societal Challenges. The projects aimed to be financed were related to industrial innovation, scientific research and societal challenges (Kugleta, 2017). Another funding instrument was *Connecting Europe Facility (CEF)*[20]*,* aimed at supporting the development of high performing, sustainable and efficiently interconnected trans-European networks in the fields of transport, energy and digital services.

To reinforce Europe 2020's priorities, the EU advanced five headline targets in the areas of employment, research and innovation, climate change and energy, education, and combating poverty. For example, 75% of the population aged 20-64 should be employed, 3% of the EU's GDP (Gross Domestic Product) should be invested in R&D, and the "20/20/20" climate and energy targets[21] should be met. These targets were representative of the three goals of Europe 2020 but also interrelated, thus to achieve the three priorities the Commission put forward seven flagship initiatives to unleash progress under each priority theme. Among these there is "*Innovation Union*", which aimed to improve framework conditions and access to finance for research and innovation, with the goal of ensuring innovative ideas into products and services that create growth and jobs. Then "*Resource efficient Europe*" to encourage the transition to a low-carbon economy, boost the use of renewable energy sources, modernize our transportation system, and advance energy efficiency to help split economic growth from resource consumption (Barroso, 2010, pp.3-4). Another significant one was "*A digital agenda for Europe*" to accelerate

[19] https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-2020_en

[20] https://cinea.ec.europa.eu/programmes/connecting-europe-facility/about-connecting-europe-facility_en

[21] The EU's 2020 climate and energy targets are the following: reducing greenhouse gas emissions by 20% compared to 1990 levels, increase the share of renewable energy use to 20%, and improve energy efficiency by 20%.

the roll-out of high-speed internet. In more detail, the Digital Agenda encouraged investments in the development of infrastructure networks, and focused on developing digital contents and services to improve the quality of life of citizens and businesses through easy access to online learning (e-learning), teaching (e-education), administration (e-government) and health (e-health). Regarding the specific funding tools of the initiative, the ERDF primarily supported the development of next generation access networks, e-Government and ICT applications. ESF provided financial support to enhance the use of ICT and to contribute to the development of digital literacy. Last, EAFRD's investments were directed to improving the accessibility and use of ICT in rural areas through the extension of broadband infrastructure and the promotion of digital skills among farmers and rural companies (Gargiulo et al., 2013, pp. 361). It can be stated that the Europe 2020 strategy represented the first attempt to sort and organize the set of Community policies related to different sectors of intervention, and it is evident that through this framework and its initiatives like the *Digital Agenda for Europe*, the EU was gradually starting to consider plans to create and improve features that characterize smart cities.

2.2.2 The Innovation Union flagship and the European Innovation Partnership on Smart Cities and Communities (EIP-SCC)

In this sense, great importance is to be attributed to the first one mentioned, the Innovation Union flagship, which created the best conditions for Europe's researchers and entrepreneurs to innovate. This initiative was developed through two stakeholders' advisory platforms, the European Technology Platforms (ETPs) and the European Innovation Partnerships (EIPs). The latter represented a new approach to EU research and innovation that brought together public and private stakeholders "*to accelerate the deployment of major innovations by committing them to undertaking supply and demand size measures (funding, regulation, procurements) across sectors and the entire innovation system (demand-driven)*" (Russo et al., 2014, pp.982). The EIPs are several and tackle specific areas: among them there is also one dedicated to smart cities, namely *Smart Cities and Communities (EIP-SCC).* The launch of this innovation partnership

definitely marked a turning point for EU's policies regarding smart cities, being its aim to bring together cities, industries and citizens to improve urban life through more sustainable integrated solutions. In more detail, the partnership sought to improve services reducing energy and resource consumption, and to catalyze progress in three linked areas (Russo et al., 2014, pp. 982):

- Urban Energy Production and Use;
- Urban Information and Communication Technology (especially 5G, Big Data, ICT Innovation, Internet of Things);
- Urban Transport and Mobility

Funded by Horizon 2020, the partnership tries to overcome bottlenecks restraining the changeover to smart cities, to co-fund demonstration projects and to help coordinate existing smart city initiatives and projects, by pooling its resources together. Ultimately, its aim is to establish strategic partnerships between industry and European cities to develop the urban systems and infrastructures of tomorrow (Maschio, n.d.). The EIP-SCC consists of the High-Level Group (HLG) that comprehends the high level representatives from industry, research and cities, and the Marketplace of the European Innovation Partnership on Smart Cities and Communities (EIP-SCC Marketplace) that is a collaborative, networking and knowledge sharing tool that identifies and spreads relevant information on technology solutions. Overall, the two interconnected governance bodies receive inputs from important stakeholders, thus the Marketplace together with the HLG, contribute to the discussion about Smart Cities in Europe from a bottom-up perspective (Russo et al., 2014, pp. 983). Now the EIP-SCC Marketplace has been merged with another EU project called "Smart Cities Information System (SCIS)" into a single platform called *Smart City Marketplace*. The platform's goal is to engage cities and towns of all sizes to create more sustainable urban environments, while providing all the knowledge required to explore ideas, shape sustainable urban initiatives, and effectively seal a deal for financing them. In addition, calls for free technical assistance, one-on-one consulting services for city-led consortia near the financing stage, financing masterclasses, and tailored assistance/matchmaking for the financing of sustainable urban projects are just a few of the many resources it provides (European Commission, 2024). An interesting example of a project that has benefited from the help of Smart City Marketplace is STEP-UP, a plan that united four European cities (Glasgow, Ghent,

Gothenburg and Riga) but also research organizations and businesses, with the goal of improving the integration of energy and urban planning, to help cities improve their Sustainable Energy Action Plans (SEAPs)[22] as developed under the Covenant of Mayors initiative, and to advance innovative projects regarding transport, energy and ICT sectors. By tackling three themes at once, energy and technology, economics, and organization and stakeholders, STEP-UP adopted an integrated approach to energy planning, project design, and implementation. The project managed to build on the partner cities' prior expertise with integrated energy planning in order to develop a cohesive and user-friendly energy planning model (European Commission, 2012).

2.2.3 Smart cities initiatives under the 2014-2020 programming period

The European Commission's proposals for the 2014-2020 programming period were firmly grounded in the strategic framework of Europe 2020 and aimed to promote integrated urban policies to enhance sustainable urban development, with a view to strengthening the role of cities also in the framework of Cohesion Policy. New attention to urban problems and the importance of cities as strategic assets by the EU can be seen through a new modification of funding. According to Article 7 of the 2014-2020 ERDF regulation[23], Member States were forced to allocate at least 5% of ERDF in cities based on the choices made in Partnership and Operational Programs (Fedeli et al., 2019, pp. 57). The concentration of investment of the ERDF pointed at four thematic priorities, such as Research and Innovation, ICT, Competitiveness of Small & Medium enterprises (SME), and Transition to a low CO2 emissions economy (energy efficiency & renewable energies). In addition, the EU requested the necessity of pre-conditions for an effective EU investment. One of the ex-ante conditionality of the 2014-2020 Cohesion Policy was encompassed in the *Smart Specialization (S3)* concept. European regions and cities, in fact, were required to fill out their Smart Specialization Strategy. To do this, they needed to have a comprehensive understanding of their regional institutional contexts in order to

[22] The Sustainable Energy Action Plan (SEAPs) is a key document that shows how the local government will reach its CO2 reduction target by 2020. This is done by local governments that decide to sign up to the Covenant of Mayors initiative.

[23] https://eur-lex.europa.eu/legal-content/ENG/ALL/?uri=LEGISSUM:2602_3

identify their strongest research, innovation and entrepreneurial assets. From this, they could select a limited number of R&D priorities that enhance a territory's resources and production capabilities with the aim of building comparative advantages and sustainable growth paths in the medium and long term (Morrison., A & Pattinson. M, 2020, pp. 4). In practice, to determine investment priorities an interactive process of public-private cooperation would be put in place. In this process, entrepreneurs with market knowledge, scientific, technological, and engineering expertise would create and disseminate information about new economic activity domains in which the region excels or has the potential to excel in the future, as well as any limitations or constraints that need to be managed. Consequently, the public sector would create ad-hoc policy initiatives. Overall, both regional and national S3 represented the strategic framework to design and implement research, technological development and innovation policy interventions (Agenzia per la Coesione Territoriale, n.d.). Clearly, this approach encouraged tailored investment in smart city technologies relevant to local needs. Partnerships to share common knowledge and innovation among regions of the EU were therefore created: for example, one of them was *Wireless ICT*. This partnership between eleven regions of the EU was established in 2020 and its goal was to assist in creating and putting into practice a shared plan that would allow investments in the field of fast and resource-efficient wireless ICT. The focus of the work was on areas like health, smart manufacturing, autonomous vehicles, and smart cities (European Commission, n.d.-d). Two related projects supported by the partnership Wireless ICT are being carried out right now. One of them is AMBITIOUS[24], a project aimed at advancing the state of the art in AI, 5G and IoT. The partners involved are 7 SMEs, 2 large companies, 1 region, 1 municipality, 3 universities and 4 innovation centers. The expected impact is to create growth and innovation in small and medium-sized high-tech companies through technology development and by facilitating knowledge transfer and fostering collaboration (AMBITIOUS, n.d.).

Another urban initiative developed during the 2014-2020 programming period was *Urban Innovative Actions (UIAs)*, an initiative financed by the ERDF that offered resources to test new and unproven solutions to address urban challenges throughout Europe. In total, the EU had a budget of €372 million for the 2014-2020 programming period. The

[24] https://ambitious-project.eu/about

underlying objective of the program was based on "disruptive innovation": authorities participating to the call should demonstrate that their idea is experimental, highlighting changes that will happen in the local situation, basically something that has never been "tested" (Fedeli et al., 2019, pp. 72). Nevertheless, one main goal was producing knowledge that could still be mainstreamed since all the actions carried out would be proposed as a sort of scientific experiment to understand how potential solutions worked if put in practice, but especially to recognize which implementation obstacles may occur. In this sense, local authorities played an important role in managing the involvement of significant stakeholders (local organization, the private sector, research institutions), highlighting the importance of innovation of governance. In the calls launched over the years, twelve topics were involved, such as Jobs and skills in the local economy, Digital Transition, Housing, Adapting to climate change, and Urban mobility. Overall, the initiative strengthened the general EU policy response to the challenges facing urban areas. Regarding the EU added value, what stands out was the opportunity for urban authorities to test new ideas and to lead local modernization processes in collaboration with other actors, enabling the setting-up of local innovation alliances (Rampton, 2020, pp.118).

URBACT III was another EU program developed during the 2014-2020 period. Launched as a part of URBAN II during the 2000-2006 programming period, the project was financed by the ERDF, national and local contributions. It is still present nowadays and is based on creating territorial cooperation plans between six to twelve cities, with the goal of developing transnational exchange through thematic networks. The aim of these plans is to exchange knowledge and good practices on fundamental issues for urban policy at the European level, but also to involve the most relevant stakeholders in the local authorities, in the civil society, in the private sector and in associations (Fedeli et al., 2019, pp. 71). An example of a project developed under URBACT is CARD4ALL[25], which focused on the implementation of innovative services and technologies through a Citizen Card System. By using this card, cities could gather information to improve their services and use it for participative processes. The areas under improvement were urban mobility, local trade and sustainable living, "*thus creating a Smart City with Smart*

[25] https://urbact.eu/networks/card4all

Citizens" (Sousa, 2018). The EU cities involved were Gijon (the leading city), Suceava, Jurmala, Sassari and Clermont-Ferrand.

Finally, *SynchroniCity* was another initiative funded by Horizon 2020 and represented the first attempt to deliver a Single Digital City Market for Europe by piloting its foundations at scale in 11 reference zones. It brings together 34 partners from 11 European countries and 4 continents and tries to foster collaboration across cities and technology providers, enabling the development and deployment of interoperable IoT solutions for smart cities. Here device manufacturers, system integrators and solution providers have the chance to innovate and openly compete (Horizon 2020, 2017). SynchroniCity was also established to give cities and companies a global platform to work together on pilot projects that use AI and IoT to enhance public welfare and spur economic development (synchronicity-iot.eu, 2023). The initiative has involved pilot projects in several cities and Milan was one of them: starting in March 2019, the city experimented with four solutions that addressed sustainable mobility, social inclusion, and energy saving. Regarding the first challenge, a system of crowdmapping was tested, with the aim of providing information on the accessibility routes and public transport stops for people with motor disabilities. In addition, a bicycle route locator was tested on BikeMi[26] bikes in order to understand cyclists' desire lines and improve infrastructure. Concerning energy saving, the new technology involved was a sensor capable of detecting the consumption of each person's electrical appliance in an entire building, applied to the municipal accounting office building in Piazza della Scala. Lastly, regarding social inclusion, a chatbot was implemented to direct citizens via their smartphone to the Municipality's online services. For example, the virtual assistant could help requesting an appointment for the identity card, or paying fines, or booking a seat to avoid queuing at the Registry Office counters (Comune di Milano, 2019).

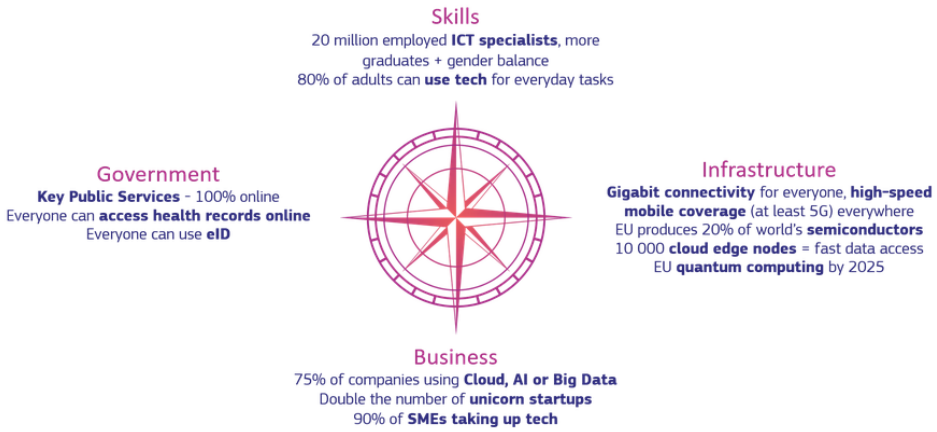
[26] BikeMi is Milan's Bike Sharing service. It is a real public bicycle transport system to be used for short trips supplemented by ATM (Azienda Trasporti Milanesi) traditional transport vehicles. https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://www.atm.it/en/AltriServizi/Bici/Pages/BikeMi.aspx&ved=2ahUKEwjbx-f8rNCKAxXR_7sIHR2NCtgQFnoECBsQAw&usg=AOvVaw1l6MoKa71gtifO1ld42TvA

2.2.4 Smart Cities Initiatives under the 2021-2027 programming period

The overarching strategies guiding smart city policies in the current programming period at the EU-level are the European Green Deal and the Digital Decade. The European Green Deal was the first and most important priority for the Von der Leyen Commission, published on the President's first day of office, and is the EU's new growth strategy. Its main goal is to set the EU on the path to a green transition with the ultimate goal of eliminating emissions of greenhouse gases by 2050 (European Commission, 2021). The key components of the strategy revolve around climate, energy, innovation, industry and mobility, thus the influence for the development of smart cities is evident since this strategy leverages digital technology to enhance urban sustainability and efficiency. The Digital Decade, on the other hand, complements the Green Deal by funding projects that integrate AI, IoT, and data management into urban infrastructure. The Digital Decade is a thorough framework that directs all digital-related activities, and its goal is to ensure that all aspects of innovation and technology benefit the people of the EU (European Commission, 2024e). In addition, the framework includes a policy program, targets, objectives and multi-country projects. The main goals can be summarized in four points included in a Digital Compass (Figure 2.1), such as:

- a digitally skilled population and highly skilled digital professionals
- secure and sustainable digital infrastructures
- digital transformation of businesses
- digitalization of public services

Figure 2.1: Digital Compass



Source: European Commission, 2024

To reach these two frameworks' ambitious goals, the EU relies on specific funding mechanisms. For the European Green Deal, the main ones are the European Green Deal Investment Plan (EGDIP), that mobilizes at least € 1 trillion in sustainable investments over the next decade. Then the Just Transition Mechanism (JTM), which provides € 55 billion to support regions and industries most affected by the green transition, ensuring fairness and inclusivity. The third one is NextGenerationEU, also shared by the Digital Decade, since it is a recovery fund aimed at prioritizing digital and green transformation, by allocating significant resources to digital projects. The Digital Europe Program (DIGITAL) also acts as a mechanism to invest in AI and cybersecurity. Another fundamental financing tool, which also operates as a general framework, is Horizon Europe. This instrument is the continuation of Horizon 2020 and intends to boost innovation through research in digital technologies like AI, IoT, and robotics. Overall, both frameworks empower the EU's smart city agenda, providing a clear roadmap and financial resources to drive the transition towards greener, more technological and smarter urban spaces.

Aligned with the EU's broader Green Deal and Digital Decade goals, the current Cohesion Policy 2021-2027 continues to support the development of smart cities. All of its five policy objectives, namely a smarter, greener, more connected, more social, and closer Europe, intend to act to improve cities and make them as smart as possible. In addition, two major events underline how the support to cities is growing: the renewal of the Leipzig Charter and the increased share of the ERDF dedicated to sustainable urban

development (Senecat et al., 2021, pp.17). Regarding the former, the Charter's approval was renewed in 2020 and presented the main characteristics of the European city (figure 2.2).

Figure 2.2: The New Leipzig Charter

Source: Senecat, 2021, pp.17

In more detail, it includes three spatial levels. The neighborhood level reflects the social, economic and environmental issues that can be solved thanks to local participation and innovative projects. In addition, local authorities in charge of local urban development provide strategic guidelines. Then, the functional areas take into consideration the interdependencies between the cities and their surroundings, the region or the metropolis. Concerning the second level, the Charter explains what good governance is: this should be based on participation and multi-level governance, and a place-based approach.

The second event displaying a rising attention to cities is the increase of ERDF share. Article 11 of the ERDF regulation[27] states that at least 8% of the fund must be allocated to sustainable urban development at the national level, increasing the previous 5% of the

[27] https://eur-lex.europa.eu/EN/legal-content/summary/european-regional-development-and-cohesion-funds-2021-2027.html

regulation of the 2014-2020 programming period (Senecat, 2021, pp. 20). In addition, the 2021-2027 programming period confirmed the previous Smart Specialization Strategies (S3). This time, increasing attention has been placed on governance through a new thematic enabling condition on "good governance of national or regional smart specialization strategy". This was made up of seven fulfillment criteria, among which there are the existence of competent regional or national institution body responsible for the management of the smart specialization strategy, and measures for enhancing cooperation with partners outside a Member State in priority areas supported by the smart specialization strategy (European Commission, n.d.). This strengthened the identification and investment in sectors related to smart city technologies, but also reinforced collaboration between local governments and research institutions to develop city-specific innovations.

Concerning initiatives, the EU also confirmed the Urban Innovative Action (UIA) program, now called European Urban Initiative (EUI). Based on the premise of the new Cohesion Policy that wants a European Union *closer* to citizens, and the increased ERDF resources of a minimum of 8% destinated to sustainable urban development, the EUI intends to offer support to cities to overcome the manifold current landscape of initiatives, programs and instruments in support of cities under Cohesion Policy. Concretely, EUI is supported by ERDF budget of € 450 million for this current programming period. The action plans revolve around strengthening capacities of cities in design of sustainable urban development strategies, policies and practices, then funding innovative actions in cities by allowing cities to experiment ground-breaking ideas thanks to its 80% direct co-funding of up to € 5 million and sharing and transfer knowhow on sustainable urban development among EU cities (European Urban Initiative, n.d.). A complementary initiative to the EUI is the New European Bauhaus (NEB). As President Von der Leyen (2021) stated "*If the European Green Deal has a soul, then it is the New European Bauhaus which has led to an explosion of creativity across our Union*". This initiative connects the European Green Deal to living spaces and experiences of the EU territories, and expresses the EU's ambition of creating beautiful, sustainable, and inclusive places, products and ways of living. In general, it tries to combine three principles, namely sustainability, culture and creativity, and the goal is to make circular, lower-carbon products that promote biodiversity preservation and natural regeneration available to all

citizens (European Urban Initiative, n.d.). For this reason, the intersection between EUI and NEB is evident: the former can act as implementation tool for NEB by financing urban projects that align with values such as sustainability, inclusivity and beauty, and supporting cities in realizing their vision by embedding these ideas into their urban planning and sustainable development strategies. Apart from the EUI, NEB is also financed by Horizon Europe for research and innovation, and the ERDF. An interesting ongoing project connected to NEB and EUI is AHA Budapest – Affordable Housing for All[28]: the plan is based on the implementation of an integrated approach that increases supply of affordable housing and providing new solutions to support people at risk of homelessness. Concretely, the aim is to transform a non-residential public building into energy-efficient social housing, while in parallel a data-driven early warning system seeks to identify homes experiencing energy poverty and rental arrears so that innovative support services based on extensive collaboration between district municipalities, social service providers, and public utilities can be evaluated. The project also comprises Transfer Partners, namely urban authorities that observe and learn, whose involvement is fundamental to ensure that the project's innovative solutions can be replicated in other contexts across the EU (European Urban Initiative, 2024). It can be stated that both initiatives, EUI and NEB, play significant roles in advancing smart city projects. As AHA Budapest shows, the initiatives support projects connected to sustainability and energy efficiency, but also promote the deployment of digital tools for smarter living in cities.

On the other hand, initiatives under the framework of the Digital Decade strategy are several and are framed around the Digital Compass. Regarding the first goal of the strategy, namely Digital Skills, the EU created the "*European Skills Agenda*". Mainly funded by the ESF + and Erasmus, this is a five-year plan aimed at helping businesses and individuals develop more and better skills (European Commission, 2024d). The Agenda includes twelve actions and among them there is the Pact of Skills, that offers public-private partnerships with the goal of making concrete commitments to upskilling and reskilling adults. National, regional, and local authorities, companies, social partners, chamber of commerce can all become members of the Pact, and from there they can have access to three dedicated services: the Networking Hub, the Knowledge Hub, the Guidance Hub. These hubs provide platforms where members can find partners, promote

[28] https://www.urban-initiative.eu/ia-cities/budapest/home

activities, organize webinars, but also information on new EU policies, instruments and funding opportunities (European Commission, 2024b). Concerning the fourth goal of the Compass, namely digitalization of public services, one initiative is the *Interoperable Europe Act*, which aims to facilitate cross-border data exchange and accelerate the digital transformation of the public sector, in line with the EU's Digital Decade objective of having 100% of key public services available online by 2030. In more detail, the Act is funded by DIGITAL and contributes to a more effective implementation of cross-border digital public services, such as exchanges of vehicle data for road safety or access to social security and health data (European Commission, 2024a). In fact, a recent study from the Joint Research Centre (JRC) stated that an improved interoperability can reduce the time citizens spend every year with administrative bodies by 25% (Gomez, 2023). The Act is implemented through a set of key measures, and among them there is the "Interoperable Europe Portal", a platform that encourages the sharing of interoperability solutions among public administrations. In this portal, one section is dedicated to smart cities: as stated by the website, "*a smart city or community aims to the well-being of its inhabitants, businesses, visitors, organizations and administrators by offering digitally enabled services that contribute to a better quality of life*" (European Commission, n.d.-c). An example of a smart city project shared on the platform is the Tree Vitality Pilot implemented in Bochum, Germany, which focuses on citywide environmental monitoring. The Smart City Innovation Unit and Environmental Agency of the city used data analytics to monitor and improve tree health: in more detail, the sensors placed on trees measure several parameters (resistivity, temperature), which are later transmitted to an IoT platform. This platform then forwards the data to an open-source monitoring system, which processes the data to determine and predict tree health. Overall, the Tree Vitality Project can be seen as an extraordinary case study that shows how data analytics can be used to address environmental challenges in urban areas by using IoT technology. In addition, it can inspire other municipalities to adopt data-driving and technology approaches in public administration (Gillick, 2024). Moreover, while issuing the proposal for the Interoperable Europe Act, the Commission also adopted the European Interoperability Framework for Smart Cities and Communities (EIF4SCC)[29], whose goal is to offer a framework of all types of interoperability, in order to contribute to the

[29] https://eur-lex.europa.eu/legal-content/FI/TXT/?uri=CELEX:52022SC0710

development of smarter cities and communities. Essentially, the framework includes definitions, principles, practical use cases, a common interoperability model and up to 30 recommendations to enable interoperability across domains, cities and regions. The aim is to improve the delivery of services to citizens, businesses and city administrations not only in a single city, but also across cities and regions across borders (Living-in, 2023).

2.3 The NetZeroCities project

2.3.1 The EU Missions and 100 Climate-Neutral and Smart Cities by 2030

Among the EU initiatives related to the general framework of the European Green Deal, Horizon Europe incorporates research and innovation missions, called *EU Missions*, to increase the effectiveness of funding by aiming at clearly defined targets. Launched in September 2021, these missions have the objective of bringing concrete solutions to some of the greatest challenges we are facing right now, whose results need to be tangible by 2030. The EU Missions are five and cover a wide range of topics, from adaptation to climate change, to health research, to protection of the oceans and waters. Each mission functions as a portfolio of activities, including legislative initiatives, policy changes, and research projects, to accomplish a quantifiable objective that cannot be met by a single action. They also aim to mobilize private and public actors like Member States, regional and local authorities, but also entrepreneurs, investors, farmers or research institutes to give life to long-term impact (European Commission, 2024f).

Among the five missions, one is "*100 Climate-Neutral and Smart Cities by 2030*". A significant goal of the European Green Deal is achieving climate neutrality by 2050, and for this, cities play a pivotal role since they are home to 75% of EU citizens, are responsible for more than 70% of worldwide CO2 emissions and more than 65% of global energy use. As a consequence, urban action is crucial for climate mitigation. Because of this, the EU is at the forefront in helping cities accelerate their green and digital transformation, in order to contribute to the Green Deal's goal of cutting emissions by 55% by 2030. The Cities Mission will involve several actors, from local authorities to

citizens, to businesses and investors and the goals are few but meaningful: first, deliver 100 climate-neutral and smart cities by 2030. Second, ensure that these cities serve as centers for innovation and experimentation, so that by 2050 other European cities may follow the example. In total, the Mission is receiving an annual investment of about € 120 million from Horizon Europe. In April 2022, 100 cities in the EU and 12 cities in nations connected to Horizon Europe were chosen to take part in the mission, while 377 cities from the EU and nine associated countries had submitted an expression of interest. To accelerate their path to climate neutrality, the 112 cities are experimenting with cutting-edge cross-sectoral strategies for internal governance, stakeholder management, and citizen engagement. Because of this, they serve as centers for innovation and experimentation, paving the way for all European cities to adopt similar practices by 2050.

2.3.2 The NetZeroCities platform

To help cities overcome the current structural, institutional and cultural barriers they face to achieve climate neutrality by 2030, the platform of NetZeroCities[30] was developed. Part of the Horizon 2020 Research and Innovation Program, the platform supports the EU's Mission of "*100 Climate-Neutral and Smart Cities by 2030*" launched as part of the Horizon Europe program. The platform is coordinated by EIT (European Institute of Innovation and Technology) Climate-KIC, Europe's leading climate innovation agency and community, whose goal is to support cities, regions, countries and industries in meeting their climate ambitions through systems innovation and place-based transformations. EIT Climate-KIC works with the 112 Mission Cities that participate in the project as testing grounds and have drafted the Climate City Contract, and with a consortium of 33 partners, from 13 countries: 13 associations and networks, 5 companies and consultancies, 8 research organizations, 3 think-tanks, and 4 universities.
The consortium's power resides in the balance of partner typologies and a strong geographical coverage, granting presence and activity all throughout Europe. In addition, NetZeroCities is forging alliances with other key EU projects, initiatives and networks to

[30] https://netzerocities.eu/

enhance knowledge exchange, and drive innovation with the aim of improving the collective impact towards climate neutrality in European cities. Some of them are the Covenant of Mayors and Smart Cities Marketplace.

The objectives of the NetZeroCities platform are four and are the following:

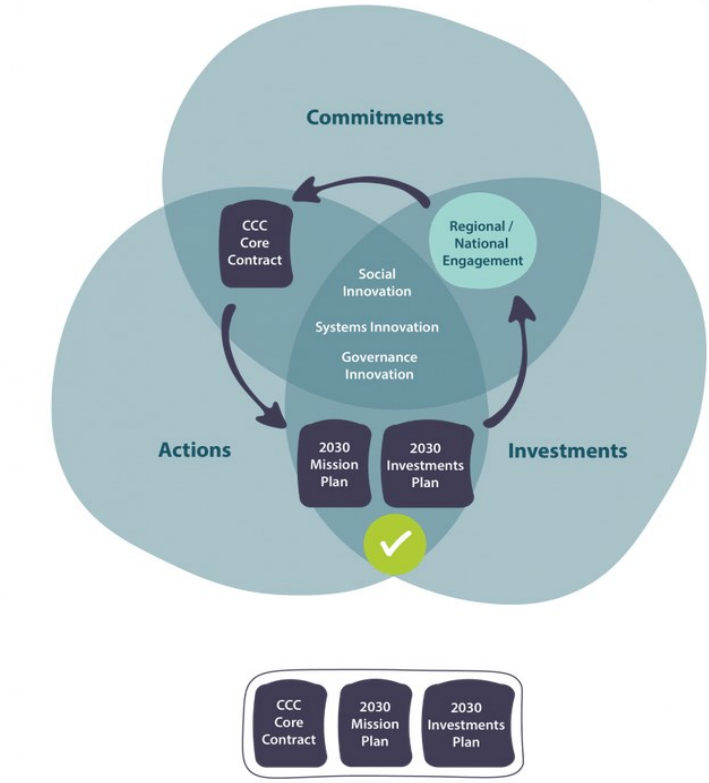
- Develop an approach to support climate-neutral transformation in cities
- Help cities build capabilities and ways of working to advance systemic change using innovation
- Forge a platform for cities to use for all services and expertise critical to climate neutrality
- Facilitate a pipeline of cities accelerating towards climate neutrality

In more detail, the one-stop platform is accessible to all cities through an online portal where new and existing tools, resources and expertise are developed and promoted. The project provides tailored support to cities, by meeting their specific needs and facilitating their journey towards net-zero emissions. It also provides capacity building, by assisting in developing capabilities related to systemic change, citizen engagement, democratic governance, capital and financial structuring, and social innovation. It also supports a series of Pilot Programs, pilot projects with the goal of helping rapid learning about how to achieve climate neutrality at city scale. To conclude, NetZeroCities facilitates peer-learning through its Twinning Learning program[31].

What concretely does the platform do for cities? As mentioned before, cities are required to lay out their Climate City Contract (Figure 2.3) that includes a comprehensive strategy for achieving climate neutrality in all areas, including buildings, transportation, waste management and energy, along with associated investment plans. For this reason, the Climate City Contract is both a process and a dynamic contract, serving as a blueprint to direct cities' investments and actions, to regularly assess their gaps and strengths, and to investigate creative ways to meet climate goals without excluding anyone. The Contract is made up of three interconnected parts: Commitments, Actions, and Investments.

[31] "The Twinning Learning Programme guides Twin Cities in their learning and replication efforts from Pilot Cities, with a practical focus on implementing the systemic transformation methodologies and innovative approaches demonstrated by the Pilot activities, on the journey to climate neutrality". https://netzerocities.eu/twinning-learning-programme/

Figure 2.3: The Climate City Contract (CCC)



Source: NetZeroCities, n.d.

The central component of the Contract refers to the 2030 Climate Neutrality Commitments, which shows the results of a co-creation process with national, regional, and local stakeholders to develop new methods of collaboration to reach carbon neutrality more quickly. It is where cities specify their 2030 goals, a plan to reach them, and the pledges made by contract participants. The second part is the 2030 Climate Neutrality Action Plan, that determines the strengths and gaps of current strategies, plans and policies, and uses all available tools to develop a well-coordinated portfolio of actions in order to meet the 2030 ambition. This part of the Climate City Contract serves as a tool to operationalize the cities' climate neutrality goal. Finally, the 2030 Climate Neutrality Investment Plan creates a long-term financial and economic strategy aimed at achieving climate neutrality by 2030. In addition to addressing how to draw in private investment to support cities' transition to climate neutrality, it systematically mobilizes and arranges governmental resources (Prieto, 2024b). A process of cooperation is put in place between local stakeholders and citizens to create these Contracts, and here precisely comes in help

the platform of NetZeroCities: the platform assists cities to put the model into action since it enables connection links with other public and private development and reporting services and initiatives, and it also guides cities through the process of drafting their Commitments, Action Plans, and Investment Plans. One of the resources available on the portal is the Climate Transition Map (Figure 2.4).

Figure 2.4: The Climate Transition Map

Source: NetZeroCities, n.d.

This map is an interactive tool that enables users to explore various stages of the climate neutrality journey in greater depth and access resources to take action at each phase. The timeline and starting point of this journey vary for each Mission city, shaped by their unique constraints, goals, previous initiatives, and local dynamics. NetZeroCities and City Advisors support cities in identifying their current position on the journey map and determining the next steps. However, the city's team ultimately takes the lead as the primary navigator of this journey. As showed, the map focuses on developing seven core elements essential for the transition: *a strong mandate* that ensures that all stakeholders are aligned on the necessary actions and investments needed to reach climate neutrality

by 2030, *a good understanding of the system* through challenges, different perspective and past actions, *a coherent portfolio* made of articulate interventions using multiple levers of change, *transformative action* based on new collaborative ways of working, *learning and reflection* that build knowledge and capabilities that are fundamental to create change, a *normalized 'net zero' practice* by embedding these new good practices that speed up inclusive decision making, improved multi-actor collaboration and effective implementation, and finally *a strong local ecosystem* that entails the positive commitment, creativity and passion of all local stakeholders. Other instruments included in the portal concern the financing part. In fact, the platform offers finance guidance tools to help cities find the right funding for projects of different sectors. The process is based on a questionnaire that municipalities are asked to fill out after choosing the specific area of their desired projects, ranging from Built Environment, Green Infrastructure and nature-based solutions, Waste and circular Economy, Transportation, and Energy Systems. Regarding these areas, cities are also called to develop a portfolio of actions that incorporate cross-sectoral impact pathways on these specific sectors, done with the support of a CCC action plan template also offered by the portal, and through collaboration and innovation with stakeholders across various governance levels (Prieto, 2024a). Moreover, the platform intends to improve climate data management, a vital component in advancing smart cities. Currently, city-level climate data management is fragmented and lacks coordination, which limits the potential for seamless integration between support platforms and services. For this reason, the idea is to develop an open API[32] to the NetZeroCities portal. By enabling cities to connect their private and public partners to data from their CCC action plans and other aggregated city-level datasets, the initiative facilitates continuous data sharing and collaboration. This could help cities to leverage a range of digital tools, like scenario modeling or conducting cost-benefit analysis, provided by academia or climate-tech firms from the private and public sectors to support the development of their action plans. In addition, municipalities could establish links between their planning and reporting obligations for the EU Cities Mission and those required by other public agencies, initiatives, and projects.

[32] "API is the acronym for application programming interface — a software intermediary that allows two applications to talk to each other. APIs are an accessible way to extract and share data within and across organizations". https://www.mulesoft.com/api/what-is-an-api

The Portal also serves as the platform where cities submit their CCCs for feedback from NetZeroCities and evaluation by the European Commission, with the support of the JRC and experts from the European Investment Bank (EIB). Once the Contracts are completed by the Municipalities, are submitted and are positively reviewed, the cities receive an EU Mission Label. This action marks a fundamental milestone in the cities' work: it recognizes the successful development of Climate City Contracts, and intends to ease access to EU, national, and regional funding and financing resources, especially private investment. The Mission Label, in addition, opens the door for cities to the Climate City Capital Hub, an international finance resource launched in June of this year that supports cities in three ways (European Commission, 2024c):

- By obtaining financial guidance in collaboration with the EIB's advisory services
- By structuring their financial needs
- By presenting projects to various capital providers, such as public and private sector lenders and investors

In conclusion, the NetZeroCities platform serves as a pivotal tool for accelerating urban climate action, providing cities with the resources, expertise, and collaborative frameworks needed to achieve ambitious climate neutrality goals by 2030. By fostering innovation, facilitating stakeholder engagement, promoting systemic solutions and digital transformation, the platform enables cities to implement transformative strategies that reduce greenhouse gas emissions, address complex urban challenges, and enhance quality of life. Its holistic approach and aligment with broader European initiatives are key features helping the EU's mission to foster sustainable, climate-neutral urban development and digital transformation by 2030.

CHAPTER 3 – LITERATURE REVIEW AND THEORETICAL FRAMEWORK

3.1 Europeanization and Smart Urban Governance

3.1.1 The Europeanization of Urban Governance: Concepts, Dimensions, and Mechanisms

Aldona Wiktorska-Święcka's (2015) work "Europeanization of Urban Governance: Definitions, Dimensions and Perspectives" provides a significant contribution to the study of how European integration influences governance structures at the urban level. Since the early 1990s, the process of European integration has profoundly influenced local governance across Europe. Cities have emerged as significant actors in the European political landscape, and this transformation is largely due to the increasing economic interdependence, globalization, and international competition that have shaped urban policies over the past decades (Wiktorska-Święcka, 2015, p. 38). Today, cities are central to Europe's economic, political, and cultural landscape, with most Europeans living and working in urban areas, leading the EU to recognize municipalities as important political spaces that offer new opportunities. For this reason, the EU provides them with access to financial resources, and participation in various EU programs that lead to urban transformation and modernization. In this sense, Marshall (2005) states that the implementation of EU programs and initiatives at the local level can influence the preferences, practices, and policies of local entities and conversely, the actions of European cities also play a role in shaping the evolution of EU programs, policies, and initiatives.

Thus, the concept of "Europeanization" can be introduced. According to Marshall (2005), the dissemination and harmonization processes that lead to the development of a shared European culture are encompassed within the concept of Europeanization. This phenomenon manifests at both national and regional levels and is influenced by adaptation pressures and institutional mediation operating within different governance

bodies. This approach moves beyond grand theories of European integration, which either suggests that EU institutions (in collaboration with local and regional actors) assume executive control from member states or, on the other hand, that national governments strictly regulate the scope of integration (Wiktorska-Święcka, 2015). Instead, Europeanization research benefits from historical and sociological institutionalist perspectives, considering both "top-down" and "bottom-up" dynamics, as well as the extent and depth of EU influence (Wach, 2011). Moreover, Europeanization fosters local engagement, strengthens urban partnerships, and promotes multi-level territorial interactions, therefore the Europeanization framework offers a valuable perspective for assessing cities' roles within the EU political system and their influence on European integration (Wiktorska-Święcka, 2015, pp. 39). To assess the relevance of Europeanization as a concept in urban governance research, Radaelli (2006, pp.58) offers a clear explanation by stating that "*Europeanization provides a theoretical lens on the effects of integration [into the European Union] on domestic political structures*".

Despite the growing influence of EU decisions on local politics, the Europeanization of cities has only recently become a subject of analysis. Few studies have examined Europeanization processes at the urban level, including the implementation of EU legislation by local authorities, the allocation of Structural Funds, and horizontal collaboration through local governance networks (Heinelt & Niederhafner, 2008). However, while these studies provide valuable insights, their focus on isolated case studies offers only a fragmented understanding of integration processes at the local level (Wiktorska-Święcka, 2015, pp.42). This leads to the question of whether the broad concept of Europeanization can be refined to better capture the urban context, especially as cities transition from traditional government structures to more complex governance frameworks. In this sense, Marshall (2004) was one of the first researchers that theorized the Europeanization of urban governance and stated that this phenomenon results in a four-stage pattern of interaction and adjustment:

- EU Initiative (Structural Fund/Community Initiatives/Urban Pilot Projects)
- Adaptational pressures ("degree of fit" between EU/domestic norms)
- Mediating institutions (local, regional, national institutional context)
- Urban structural change (institutional shifts/governance change)

In a more detailed study, Marshall and Bache (2004) defined Europeanization as "*the redirection or reshaping of politics in the domestic arena in ways that reflect the policies, practices, or preferences of EU-level actors/institutions*" (Bache & Marshall, 2004, pp.3). Beyond this definition, they differentiate between "direct Europeanization", which refers to the intended effects of an EU initiative, and "indirect Europeanization", which captures its unintended consequences. Moreover, they make a further distinction between "voluntary Europeanization" (embraced by key domestic actors) and "coercive Europeanization" (opposed by key domestic actors). Since they make a distinction between direct and indirect impacts, then "voluntary-direct Europeanization" is the adoption of EU decisions in a given area (compliance with EU regional policy regulations) and "voluntary indirect Europeanization" refers to the adoption of EU preferences, practices, or policies in a different policy area (e.g., applying EU regional policy approaches to domestic regional policy). Similarly, "coercive-direct Europeanization" describes the enforced implementation of EU preferences, practices, or policies in a specific area, while "coercive-indirect Europeanization" relates to the spillover effects of coercive-direct Europeanization, where changes in one area unintentionally influence another (Bache & Marshall, 2004, pp.5-6). Building on this, Marshall develops his own interpretation of Europeanization in the context of urban governance and identifies four distinct forms of this process in cities (Marshall, 2005):

- Europeanization of local government ("download", "coercive-indirect" and "voluntary-indirect")
- Europeanization of non-statutory actors involved in processes of urban renewal and governance ("download"; "voluntary-indirect");
- Europeanization of local regeneration partnerships and networks ("download"; "voluntary-indirect");
- Europeanization that engenders dissemination of local practices to the supranational level, and thus to other cities via trans-national networks ("upload and "crossload"; "voluntary-direct").

Building on the study of Bache and Marshall (2004) and Marshall (2005), Wiktorska-Święcka (2015) consequently identifies three key dimensions of Europeanization through

which cities interact with EU policies: top-down, bottom-up, and horizontal Europeanization. The top-down approach can be understood through the Bache and Marshall (2004) definition of Europeanization mentioned before, namely "*the redirection or reshaping of politics in the domestic arena in ways that reflect the policies, practices, or preferences of EU-level actors/institutions*" (Bache & Marshall, 2004, pp. 3). Given that most EU regulations are ultimately enforced at the local level, this approach is especially relevant when analyzing the Europeanization of cities. From this viewpoint, local authorities are seen as components of a hierarchically structured nation-state, responsible for implementing EU legislation but lacking direct access to EU decision-making. As a result, they are often regarded as passive recipients rather than active participants in the Europeanization process (Heinelt & Niederhafner, 2008). This approach also emphasizes that the political structures of each Member State act as filters, shaping Europeanization in different ways and producing diverse national responses to EU policies (Börzel, 2003; Börzel, 2005). For this reason, Marshall (2005) refers to "Download Europeanization", referring to changes in local systems, including policies, practices and preferences, arising from the implementation of EU programs and initiatives. Initially driven by "coercive indirect" pressures to encourage more integrated governance, this top-down Europeanization has largely evolved into a "voluntary indirect" process, with urban actors and institutions proactively adapting their strategies to benefit from EU funding and expand their political influence (Marshall, 2003, 2008).
However, while Europeanization does impose constraints on cities, it also presents them with new opportunities. When cities actively develop their own initiatives and seek to influence EU decisions directly, they shift from policy-takers to policy-makers, becoming key players in the European integration process. Over time, cities have evolved from being passive recipients of EU policies to active participants in the EU multi-level governance system. Many have established offices in Brussels, formed transnational city networks, and sought direct access to EU institutions. By fostering a direct link between EU activities and local governance, the European Commission aims to enhance the legitimacy of EU decisions and address concerns about the democratic deficit. The engagement of cities in European initiatives and the extension of EU legislation to subnational entities create new expectations and interests among local actors regarding their role at the European level (Wiktorska-Święcka, 2015, pp. 46). For this reason, a

purely top-down perspective does not fully capture the complexities of the multi-level governance system in the EU. The growing involvement of cities at the European level opens new transnational spaces for local actors, demonstrating that Europeanization is not just a challenge but an opportunity. Marshall (2005) refers to this bottom-up dimension as “Upload Europeanisation”, where cities transfer innovative urban practices to the European level, leading to their incorporation into EU programs or frameworks. This concept also includes horizontal policy transfer, known as “cross-loading”, which facilitates the exchange of best practices between cities without direct EU intervention (Marshall, 2003, 2008). From this bottom-up perspective, cities actively participate in European policymaking, whether by influencing their national governments’ positions or directly lobbying EU institutions. Their involvement in transnational networks and organizations enables them to strengthen their presence at the EU level and therefore become proactive players in the European political system, using transnational cooperation to share best practices and shape the EU’s urban policy agenda. Taking into consideration both the top-down and bottom-up perspectives, Quaglia et al. (2007, pp. 406) explain Europeanization as a two-way process where member states influence EU policies and institutions by "uploading" their own policies and practices to the European level. In turn, they then "download" EU policies and institutions, adapting them into their domestic governance frameworks.

Lastly, Wiktorska-Święcka (2015, pp. 48) refers to the third perspective by examining the horizontal transformations in urban policy that arise from EU influences. In fact, Europeanization in urban governance can occur even in the absence of direct involvement from EU institutions. The complex multi-level ties between EU bodies, national governments, regional administrations, and local authorities do not follow a strict hierarchy. Instead, governance structures increasingly incorporate private sector actors and civil society organizations, taking over responsibilities once managed exclusively by national or local governments. These inclusive, participatory, and networked relationships bring together different stakeholders fostering trust and cooperation. In Europe, there are multiple forms of best practice exchange occurring between Member States, regions, and cities. EU programs have played a significant role in initiating and accelerating new horizontal governance models, and as a result local authorities increasingly share decision-making power with non-governmental organizations

(NGOs), social partners, and businesses. Horizontal governance also fosters new networks that integrate actors from political-administrative systems, corporatist organizations, the private sector, and civil society. Within public administration, cross-departmental cooperation, often encouraged by EU programs, has created more integrated policy approaches. Additionally, new participatory mechanisms enable a wider range of citizens to engage in local political decision-making, regardless of their economic, social, or cultural background. In this sense, in recent years the EU has actively promoted experience-sharing, peer learning, and best practice transfer among European cities: facing similar challenges, cities have adopted transnational cooperation strategies, enabling them to exchange knowledge and develop innovative solutions together. This type of Europeanization is particularly influential at the local level, where cities engage in initiatives such as city twinning and transnational city networks (Wiktorska-Święcka 2015, pp. 49).

3.1.2 The Depth of Europeanization in Urban Governance

Wiktorska-Święcka (2015) also explores the varying degrees of Europeanization in urban governance. Concerning this aspect in the context of urban governance, specifically the "depth" of the EU's influence on domestic policies and political structures, Börzel (2005) proposed a classification that tries to illustrate a spectrum that ranges from no change at all to significant transformation. She then considered the following waves of impact that the EU has on cities (Börzel, 2005):

- Inertia: a complete lack of change, where adaptations required to meet European standards are actively resisted, sometimes resulting in non-compliance with EU legislation
- Absorption: cities integrate EU requirements into their institutions and policies while maintaining their existing structures and political practices largely unchanged, resulting in a low degree of transformation.
- Accommodation: cities respond to European influence by adjusting existing processes, policies, and institutions at the periphery while preserving their core structures and the fundamental principles that define them.

- Transformation: Cities undergo a profound transformation by replacing existing policies, processes, and institutions with entirely new and substantially different ones. This leads to a fundamental shift in their core characteristics and underlying collective understandings, resulting in a high degree of urban change that impacts political, economic, and social structures at their core.

This classification highlights the varying degrees to which cities internalize European influence, demonstrating that while some resist change entirely, others gradually adapt or fully transform their governance structures.

3.2 Smart Governance and Collaborative Governance in Smart Cities

In order to properly understand the development of smart city policies, the issue of governance becomes essential as the ways in which a smart city is designed and implemented have a direct impact on the outcomes it produces (Meijer & Bolivar, 2015 in Nesti, 2018, pp. 35). Governance is a broad concept encompassing complex structures and networks in the governing process (Weiss, 2000). The core characteristic of governance is an autonomous collaboration by a self-organized network (Jessop, 1999; Rhodes, 1996). The idea of networks and collaboration is also highlighted by Kooiman (2003), who stated that governance is fundamental in urban planning because relationships and networks among various stakeholders are crucial to solving modern cities' "wicked problems". According to Pierre (1999), governance is about balancing the public and private interests and representing citizens' interests.

When put into the context of smart cities, governance plays a significant role. In this sense, the literature on smart city governance shows two fundamental characteristics (Lim et al., 2022, pp.186): first, a strong emphasis on various stakeholders' participation (Nam & Pardo, 2011; Albino et al., 2015). Second, the use of ICTs (Information and Communication Technology) to enable active participation, collaboration, and transparent decision-making (Viale Pereira et al., 2017; Harrison et al., 2010).

Regarding stakeholders' participation, the presence of a consensus-building process to reach a shared agreement among stakeholders is highly important (Ruhlandt, 2018), and as Nam and Pardo (2011) argued, interaction among stakeholders can foster innovative

and sustainable urban development. The importance of collaboration is therefore emphasized. In the context of government, collaboration is considered the sharing of authority and responsibility for decisions, actions, and policy-making between government and multiple sets of stakeholders (Harrison et al., 2012). Nam and Pardo (2011) also argued that collaboration can be multi-level, and it can be inter-organizational or through the government-citizen relationship. As Chun et al., (2012) have highlighted, a collaborative government can apply collective intelligence to develop innovative solutions to challenges while also promoting shared governance, which ultimately strengthens public trust and confidence in governmental institutions. Therefore, the concept of collaborative governance can be introduced. Some of the first authors who theorized collaborative governance were Ansell and Gash (2008), who provided a comprehensive definition of the concept by stating that collaborative governance refers to "a governing arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process that is formal, consensus-oriented, and deliberative and that aims to make or implement public policy or manage public programs or assets" (Ansell & Gash, 2008, pp. 544). Ansell and Gash (2008) stated that collaboration emphasizes consensus-building and mutual decision-making, an attribute that smart city governance emphasizes too (Lim et al., 2022, pp. 188). Moreover, collaborative governance can be characterized as inter-departmental or inter-institutional (between public organizations), while external collaboration refers to the involvement of governmental and non-governmental bodies, like companies, non-profit organizations, and individual citizens (Viale Pereira et al., 2017). Ansell and Gash (2008) have also created a model of collaborative governance where they highlight the presence of three starting conditions that can either facilitate or discourage collaboration between state and non-state actors. These are a prehistory of interactions among stakeholders that can shape the initial level of trust, and the presence of various incentives and constraints within the relevant institutions and organizations (Bartenberger & Grubmüller, 2014, pp.40). Lastly, as the authors state, "If some stakeholders do not have the capacity, organization, status, or resources to participate, or to participate on an equal footing with other stakeholders, the collaborative governance process will be prone to manipulation by stronger actors" (Ansell & Gash, 2008, pp.551), meaning that asymmetries of power, resources, and knowledge can also influence the possibility of a smooth collaboration.

Institutional design, in fact, constitutes one of the elements that characterize the most general form of governance used to define and organize the collaborative innovation process (Nesti, 2018, pp. 34). This aspect is taken into consideration by Sørensen and Torfing (2016), who refer to this aspect as "metagovernance", namely a process through which collaborative interaction is sought to be encouraged, guided, and managed through self-regulating mechanisms (Sørensen and Torfing in Nesti, 2018, pp. 34). Regarding the collaborative process itself, Ansell and Gash (2008) specifically divide it into five distinctive phases: first, face-to-face dialogue among the parts is needed so trust can be established. Second, trust-building which is then just a result of the first phase. Then, it becomes possible to assess the counterpart's commitment to the process, which is the third step. The fourth phase is the shared understanding of what stakeholders can collectively achieve, be it common goals, mission, and purpose. The last phase concerns "intermediate outcomes". Ansell and Gash (2008) intend that collaboration is more likely to be achieved when "small wins" are reached through collaboration. In the process of designing the institutions of collaboration, stakeholders should also strive to achieve internal inclusiveness (participation of all relevant stakeholders), external exclusiveness (no other similar forums of collaboration in the area), and lay down clear and transparent processes and rules (Ansell & Gash, 2008, pp. 556). Moreover, a significant role is to be attributed to leaders, which can range from being stewards (they manage collaboration and process integrity), mediators (they manage conflicts), or catalysts (they identify and realize opportunities) (Ansell & Gash, 2012). Leadership is also important for Emerson, Nabatchi, and Balogh (2011), as the presence of a leader can support, initiate, and help secure resources and support for a collaborative governance regime. The authors also provide their definition of collaborative governance, as "the processes and structures of public policy decision-making and management that engage people constructively across the boundaries of public agencies, levels of government, and/or the public, private and civic spheres in order to carry out a public purpose that could not otherwise be accomplished" (Emerson et al., 2011, pp. 2). The authors add that their definition, compared to the one provided by Ansell and Gash, "does not limit collaborative governance to only formal, state-initiated arrangements, and to engagement between government and nongovernmental stakeholder" (…), since "our definition encompasses multipartner governance, which can include partnerships among the state, the private

sector, civil society, and the community, as well as joined-up government and hybrid arrangements such as public-private and private-social partnerships and co-management regimes" (Emerson et al., 2011, pp. 3).

While collaborative governance is often associated with more inclusive policy processes, some scholars question whether such collaborations genuinely lead to better outcomes or merely introduce additional complexity. Vangen and Huxham (2013) describe this challenge through the concept of "collaborative inertia", referring to "the tendency for collaborative activities to be frustratingly slow to produce output or uncomfortably conflict ridden" (Vangen & Huxham, 2013, pp.2). Furthermore, concerns related to power dynamics and democratic legitimacy also emerge. As Dvir and Pasher (2004) stressed, governments should provide their citizens with enabling conditions to foster knowledge creation, exchange and innovation, in order for all the citizens to actually generate a smart and learning system.

The idea of generating a better learning environment is also linked to the relationship between open data and the governance of smart cities. Open data is often promoted as a tool to enhance a city's collective intelligence by allowing companies, innovators, NGOs (non-governmental organization), and citizens to derive value from them. However, smartness does not necessarily equate to unrestricted access for all. As Walravens (2012) points out, while governments should advocate for open data systems, they must also carefully determine the conditions under which data is made available and to whom.

The use of Open Data reconnects to the second characteristic of smart city governance, namely the idea of using ICTs by local governments. Regarding the use of ICTs, and stemming from e-government, smart cities contemplate the use of ICT in urban governance to enhance collaboration and networking among the stakeholders, but also to give access to information and encourage citizens to engage in urban planning and public decision-making (Bisschops & Beunen, 2019). As Meijer and Bolivar (2015) have stated, synergies between the social structure and the new technology have been a central study of e-government, and what we are witnessing nowadays is the issue of socio-techno synergies being scaled up to the level of urban system (Meijer & Bolivar, 2015, pp. 394). For some scholars, in fact, the development of ICT has the power to transform urban governance into "smart governance", since ICTs provide city governments with innovative tools to carry out their tasks more efficiently (Hoon Lee et al., 2013).

Moreover, online participatory tools encourage citizens to participate in the decision-making process (Romanelli, 2013).

Meijer and Bolivar (2015, pp. 392) provide a definition of smart city governance, being "smart city governance is about crafting new forms of human collaboration through the use of ICTs to obtain better outcomes and more open governance processes", and that "the smartness of a city refers to its ability to attract human capital and to mobilize this human capital in collaborations between the various (organized and individual) actors through the use of information and communication technologies" (Meijer & Bolivar, 2015, pp. 398).

Moreover, according to Viale Pereira et al., (2017), smart city governance emphasizes collaboration and consensus-building among stakeholders backed up by digital technologies (Viale Pereira et al., 2017).

In this sense, digital tools and open data platforms have the power to enhance transparency, participation, and citizen engagement, while inclusive collaboration ensures that public, private, and civic actors work together through participatory policymaking and decision-making. Together, they give rise to an adaptive governance model that integrates digital innovation with inclusive strategies to address urban challenges and promote the innovative and sustainable development of smart cities.

3.3 Smart Urban European Governance

As individualized by Wiktorska-Święcka (2015), another trend is emerging at the city level in Europe. Various local actors have made significant efforts to integrate the principles of multi-level European governance into urban policies, aiming to address the challenges posed by globalization and Europeanization. In fact, modern urban development is shaped by demographic, social, and economic changes, leading to spatial expansion and transformation. To navigate these shifts effectively, cities must move away from compartmentalized approaches and instead adopt integrated strategies that consider the spatial, economic, and social dimensions of urban development. This holistic approach enables cities to better coordinate their policies, activities, and services, fostering a more cohesive and adaptive urban environment. To effectively implement this integrated approach, cities must embrace a governance model that is both inclusive and

adaptive, ensuring that decision-making is responsive to local needs and interconnected across various governance levels (Wiktorska-Święcka, 2015, pp.49).

In this context, throughout the years the European Union has promoted integrated urban governance through pronouncements, documents, and EU programs, encompassing the complex nature of urban issues and highlighting the need for a holistic approach. As explained in Chapter 2, from the Lille Action Program (2000) to the Toledo Declaration (2010), the EU has increasingly recognized the importance of this concept. For example, the Lille Action Program established a framework for cooperation among Member States, cities, and the European Commission, to address urban challenges by promoting public-private partnerships, enhancing digital innovation, supporting community life in disadvantaged neighborhoods, and facilitating knowledge exchange among cities (Parkinson, 2005, pp.11). The Leipzig Charter on Sustainable European Cities (2007) emphasized the importance of coordinated planning across key urban policy areas such as social cohesion, quality of life, energy efficiency, and public space development. The Territorial Agenda of the EU (2007) expanded on the concept of territorial cohesion and strengthened coordination between national and EU policies while encouraging a more place-based approach to urban and regional development (De Santiago Rodríguez, 2017, p. 33). Lastly, the Toledo Declaration (2010) reinforced the urban dimension of EU Cohesion Policy and promoted research and knowledge dissemination on urban governance (De Santiago Rodríguez, 2017, p. 37). These initiatives highlight the EU's evolving approach to urban governance, shifting away from sectoral, top-down policies toward more collaborative, integrated, and multi-level governance models.

In addition, the *Integrated Urban Governance. The Way Forward* (2011) document outlined key seven principles that reinforce the importance of an integrated approach to smart urban governance (Integrated Urban Governance, 2011, pp.11). Specifically, the principles highlight the need for the adoption of:

- a decision-making process close to the citizens and of the subsidiarity principles in order to respond appropriately to local needs
- a systematic approach to urban issues that takes into consideration what already exists
- an integrated action to solve urban problems in a holistic way, through a cooperation between the municipal units and departments

- a ‘client orientation’ that means to perceive residents as individuals with specific interests and needs, to which government should respond fairly;
- a public participation approach, including all residents in the policy-making process;
- an enabling and empowering environment for all local stakeholders, including those groups which are not able to articulate their needs sufficiently and vulnerable people;
- a management approach to solving collective problems.

By combining the EU’s strategic guidelines developed throughout the years with the governance principles included in the Integrated Urban Governance document, cities are encouraged to move beyond fragmented, sectoral approaches and adopt holistic, participatory, and efficient strategies. This integration ensures that urban policies are not only aligned with European objectives but also tailored to local needs, fostering smarter and more inclusive cities across Europe.

3.4 Research Question and Methodology

The research questions of this thesis are the following: *Has the city of Barcelona become Europeanized in the context of smart European urban governance? If so, how? Which factors can help explain the Europeanization process?* To answer these questions this thesis bases its analysis on the intersection of Europeanization and smart and collaborative governance in the context of Smart Cities. For this reason, based on the previously mentioned literature, I propose the following theoretical framework (Table 3.1) that analyzes Europeanization in relation to the topic of smart urban governance.

Table 3.1: Dimensions of Europeanization of Smart Urban European Governance

Dimensions related to the Europeanization of urban policies
Participation of the city in European projects
Dimensions Related to Smart and collaborative governance
Application of the principles of smart urban governance: 1) decisions made close to the citizens and subsidiarity as a principle within the city 2) systematic approach to urban issues 3) integrated action towards problem-solving 4) citizens orientation 5) public participation approach 6) enabling and empowering environment 7) management approach
Results of the process of Europeanization
- Inertia - Absorption - Accommodation - Transformation

Regarding the first dimension, namely participation in EU projects, a key indicator of Europeanization in smart city governance is the city's engagement in EU funded initiatives and projects. In this sense, participation in European initiatives allows cities to access funding, expertise, and transnational networks that foster innovation and urban governance (Wiktorska-Święcka, 2015, pp. 46). As already mentioned in Chapter 2, some examples include Horizon 2020 and Horizon Europe which support research and innovation, the NetZeroCities project that fosters multi-level governance approaches to climate-neutral cities, or URBACT and UIA that promote financial support for smart city

infrastructures and digital transformation. As a consequence, by participating in these initiatives cities can align their urban policies with EU priorities.

Concerning the second dimension, the *Integrated Urban Governance* (2011, p. 11) document further refines the EU's vision of urban governance already conceptualized in major EU declarations and initiatives (ex. Lille Action Program and the Toledo Declaration) by outlining seven key principles that serve as concrete criteria for evaluating how well a city aligns with Europeanization in smart governance. *Decisions* should follow the principle of subsidiarity, meaning they should be made as close to the citizens as possible to better address local needs. A *systematic approach* ensures that policies build on existing frameworks rather than being applied in isolation. *Integrated action* fosters cooperation between different administrative sectors, preventing fragmentation and maximizing synergies. Governance should also be *citizen-centered*, meaning that policies produced and goals to be achieved should be tailored to citizens' needs. *Public participation* is essential for inclusivity, ensuring that all voices are heard in decision-making. To further promote equity, the principle *of enabling and empowerment* supports marginalized groups by providing resources and opportunities for engagement. Lastly, a *management-oriented* approach encourages efficient, results-driven policy implementation (Wiktorska-Święcka, 2015, pp.50).

Regarding the last dimension, the impact of Europeanization, it varies according to how deeply EU principles and policies reshape local governance structures (Wiktorska-Święcka, 2015, pp. 44). Following Börzel's (2005) classification, the degree of change can be categorized into four possible outcomes, namely inertia, absorption, accommodation, and transformation. As stated before, inertia is connected to how some cities resist EU smart governance principles and fail to adopt European requirements, even at the risk of non-compliance with EU legislation. Absorption relates to how cities formally integrate EU policies into their institutions but without fundamentally changing their governance structures or political behavior, so the degree of Europeanization is low. Accommodation states that cities adjust their policies and institutions to partially align with EU smart governance principles while retaining their core governance structures. Transformation is when cities undergo a deep structural change, replacing existing policies and governance frameworks with fully integrated EU smart governance models,

leading to significant shifts in political, economic, and social structures (Wiktorska-Święcka, 2015, pp. 44).

By evaluating these three dimensions, namely participation in EU smart city projects and initiatives, alignment with EU's governance principles, and depth of governance transformation, this framework allows for a structured analysis of how and to what extent Europeanization influences smart city governance.

For this reason, to understand the phenomenon of Europeanization from the perspective of smart urban governance, the city of Barcelona serves as a case study. Therefore, the research question is the following: *Has the city of Barcelona become Europeanized in the context of smart European urban governance? If so, how? Which factors can help explain the Europeanization process?*

In order to answer the question, a comparative analysis of three administrations of Barcelona that have implemented smart city policies is carried out, with the aim of capturing the variation over time in the Europeanization process and assessing whether and to what extent it has occurred. More specifically, the administrations considered for the analysis are the ones of Xavier Trias (2011-2015), Ada Colau (2015-2023), and Jaume Collboni (2023-present). Due to the different mayors' governments, it becomes easier to observe how governance approaches, priorities, and policies have evolved over time, allowing for a clearer analysis of the variation in the Europeanization process and its impact on smart city governance.

Primary and secondary sources are used. Regarding the former, they include EU documents such as EU web pages detailing projects and EU official strategies, but also municipal sources such as city administration reports and smart city strategies. The secondary sources consist of academic literature, journal articles, and expert analysis on smart city governance and EU urban policies.

CHAPTER 4: BARCELONA'S JOURNEY AS A SMART CITY

4.1 Barcelona's historical development of the territory and urban context

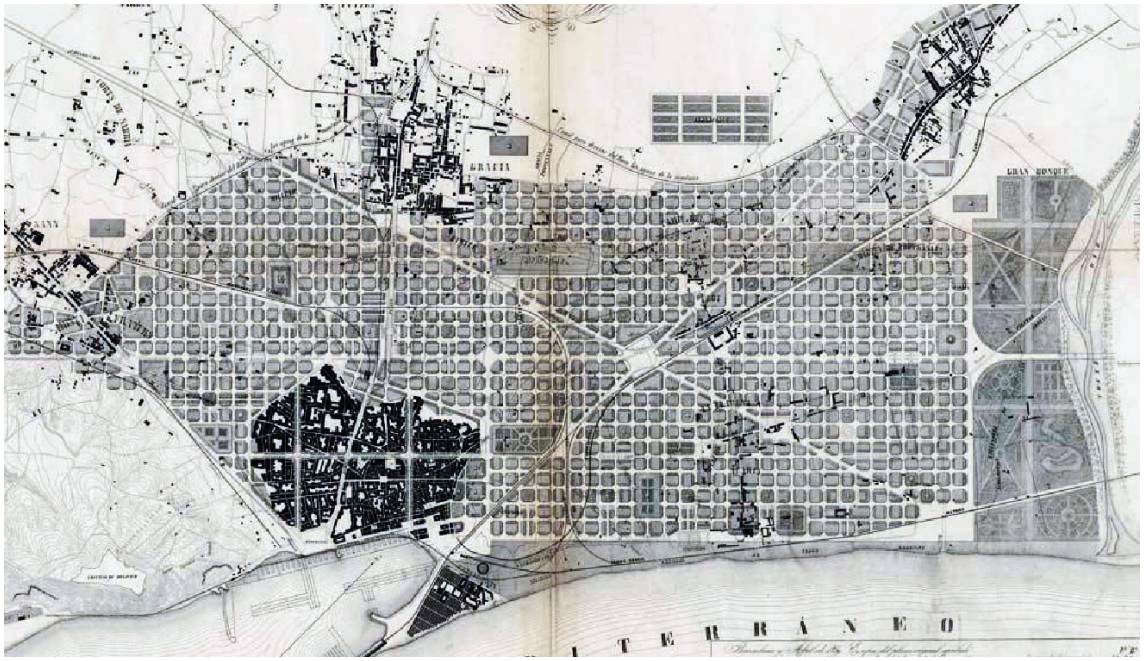
Barcelona, located on the northeastern coast of the Iberian Peninsula, is the capital of Catalonia, one of the seventeen autonomous communities of Spain. The city has a population of 1.686.208 people, second to the capital Madrid, and a surface area of 101,25 km^2. The city is part of the Àrea Metropolitana de Barcelona (AMB), which is made up of 36 neighboring municipalities and has 3.347.881 inhabitants. The AMB is also one of the largest metropolitan areas in Europe, ranking 8^{th} in population (AMB - Àrea Metropolitana de Barcelona, n.d.).

4.1.1. One Hundred Years of Urban Transformation

The city has long demonstrated visionary thinking when it comes to urban development and renewal. From 1750 to 1850, the area inside the walls of Barcelona (now the Ciutat Vella), was subject to severe overcrowding, heavy pollution and in general unhealthy conditions. In 1858 the Barcelona government organized a competition to extend the city, won by the architect Antoni Rovira I Trias. However, the government in Madrid decided to impose Ildefons Cerdà's plan (Hassan et al., 2015, pp.96). Cerdà (1815-1876), a Catalan engineer, had long studied the living conditions inside the city's medieval walls, thus his proposal for urban expansion was strongly based on improving the social well-being of the population. The city expansion was then organized around a regular orthogonal grid: each block was designed as a 113-meter square, with its corners cut at a 45º angle (Figure 4.1). This unique feature enhanced visibility at street intersections, improved traffic flow, and provided space for a small central plaza dedicated to services and supplementary activities. Cerdà also knew that a green city was needed, so he set a maximum building height of 22 meters and provided building footprints to generate green public spaces on all blocks. This open area would guarantee sun, light, and ventilation to all residential units. He also planned to create a large park for the city in the Besòs river

area, which unfortunately never saw the light because of real estate pressures (Urbano, 2016, pp.48). Twenty years later, to create a new and developed city, the Barcelona government established a universal exposition. The exposition was held in Parc de la Ciutadella, and depicted the city as a bourgeoisie and industrial city on an international level. The Exhibition attracted around two million visitors and showed innovations such as electric lighting, a new sewage and water system, and many urban regeneration projects. In 1929 Barcelona hosted a second exhibition, the *Exhibition of Electric Industries and Their Applications*, to highlight the city's further technological progress. Because of this, the urban planning of Montjuïc and its surrounding areas necessitated a comprehensive renovation of public spaces. To enhance accessibility, a funicular was constructed to reach the mountain's summit, while an aerial tramway was introduced to establish a direct connection between Montjuïc and the Port of Barcelona (Hassan et al., 2015, pp.98). Beyond the relative success of the Exhibition itself, it was a significant social triumph, attracting a large influx of visitors and bringing notable advancements to Barcelona, particularly in architecture and urban planning.

Figure 4.1: Cerdà's plan for Barcelona, 1859



Source: Urbano, 2016, pp. 49

4.1.2. The Entry of Spain into the EU and the Olympic Games Effect on the City

The second half of the twentieth century was a turning point for the Catalan capital. The end of Franco's rule in 1975 brought a new era of freedom, enhanced by the entry of the country into the European Union in 1986, which opened opportunities for growth and development. The newly elected socialist leaders started to spread the idea that hosting an international event would mark the city's revival, so in the same year that the country became a new member of the EU, it was also selected to host the 1992 Olympic Games. The city's preparations for the sporting event, largely funded by the EU, national and regional entities, provided the necessary resources to finance the city's urban regeneration projects. The "Barcelona model" focused not only on constructing a few large sports venues, but the Municipality adopted a governance dynamic of seeing the city as a whole: it initiated several urban development strategies, ranging from connecting the city with its metropolitan hinterland, renovating the seafront, improving transportation and communication infrastructures, and distributing new civic facilities across the city. The private sector was strongly involved in the collaboration of the city's transformation, especially in the regeneration of the waterfront areas (Degen & García, 2012, pp.7). Culture was also given a significant role in enhancing local support of the population, reflected in the promotion of a "Cultural Olympics". The Olympic Committee had the role of carrying out a city-wide cultural program aimed at strengthening the Catalan identity and residents' pride by building and renovating the city's museums and cultural infrastructures. This period also saw the introduction of marketing as a significant tool to portray the city's global identity, further institutionalized by the first Strategic Plan[33], aimed at consolidating Barcelona as a European competitive metropolis (Degen & García, 2012, pp.6). To cap off this significant period of urban revival, in 1999 the Royal Institute of British Architects made the unprecedented decision to award its Royal Gold Medal not to an individual architect, but to the city of Barcelona for "*inspired city leadership, pursuing an ambitious yet pragmatic urban strategy and the highest design standards*", which have "*transformed the city's public realm, immensely expanded its amenities and regenerated its economy, providing pride in its inhabitants and delight in its visitors*"

[33] https://pemb.cat/en/publications/1st_economic_and_social_strategic_plan_2000/35/

(The Architects' Journal, 2020). The Olympic Games marked the transformation of Barcelona into a fully modern and global city, it enhanced its fame and converted it into one of the most popular metropolises in the world. It also reinforced strategic planning efforts and established a policy framework that gathered broad local support (Degen & García, 2012, pp.8).

4.2 The Evolution of Barcelona's Smart City Initiatives

4.2.1 A Cultural and Knowledge Economy: the 22@ District

The 1990s saw the economic model of Barcelona shift, as a prominent role was given to the construction, tourism and service sectors. As a result, the city's GDP per year grew by an average of 2.4% per year in the '90s decade, and by 2.8% from 2000 to 2005, almost entirely because of employment growth. Culture and knowledge economy became central to Barcelona's urban policies, with significant private sector investment in cultural flagship projects following the Olympics. The city's Second Strategic Plan[34], introduced in 1994, acknowledged culture for the first time as a key driver for enhancing the city's global standing and was institutionally redefined in its broadest sense to include symbolic production, social dialogue, and citizen participation. Cultural infrastructures also became fundamental to attract conferences, urban tourism and festivals, and a strong importance was relegated to cultural agents such as cultural and civic associations, along with private sponsors for the city's cultural activities managed by the public administrations. In 1996, the Institut de Cultura de Barcelona (ICUB) was created, together with the first cultural strategy for the city. However, it was not until the third Barcelona Strategic Plan[35], approved in 1999, that culture was assigned a specific role in the city's development: positioning Barcelona as a knowledge economy (Degen & García, 2012, pp.7-8). This conversion of the city's economy, based on innovation and knowledge, was also the center of the new Metropolitan area plan approved in March 2003. The plan intended to adapt the city to the new context arising from the renewed European Union, "*in order to*

[34] https://pemb.cat/en/publications/2nd_economic_and_social_strategic_plan_of_barcelona/36/
[35] https://pemb.cat/en/publications/3rd_strategic_economic_and_social_plan_of_barcelona/37/

manage with maximum efficiency the process of economic, social and political change that should permit the metropolitan area of Barcelona to continue advancing its position among the most advanced European regions" (Pla Estratègic Metropolità de Barcelona, 2003, pp. 50). In addition, the plan added that "*in the following years, the Àrea Metropolitana de Barcelona (AMB) will grow on the basis of the renewal of its sectors, along the route of the greatest added value and that of giving impetus to other sectors that will be based on the generation and dissemination of knowledge as a basic raw material*", and that "*human capital will be the most valued resource, and businesses, universities and other research centers will collaborate to make the transition work*" (Pla Estratègic Metropolità de Barcelona, 2003, pp. 50). The strategic lines to follow were based on "*making innovation, creativity and knowledge the basis of competitiveness and progress for the AMB, valuing the potential that exists and facilitating the dissemination and application of new knowledge that is generated and collected*", and "*to act on those elements that intervene in what we call the productivity of the territory (the dynamic elements of the territory itself), in order to guarantee people's progress, within a context of economic, social and environmental sustainability (mobility, housing, quality of life, culture, etc.)"* (Pla Estratègic Metropolità de Barcelona, 2003, pp. 50).

The most visible example of this new ambition can be reflected in the urban regeneration of Poblenou. This neighborhood, located in front of the seaside in the Eastern part of the city, used to be called "the Catalan Manchester" at the beginning of the XX century, due to a strong presence of factories and industrial areas that served the entire region of Catalonia (Battaglia & Tremblay, 2011, pp. 6). Already partially renovated for the Olympic Games, the finalization of the urban regeneration of this area began in 2000 with the creation of a strategic plan aimed at transforming the Eastern part of Barcelona and establishing a new socio-economic identity to the territory. The urban policies intended to give life to a technological district based on the following innovative sectors and clusters: New Information Technology and Communication, Multimedia, Energy, Biotechnology, Medical Technology, and Design. The neighborhood was called 22@Barcelona, involved the transformation of 200 hectares of industrial land (Ajuntament de Barcelona, 2012, pp.2), and 180€ million of investments (Ajuntament de Barcelona, n.d., pp.1). The project was strongly based on the Triple Helix concept since the district is also the location of many universities and research centers (Battaglia &

Tremblay, 2011, pp. 6), and about 1.500 companies linked to the sectors (*22@*, n.d.). The creation process of 22@ was managed by 22@BarcelonActiva, and the lighthouse urban project connected to the neighborhood was the construction of the MediaTIC Building, a *smart building* designed to become the hub of the new neighborhood. The building "*has been built according to the most demanding sustainability and efficiency criteria, and it is a model for Europe's new architecture*" (22@, n.d.). The façade was made using an innovative material, ETFE, an eco-efficient material that "*achieves perfect acclimatization and energy savings above the world average*" (22@, n.d.). Regarding the building, the socialist mayor of the time, Jordi Hereu, declared that: "*the Media-ICT building embodies the effort Barcelona aims to achieve during the decade from 2010 to 2020: an innovative and creative city, as well as a driving force for a sustainable economy. [...] It would become a global benchmark for intelligent and sustainable architecture*" (Hereu, in E.Ruiz-Geli, 2011). The 22@ district was also where the Barcelona Urban Lab was set up in 2008. The lab aimed at conducting tests and pilot programs for products and services that affected urban life, based on the concept of utilizing the city as a living urban laboratory. Since 2008, 80 projects have been proposed across various topics, with a quarter of them being tested on the streets of Barcelona. Some of the pilots included sensors for parking spaces that transfer information about the availability of spaces to drivers' mobile phones and municipal applications, or urban lighting that includes LED technology, telecommunications services, electric vehicle chargers, or information points for citizens (Majó, 2011, pp.4). According to Barcelona's Office for Economic Growth, 90% of the projects piloted in the city have successfully transitioned into business ventures based on their initial trials (Center for Public Impact, 2024).

Nevertheless, the creation of this cutting-edge district did not come without challenges and resistance. In fact, as highlighted by Zarlenga et al. (2013), a lack of social interactions between workers and individuals outside the clusters was perceived, except for those necessary to deliver services to its professionals. Moreover, the generation of this innovative project, implemented through a top-down governance strategy, led to many associations criticizing the limited public involvement in developing the urban district and the strong influence exerted by real estate investments. Overall, the focus of the debate shifted from the reconversion of buildings and activities to a more profound

intellectual discussion about the landscape and industrial heritage of the neighborhood that should have been safeguarded and preserved as part of the historical memory (Battaglia & Tremblay, 2011, pp.9). As Martí-Costa and Pradel (2011) highlighted, the development of 22@ has led to the disappearance of many spaces that once housed artists' studios, effectively dismantling the pre-existing artistic community.
Overall, the importance given to innovation led to the district becoming a testing ground for smart solutions. Not without opposition, the creation of the 22@ district marked the beginning of smart city innovations in the Catalan capital.

4.2.2 The Trias administration

In 2011, the new elections proclaimed a new liberal Mayor in the city, Xavier Trias. The new administration's goal was to enforce the city's smart city brand as a promoter of a new economy of urban services. The idea behind this was to position Barcelona as a key reference point for all cities aiming to redirect their economies and reshape their external image according to this paradigm. In this sense, the Smart City Expo and World Congress (SCEWC), carried out in 2011 in Barcelona, which still carries out today, facilitated the launch and promotion of this policy (Gascó-Hernandez, n.d., pp. 52). During the first two years under Mayor Trias, the Barcelona City Council initiated the planning of new projects while also completing those already underway (ex. Smart City Campus at 22@). However, it was in 2013 that the City Council recognized the need to develop a comprehensive strategy, as well as to declare its desire to become the first truly smart city in Spain. In this light, the City Council established its definition of a smart city, namely "*a self-sufficient city of productive neighborhoods at human speed, inside a hyper-connected zero emissions metropolitan area*" (Gascó-Hernandez, n.d., pp. 53). Key elements of this characterization included technology and physical infrastructures, the economy, social communities, and the natural environment. Barcelona's goal was twofold: to leverage new technologies to drive economic growth, and enhance the quality of life for its citizens. *Barcelona Smart City* (BSC) was then created in collaboration with local and regional stakeholders, businesses, and universities (Gascó-Hernandez, n.d., pp. 54). The strategy included 22 smart local programs implemented by public-private partnerships. Among them figured a master lighting plan composed of 1.155 urban lights

with LED bulbs, smart grid, cooling and heating network and smart-meter electricity distribution, BarcelonaWiFi, sensorization and identification of buses, the acquisition of 500 hybrid taxis and 130 electric bikes, and two FabLab involving 5.400 citizens and 200 institutions (Gascó-Hernandez, n.d., pp. 55).

The strategic framework of BSC aligned with the broader EU strategy, Europe 2020 (Nesti, 2018, pp.53), and was officially formalized through the drafting and approval of two other significant strategic documents: the *Municipal Action Program 2012-2015* and the *Government Measure MES (Mobility, E-Government, Smart Cities).* The former contained a vision, strategic commitments, and objectives proposed at the political level, as well as goals and actions at the executive level to accomplish the political priorities. The latter highlighted the willingness to use technology by establishing the cornerstones of a comprehensive ICT strategy and entrusting the strategy coordination and responsibility of actions to the Municipal Institute of Information Technology (IMI), the point of reference for all activities related to the ICT sector (Bolici & Mora, 2016, pp.7). In addition, the MES stated that Barcelona aimed at creating research centers and developing strategic agreements with private companies such as Cisco, Abertis, GDF Suez, and building up a Smart City Campus inside the 22@ (Nesti, 2018, pp. 53). The two documents show the significant importance given to the development of a comprehensive smart city strategy, strongly supported by the use of ICT. In respect, the Ajuntament de Barcelona (2012) stated that "*ICTs are with no doubts a fundamental factor to consider in order to come out from [the] crisis" and "[they] have become vital to the future of the city and its citizens*" (in Bolici & Mora, 2016, pp.7). The use of technology was, in fact, the flagship initiative of Trias's electoral program. As Julia Lopez explained, former coordinator of the BSC, at the heart of Barcelona's commitment to the Smart City project was the idea that the city should function as a "network of networks." She pointed out that, to develop a strategy for the city, it was essential to first understand how to connect the various "networks" associated with the city, such as transportation, energy, and technology. Once this was done, the program was designed based on those principles (Cisco, 2014, pp.3). In 2014, the European Commission decided to award the European Capital of Innovation to Barcelona, "*for introducing new technologies to stay better connected to citizens*" (Gascó-Hernandez, n.d., pp. 53).

A change in the organizational structure of the government was fundamental to ensure the success of the strategy. In 2011 Vicente Guallart was nominated Chief Architect of the City Council, who aimed to create "*a fusion of urban planning and the environment, based on new principles derived from a networked society, aimed at helping cities determine their own future*" (Guallart, 2015, pp.24). In the same year, Habitat Urbà was created. Habitat Urbà consisted of two organizational elements: the Executive Office for Urban Habitat which combined all the departments related to planning, infrastructure, housing, environment, and the IMI that encompassed the field of ICTs (Bolici & Mora, 2016, pp.7). The direction of the BSC and of Habitat Urbà was assigned to Antoni Vives, deputy mayor. Habitat Urbà also collaborated with the Chief Information Office of the municipality, with IMI and other local actors such as Barcelona Institute of Technology and Barcelona Activa, the city's economic-promotion agency (Nesti, 2018, pp.54). The implementation of the projects was delegated to a Project Management Office (PMO), which supported the activities carried out by the IMI and the several departments of Habitat Urbà. Its direction was entrusted to Doxa Consulting, a Spanish consulting firm. The PMO's responsibilities included ensuring that projects aligned with the smart city strategy objectives, coordinating and monitoring project development activities, managing project tasks, creating quality and improvement plans, producing progress reports on the various projects, evaluating activities and offering recommendations, and addressing any contingencies. The involvement of citizens was also supported by the creation of the OpenData BCN web-portal, where people could use public data for creating new services (Bolici & Mora, 2016, pp.10), and that let citizens have access to data collected by the Council to see the results obtained through the BSC (Cisco, 2014).
Thanks to the approval of the MES, the city administration allocated 1,2 million euros for the development of the city's ICT strategy: some of the money was acquired through the Municipal Action Program, and some by private investments.

4.2.3 The Colau Administration

In 2015, the new elections were won by *Barcelona en Comú (*BeC), a participatory platform born out of social movements, independent of direct political party affiliation. Ada Colau was then proclaimed as the new Mayor. The historical and economic Spanish

context was key to the win of the former PAH[36] spokesperson. At the time, the Spanish country was living with the consequences of the global financial crisis, which highly affected the national real estate market. In 2012, almost 50.000 families were evicted for late payment, almost 16% more compared to the same period the year before, and one household was evicted every 15 minutes. For this reason, in 2009 and through a bottom-up approach, the *Plataforma de Afectados por la Hipoteca* (PAH) was created, which aimed at articulating moral outrage and mobilizing it into effective practical action. This mobilization further developed beyond Barcelona and spread to several Spanish cities like Madrid, Seville and A Coruña (De Hoop et al., 2018, pp.9). The PAH established a power base that allowed it to renegotiate housing contracts and debt repayments for individual members. It achieved this by reframing evictions as a systemic and institutional problem rather than a personal failure, while combining traditional advocacy for housing reforms with practical support and solidarity for affected households. Digital tools were fundamental for the organization and communication of the PAH's activities, and for assisting and coordinating solidarity and cooperative economic plans. Experimental platforms were being developed, often guided by an ethic of openness and collaboration, which aimed to connect local producers with consumers and foster ethical and solidarity-based exchanges. The philosophy behind *Barcelona en Comú* was a rejection of neo-liberal models of globally competitive and marketized cities. In the context of urbanism, new approaches to urban practices focused on creating common goods and services through collaborative and innovative methods (De Hoop et al., 2018, pp.11). All of this was happening alongside Barcelona's international promotion as a smart city. Activists perceived two distinct cities: one, an elite-driven city leveraging the smart city concept as a brand in its neo-liberal competition for capital, transforming itself into an efficient, appealing hub for mass tourism and the global knowledge economy; and the other, a grassroots Barcelona rooted in neighborhood activism, striving to construct from the ground up a more democratic urbanism aimed at tackling the challenges and issues they saw as inherent to the neo-liberal model. A clear example of this ideological clash can be explained when in 2013 the City Council tried to open one of its first FabLab[37] in Ciutat

[36] The Platform of Mortgage Victims (PAH) was a movement that emerged in 2009 in Barcelona and is the biggest grassroot social movements for housing rights in the world at national level.
[37] A Fablab is a small-scale workshop offering digital fabrication. It is a place where people can create, learn and invent, as well as providing stimulus for local entrepreneurship.

Meridiana, a disadvantaged neighborhood of the city. At that time the building chosen to host the FabLab was already being used by a community food bank. This caused a massive outrage among the neighbors, who occupied the building in protest. A resolution was found in relocating the food bank and dedicating the FabLab to training young people for employment (De Hoop et al., 2018, pp.12), but the clash clearly points out how the Municipality was eager to proceed with the ambitious projects of the BSC, even at the cost of overlooking the urgent challenges faced by citizens. It was in this context that new parties like *Barcelona en Comú* emerged among activists as a strategy to enter and reshape urban institutions (De Hoop et al., 2018, pp.11).

When Ada Colau became the new Mayor of Barcelona in 2015, the urban planning focused on smartness of the Trias administration was partially set aside in favor of addressing more pressing issues, such as those related to the real estate sector, mass tourism, and the aspiration for an economy more centered on common goods, fight against climate poverty and corruption. Digital tools for public deliberation were of particular importance in creating a new way for city politics, accentuating the rising importance of democratic "techno-politics". This concept can be understood as "*making tactical, strategic, and critical use of digital technologies for collective political action*" (Smith & Martín, 2020, pp.314), which was key in the development of the new political party of Ada Colau. In fact, digital platforms were created to select candidates, publish financial information, set agendas, and debate issues. For this reason, the smart city vision of the previous administration was reinterpreted through a techno-political perspective, and digital urbanism in the city was redirected toward a policy emphasizing technological sovereignty (De Hoop et al., 2018, pp.13). This was always done through a form of urbanism focused on common goods and a strong involvement of citizens, enhanced by digital tools for public deliberation.

When the new administration took office, Mayor Colau decided to change the governance approach by nominating Francesca Bria as the new Technology and Digital Innovation Commissioner, in charge of a new Digital Innovation Office that had the goal of initiating new strategic innovation projects aligned with the policy priorities of all key departments through the creation of a Mayor's Committee on Digital Innovation. The goal was to create a new vision where the city started to envision and experiment with technology designed to serve people (Morozov & Bria, 2018, pp.27). In addition, a Municipal Data

Office (MDO) was created, with Marius Boada as the new chief data officer, the first such position introduced in Spain (Monge et al., 2022, pp.6). The government plan's vision was strongly influenced by ideas developed under the EU Horizon 2020 project D-CENT (Decentralized Citizens ENgagement Technologies) launched in 2013, which united several citizen-led organizations across Europe, aiming to link them with the next generation of open-source, decentralized, and privacy-focused tools for direct democracy and economic empowerment (Monge et al., 2022, pp.8). In this context, in October 2016 the *Barcelona Digital Plan*[38] was launched with an allocation of 75€ million to be spent annually on digital transformation (Monge et al., 2022, pp.7). The plan was the result of a collaborative production between citizens, tech communities, tech companies, and academic institutions.

Regarding citizen participation, in February of the same year, the platform *Decidim* ("we decide" in Catalan) was launched. It received support from the D-CENT initiative and was developed to support the co-production of the Municipal Action Plan. The platform offered 2000 proposals for citizens to comment on, and at the same time they could also publish their ideas (Monge et al., 2022, pp.9). Barcelona aimed to lead a transition toward technological sovereignty, enabling the government and its citizens to define their own priorities regarding the direction and application of technological innovations, ensuring clear social benefits and public returns. Moreover, the City Council produced a digital transformation roadmap that included clear guidelines and democratic digital standards, including a technological code of conduct, the migration to open-source software, open architectures, and open standards. Concerning this last aspect, this was implemented through the initiative called Data Commons Barcelona and the development of a New Social Pact on Data, to make the most out of data while preserving sovereignty and privacy (Morozov & Bria, 2018, pp.27). In general, Ada Colau's administration shifted from corporate-led projects to community-driven solutions. Her administration prioritized improving the daily lives of citizens, tackling issues such as social justice, sustainability and inclusivity. She focused on public housing: her Right To Housing

38 https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://bcnroc.ajuntament.barcelona.cat/jspui/bitstream/11703/115020/1/LE_MesuradeGovern_EN.pdf&ved=2ahUKEwi2uOuk0PqKAxUE0AIHHaTTOCMQFnoECBgQAQ&usg=AOvVaw3bgfY2taiAQxGaS1bjpLeM

Plan[39] aimed at building 15,000 more social houses by 2025. She also focused on mobility and green urban planning, whose flagship initiative was the famous Superblocks project (Figure 4.2). Superblocks (Superilles in Catalan) are urbanistic plans aimed at reducing traffic in the city by giving back living spaces to the residents. Barcelona has a block-structured plan, so the idea is to combine nine blocks into a larger one, with its perimeter accessible to all vehicles. Inside the area, however, only residents can drive, at a reduced speed, as the space within the perimeter is reclaimed for the community to create a social hub (Bioedil, 2022). By an analysis of the first two superblocks created, the Sant Antoni superblock reduced pollution by 25%, while the Glòries one strongly reduced noise by 9 decibels (European Commission, 2022).

Figure 4.2: The Barcelona Superblock

Source: Barcelona Architecture Walks, n.d.

Colau's administration also worked on a Climate Action Plan[40]. The plan focused on five areas (People First, Starting at Home, Transforming Communal spaces, Climate

39 https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://www.habitatge.barcelona/sites/default/files/en-web_balanc_2018_-_pla_pel_dret_a_lhabitatge_2016-2025-en-gb.pdf&ved=2ahUKEwiCvJKPx_yKAxWC0AIHHfmoKksQFnoECBsQAQ&usg=AOvVaw34Jk0vNWsVY1xzpQGxbl3J

40 https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://www.barcelona.cat/barcelona-pel-clima/sites/default/files/climate_plan_maig.pdf&ved=2ahUKEwiJ6fr-zPyKAxVhygIHHX07EsAQFnoECBwQAQ&usg=AOvVaw2SRsBZq3lxC3B3PHGDcCxr

Economy, Building Together), implemented through 18 lines of action like “planning with a more climate focus”, or “renewables in public spaces” and “responsible consumption”. The use of Decidim was fundamental for the development of the plan, as it enabled consultation and collaboration with citizens regarding the creation of urban policies. Overall, Ada Colau ensured that the smart city framework addressed human-centric challenges, with technology serving the public good instead of corporate profits.

4.2.4 The Collboni administration

The 2023 City Council elections were won by Jaume Collboni of the Catalan Socialist Party. Former First Deputy Mayor for Economy, Labor, Competitiveness and Finance during the Colau’s administration, in his inaugural speech he highlighted the role of cities in the 21st century as arenas for addressing complex global issues like the climate crisis and technological revolution, as well as the importance of fundamental needs such as housing, employment, and security. He also stated that he wishes Barcelona to become a leading city, especially in the fight against climate change, and in the importance of creating a city with a strong economic and social attention to its citizens. In this regard, he insisted on the issue of housing, decent wages, and in the will to make Barcelona the economic capital of Catalonia, Spain and Southern Europe.

Mayor Collboni has not published a specific smart city strategy document, however his administration has created several plans and initiated various projects that align with smart city principles. His views focus on digital transformation and innovation, sustainability, social needs and urban planning, accentuated by a stronger involvement of the European Union.

The *Municipal Action Plan 2023-2027*[41] (PAM) is based on four areas:

- Public space, climate change and decarbonization
- Social progress and welfare
- Economy and digitalization
- Dialogue and equality

[41] https://ajuntament.barcelona.cat/premsa/wp-content/uploads/2024/04/PAM-2023-2027-Presentacio-DEF.pdf

The PAM is then articulated in 622 actions, organized into ten spheres like housing, mobility and infrastructures, economy and work, public space and ecological transition. Regarding the last aspect, the Collboni administration is strongly investing in large-scale infrastructure. The allocation of the 2025 Municipal budget to public space and public transportation is 40% of the total available: among the most crucial projects involved there is the extension of the tram network (Ajuntament de Barcelona, 2025), and of the L2 metro line (Catalan News, 2024). By doing this, urban mobility will be enhanced, and carbon emissions will be expected to be reduced. The second most financed area of the PAM is social housing, with 201€ million invested. In relation to this, the City Council published the *Pla Viure*[42], the strategic framework for housing policy in the city. The main objectives of the plan are an increase in the stock of affordable housing and renovation of homes in terms of accessibility and comfort. Related to mass tourism, the mayor proposed removing all the current tourist apartments in the city by November 2028 so that the flats can be converted into primary homes, by not renovating tourist license apartments (Catalan News, 2024a). It is expected that this move will benefit more than 25.000 citizens (SPI News, 2024). This radical strategy clearly shows how social housing is a heart-felt issue that the administration is trying to solve, making Barcelona a pioneer in the fight against overtourism.

Digital transformation and innovation are also key aspects of Collboni's administration. The involvement of the Mobile World Capital Barcelona (MWC)[43], the world's premier connectivity event, was fundamental for the creation of the Strategic Plan 2023-2024, which is based on *sustainable urban transformation*. The plan aims to improve people's quality of life and consolidate the city as a digital tech capital in Southern Europe. The actions of Mobile World Capital Barcelona are focused on positioning Barcelona as a magnet for digital talent and making it an international leader in digital knowledge, as well as promoting projects with a positive impact on society. Under the MWC's framework, an observatory to generate and disseminate the city's knowledge will be created, specifically focused on matters regarding digitalization in society (Ajuntament de Barcelona, 2023b). In addition, the Mobile World Capital Barcelona is expected to launch the Talent Arena 2025, an event dedicated to empowering tech professionals and

[42] https://www.habitatge.barcelona/en/plaviure

[43] https://mobileworldcapital.com/en/about-us-2/

connecting them with industry leaders and educational institutions. This initiative marks a step further in establishing the city as a favorite destination for developing and attracting talent (Catalonia & Trade Investment, 2024). Partnerships with the private sector are also significant for the current administration. During the 2024 edition of the MWC, the City Council and Cisco signed a collaboration agreement aimed at promoting technological talent. The City Council and the private company will work together through *Barcelona Activa,* the city's economic-promotion agency, and the Cisco Networking Academy (non-profit IT training program). The partnership will empower *Barcelona Activa* to meet the needs of the knowledge-driven economy, positioning Barcelona as a leading international technology hub in Southern Europe (Barcelona Digital City, 2024). Another partnership signed is the one with Huawei, the Chinese technological firm. The agreement reinforces collaboration in various areas of mutual interest, such as the complete connectivity ecosystem (IoT) and the digitalization of buildings through connectivity (smart buildings) (Barcelona Digital City, 2024b). The third partnership signed by the City Council is the one with the Cotec Foundation, a non-profit organization whose main mission is to promote innovation and technological development as significant aspects of social and economic progress. The partnership's goal is to enhance the city's position in initiatives that promote research, technology, and innovation, solidifying Barcelona's status as a science capital (Barcelona Digital City, 2024b). The Barcelona City Council's attention to technology can also be shown through the improvements done to the 5G mobile phone network carried out for the America's Cup of October 2024, and of digital twins[44]. One digital twin project carried out by the Municipality was centered around checking whether the city meets service and facility provision requirements according to the 15-minute cities. The project is the result of a collaboration between Barcelona Supercomputing Center – Centre Nacional de Supercomputació (BSC-CNS) and Barcelona Regional (BR), enabling simulations of various use cases to predict outcomes and assess the potential impact of implementing specific projects or introducing certain public policies (Barcelona Digital City, 2024c). The Collboni's administration also focuses on creating stronger partnerships with other municipalities. For example, it recently signed an action plan with the city of Madrid to collaborate on the digital transformation of municipal services. The plan establishes a four-year cooperation framework to advance initiatives

[44] Digital twins are virtual representations that are used to test an object or a physical process.

utilizing advanced technologies such as artificial intelligence, digital twins, the Internet of Things (IoT), and 5G networks. Regarding digital twins, the two municipalities will develop digital models that replicate the urban environment to enhance the efficiency of planning and management processes. Concerning the IoT system, the two will set up an IoT Lab in Madrid (IoTMADLab) and implement technology in public spaces, urban infrastructure, and major events, in partnership with the Barcelona Innova Lab. Lastly, they will commit to enhancing access to open data and city indicators to promote evidence-based decision-making and greater transparency (Info Barcelona, 2024). Regarding civic participation at the local level, Mayor Collboni started the initiative "El Alcalde Cerca de Ti" ("The Mayor within Reach"), which brings the mayor to different city districts once a month to get closer to people and engage more directly at a local level with Barcelona's inhabitants and social bodies (Ajuntament de Barcelona, 2024). At the supranational level, during the Smart City World Congress of 2023 held in Barcelona, Mayor Collboni signed a declaration addressed to the European Council and Member States of the EU. *The Declaration of European Cities for European Policy-Making and Democracy* first highlighted the need to increase the recognition and participation of local authorities in European decision-making processes, then outlines strategies to strengthen collaboration between cities and the EU, such as enhancing cities' access to EU funds, involving them in EU Presidencies for matters affecting urban areas, and reforming the European Committee of the Regions to promote greater participation by city administrations. The Barcelona Mayor also stated that "*the EU needs to be more in touch with the public through cities, as they are the most accessible and efficient administrative bodies when it comes to channeling policies that have a direct impact*" (Collboni in Ajuntament de Barcelona, 2023a).

Regarding any change of government, mayor Collboni has not implemented a formal restructuring of Barcelona's government specifically to execute a distinct smart city strategy. However, by generating a new manager's office to manage and coordinate municipal services operating in public streets and squares, he strengthened areas such as urban services and the care of public space. In addition, the new structure strengthened the economics and central services of the Council, to enhance the effectiveness and efficiency of internal management while ensuring a successful digital transition, positioning the city as a leader in e-administration (Ajuntament de Barcelona, 2023). The

most significant innovation, however, is the creation of a Commissioner of Mayor's Office for European Affairs, and the future opening of a permanent office in Brussels to closely monitor European opportunities in areas like housing and climate change policies (Sans, 2025)

4.2.5 Main EU Smart City Projects carried out in Barcelona

The European Union has supported Barcelona's transformation into a smart city through numerous projects focusing on several areas, ranging from sustainable urban development to energy efficiency, and to digital innovation.

Aligned with the Digital Agenda for Europe, one of the first initiatives carried out by the Trias administration was the creation of Sentilo. Sponsored by the Barcelona City Council and through the IMI, the project started in November 2011 and was a part of the strategy aimed at positioning Barcelona as a reference in the field of Smart Cities. The core concept behind Sentilo's design was the aspiration to develop a cross-platform infrastructure and data management service, moving away from isolated vertical ICT "silo"[45] solutions. These tech silos could be eliminated only by implementing horizontal and global platforms that are as open as possible, enabling information to flow seamlessly across all domains. Generally, it aimed to facilitate information sharing between diverse systems (Sentilo, 2024). In 2016, the project received the Open Awards as the most innovative platform with free software (Sentilo, 2016).

Under the Horizon 2020 program for research and innovation, another EU project implemented by the Trias administration was the *GrowSmarter* project. *GrowSmarter* started in 2015 and united cities and industry to implement and showcase "12 smart city solutions" across energy, resource efficiency and infrastructure, and transport, offering other cities valuable insights into their practical application and potential for replication. The initiative aimed to establish a ready market for these solutions, fostering growth and advancing the transition toward a smart and sustainable Europe (GrowSmarter, n.d.). Among the three lighthouse cities there was Barcelona, where the solutions were implemented in the 22@ District. One measure adopted was related to sustainable urban

[45] A vertical silo is a system that is unable to communicate or interoperate with others.

mobility, and was centered around installing charging stations that allowed for rapid charging of taxis through green electricity from renewables. The project led to 68 tons of Co2 reduction annually in the city[46].

The Colau's administration was strongly influenced by the D-CENT project, an EU project launched in 2013 aimed to create open, secure and privacy-aware tools for direct democracy. The project born out of D-CENT was the Decidim platform, which built a "*democratic, open, and transparent city by enhancing citizen participation in the definition and development of policies*" (*D-CENT*, n.d.). Still in use nowadays, it is a fundamental platform that ensures citizen participation in the development of policies for the city, enabling deep contact between the residents of the city and the City Council.

Funded by Horizon 2020 with a total of 65€ million, DECODE (DEvelop COmpetences in Digital Era) was another experimental project aimed at providing practical alternatives for managing personal data and online interactions. The project developed a technology that empowers individuals to control their personal data, allowing them to decide how it is shared. This includes an architecture for controlled and, if desired, anonymized data sharing. The project was tested in four pilots between Amsterdam and Barcelona from 2017 to 2019, whose goal was to investigate ways to establish a data-centric digital economy, making data generated by citizens, the Internet of Things (IoT), and sensor networks accessible for broader communal use while ensuring adequate privacy protections. One of the two pilots carried out in the Catalan capital was *Digital Democracy and Data Commons*, which involved the City Council and the city's democracy software Decidim[47]. The platform incorporated a DECODE module that enables petitions to be signed anonymously while still meeting authentication requirements, and by doing so it provided individuals with greater control over their data. The second pilot was Citizen Science Data Governance, where residents used environmental sensors that recorded several factors (ex. Noise levels, pollution) situated in their homes. The DECODE technology allowed individuals to share encrypted data anonymously with their communities, giving them full control over the terms of sharing.

[46] https://grow-smarter.eu/fileadmin/editor-upload/Smart/Factsheet_37__Developing_charging_infra__All.pdf

[47] Decidim is a digital infrastructure for participatory democracy based on open-source software (Ruby on Rails), which facilitates the creation of citizen participation portals. https://docs.decidim.org/en/develop/understand/about.html

In addition, it tackled the technical challenges of collecting and storing a continuous stream of citizen-sensed data, while empowering citizens to control what information is shared, with whom, and under what conditions (DECODE, 2020). During the Colau administration, the European Union supported Barcelona's smart city transformation not only through collaborative projects but also by providing direct funding. In 2021 the City Council received 75€ million for environmental quality and mobility, to tackle the climate emergency. The main budgetary item that accounted for a third of the total budget was the Barcelona Superblock project (Info Barcelona, 2022). In the same year, the EIB supported the City Council by providing 36,2€ million to finance around 500 affordable social rental homes (Eib, 2021). Another project financed under the Horizon 2020 program is Sun4All, aimed at facilitating access to renewable energy generation for vulnerable households that suffer from energy poverty. Among the four pilot cities there is Barcelona, where photovoltaic panels on rooftops of two specific buildings have been installed. The energy produced by the rooftop PV installation on the apartment building is shared among its residents, leading to a reduction in their electricity bills (Sun4All, n.d.).

Regarding urban regeneration and under the Horizon Europe framework, during the Collboni administration the EU project ReGreeneration was launched. The project focused on shaping the future of sustainable and inclusive smart cities. The Barcelona City Council aims to enhance the value of nearby public spaces by expanding green areas and adapting them to the evolving climate. The Trinitat Nova project focuses on improving pedestrian spaces and connectivity within the Nou Barris neighborhood, creating a large green area, encouraging diverse uses and economic activities in the vicinity, revitalizing the social and urban environment, and promoting a new development model centered on sustainability. The goal is to achieve more than 25% of green space coverage (Digiotouch, n.d.). However, the most significant project engaged by the Collboni administration was NetZeroCities. Despite Barcelona joined in 2022 under Colau's leadership, the mayoralty acquired the year later by Collboni makes his administration the central one in the implementation of the project.

4.3 Barcelona in NetZeroCities

4.3.1 Barcelona's Recent Journey Regarding Climate Change Mitigation

In 2015, during the COP21 (Conference of the Parties) of the UN, the City Council presented the *Barcelona Climate Commitment (BCC),* which affirmed the city's commitments under the Covenant of Mayors on Energy and Adaptation and outlined Barcelona's strategic roadmap. Three years later, the *Climate Plan 2018-2030* co-produced by hundreds of city organizations, was approved by the Municipal Council Plenary and received the Covenant of Mayors award for the best initiative from a major city. In 2019, the Climate Emergency Board was established, made up of representatives from over 200 organizations participating in its working groups. The Board led to the *Climate Emergency Declaration* of January 2020, which called for increasing ambition by specifying, accelerating, and strengthening the actions already outlined in the Climate Plan, introducing new measures, and urging other relevant authorities to take action on the climate emergency. Seven key areas for transformation were identified—urban planning, mobility and infrastructure, energy, economy, consumption and waste, food, culture, and education—along with the eighteen action lines from the Climate Plan. Together, these formed the *2030 Climate Emergency Action Plan (CEAP[48]),* published in November 2021 (Ajuntament de Barcelona, n.d.). Additionally, Barcelona has been an active and pioneering participant in numerous climate cooperation initiatives and city networks. One is the C40 network, a global network of around 100 mayors from the world's leading cities united in action to fight the climate crisis (C40, 2024). Under this network framework, the city also joined the "Cities Race to Zero", a commitment to reduce global carbon emissions by 50% by 2030 and purchase only zero-emission buses from 2025 onwards.

Confronted with the climate challenge and other complex urban issues, Barcelona has stood out for its dedication to finding solutions through scientific knowledge,

[48] Barcelona Climate Emergency Action Plan 2030 https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://bcnroc.ajuntament.barcelona.cat/jspui/bitstream/11703/123712/1/Climate_emergency_action_plan_2030_eng.pdf&ved=2ahUKEwjL0LnlnY6LAxUE_7sIHSuGHVIQFnoECB0QAQ&usg=AOvVaw0-XJ1T0ppH1rQFCmGFpWcv

technological and social innovations, and collaboration with its citizens and various stakeholders. Regarding this last aspect, the creation of *Barcelona+ Sostenible* network is of major importance. The network was born out of the city's commitment to sustainability, rooted in the 1992 Earth Summit's call for local Agenda 21 frameworks, and the Citizen Commitment to Sustainability (2002-2022), which outlined specific goals for a decade-long collective effort (Barcelona + Sostenible, n.d.). The network is a collective of organizations and individuals dedicated to sustainability, working together to create a socially and environmentally responsible Barcelona. Involved are citizens' organizations, businesses and trade organizations, as well as schools and universities, professional associations and public administrations. Recently, also individuals have joined it. The network promotes the implementation of sustainability initiatives, the exchange of best practices, and the development of collaborative projects among its members (Barcelona + Sostenible, n.d.).

4.3.2 The Barcelona Climate City Contract

Confronted with the climate crisis and other intricate urban challenges, Barcelona has distinguished itself through its commitment to leveraging scientific knowledge, technological advancements, and social innovations, working collaboratively with its citizens and diverse stakeholders. In this context, Mayor Collboni stated that "*we view the European Mission "100 Smart and Climate-Neutral Cities by 2030" as an innovative public policy instrument that offers Barcelona the opportunity to increase its level of commitment and enhance its climate action, while also serving as a catalyst and example for other cities and regions in the decarbonization effort*" (Collboni in Ajuntament de Barcelona, n.d.).

The city of Barcelona's efforts to reduce emissions are embedded in the Spanish and Catalan desire to achieve climate neutrality. Law 7/2021 on climate change and energy transition includes among its goals for 2030 a reduction of emissions for the Spanish economy by at least 23% compared to the year 1990. Meanwhile, Catalonia's Climate Change Law 17/2017 states that every five years, the Government of Catalonia must present to the Catalan Parliament a proposal for greenhouse gas emission reduction objectives. The current goal for the autonomous community is to reduce emissions by

51% compared to those of 2005. At the local level, the Barcelona Climate Commitment established a target to reduce the city's per capita greenhouse gas (GHG) emissions by 40% by 2030, compared to 2005 levels. In 2021, building on the commitments outlined in the Climate Emergency Declaration, Barcelona pledged in the 2030 Climate Emergency Action Plan (CEAP) to cut greenhouse gas emissions by 50% by 2030 compared to 1992 levels and to achieve climate neutrality by 2050.

In this context, the participation of the city in the European Mission 100 Smart and Climate-Neutral Cities by 2030 pushes for intensification and acceleration of policies regarding energy and climate transitions, in order to achieve neutrality in greenhouse gas emissions of Scope 1 and Scope 2[49]. The Barcelona Climate City Contract states that the intention for the Catalan capital is to achieve an 80% reduction of these emissions compared to what would be expected in a continuity scenario without climate policies in 2030, bringing down emissions from 2,84 million tons of CO2 equivalent to 700.000 tons. Regarding emissions from electricity production, it is anticipated that, in line with the commitments made by the Spanish and Catalan governments, Barcelona will have a predominantly renewable energy mix by 2030. By doing so, emissions generation will strongly decrease. Moreover, residual emissions expected for 2030 will be offset, on one hand, by increasing the city's green infrastructure (Nature Plan 2030). On the other hand, thanks to Municipal policies in the areas of food, and waste prevention and reduction, that will lead to a major decrease in emissions embedded in construction and consumer products.

The Action Plan for the Climate City Contract of Barcelona is based on the Climate Emergency Action Plan 2030 (CEAP), published in 2021, and complemented by contributions from more recent strategies. The strategy to follow is shaped around five sectors, considered crucial for the city's functioning and decarbonization:

- Transportation sector
- Building sector
- Energy sector
- Waste sector
- Green infrastructure and water sectors

[49] Scope 1 refers to emissions occurring physically within a city. Scope 2 refers to emissions generated using electricity, steam, and/or heating/cooling supplied by grids.

Regarding the transportation sector, actions to reduce greenhouse gas emissions revolve around expanding public transportation infrastructure and services, improving reliability, and collaborating with the government of Catalonia to increase interurban bus services, as well as promoting electric vehicles and enlarging low-emission zones. Concerning the building sector, advances in the knowledge of new construction systems and solutions to enhance heat protection of buildings will be spread, together with fostering a change of mindset among all stakeholders regarding design, construction, and renovation of buildings. Actions related to the energy sector focus on encouraging the establishment of energy communities, increasing public infrastructure for energy generation and efficient energy use by accelerating the implementation of renewable generation in municipal buildings and in public spaces. Regarding the waste sector, the promotion of locally sourced products will be enhanced, together with the deployment of individualized collection systems for household and commercial waste. Lastly, concerning green infrastructures and the water sectors, a significant increase in the city's green space will be fostered, as well as an expansion of green infrastructure in buildings by adding plants in roofs, facades, and interior spaces. Co-benefits, namely additional value created other than CO2 reductions, are evident in all sectors ranging from reduced air pollution by the transportation sector, to increased comfort for occupants of renovated buildings, to reduced dependence on imported fossil fuels of the energy sector. In general, the whole transformation of the urban model brings numerous co-benefits. Expanding public spaces for social interaction, play, and relaxation enhances social cohesion and quality of life. Moreover, increasing urban greenery improves biodiversity and air quality while mitigating the urban heat island effect. Overall, these co-benefits contribute to a healthier urban environment, create new economic opportunities, and raise the quality of life. They also play a crucial role in climate change adaptation and ensuring a just energy transition. The implementation of the Action Plan and the entire Climate City Contract (CCC) is guided by 12 key principles, of which four are goal-guiding. The remaining eight are connected to methodological approaches and working methods that will be used to achieve the goals of the Contract. The governance model adopted by the City Council is based on internal cross-cutting management of the Council itself, the adoption of a metropolitan approach together with strong multi-level cooperation with other cities, and strong citizen participation. In this sense, the City Council ensures that there will be a

dedicated team to drive and implement the CCC and an internal coordination mechanism to guarantee the communication of advances and the follow-up of sectorial strategic plans. Achieving this requires the establishment of a unified coordination and monitoring committee, composed of representatives from all municipal departments and entities within the so-called Municipal Group, including the Council and its autonomous bodies. A proximity-focused approach is also fundamental for the proper implementation of the CCC. In this sense, the CCC states that each district will have a dedicated technician and municipal equipment serving as a reference point for sustainability and climate change initiatives. In this sense, local community involvement will be enhanced through neighborhood councils and other mechanisms to define urban, green, and mobility proposals aimed at mitigating climate change effects. Additionally, the creation of citizen networks and neighborhood-level climate action groups will be promoted using the tools provided by other Municipal plans such as the *Neighbourhoods Plan* and the *Nature Plan*.
The Climate City Contract and its implementation are aligned with the Metropolitan Strategic Plan of Barcelona 2030, the first plan developed within the framework of the "city 5 million" concept established by the Metropolitan Region of Barcelona. The Plan is structured around eight missions, one of which is related to the climate emergency. Adopting a metropolitan approach will need the establishment of the necessary external coordination and communication mechanisms among the administrations involved, especially the Metropolitan Area of Barcelona, the Barcelona Provincial Council, and the Government of Catalonia. This will ease the creation of synergies and the achievement of the goals of the CCC.
Regarding democratic planning, the City Council of Barcelona considers transparency and participation as key points. The CCC states that the Council must ensure access to climate information for the entire population about the impacts of climate change, as well as information related to mitigation and adaptation policies. In addition, it will be fundamental to update and report improvements in the reduction of greenhouse gas emissions. All of this will be published on the municipal website, in statistics and open data sections. Concerning participation, the CCC states that "*Barcelona's participatory model is based on the conviction that achieving climate neutrality will require the involvement of all people and all stakeholders, both public and private*". In this sense, two participant mechanisms will be of fundamental importance: the *Citizen Council for*

Sustainability and the digital platform Decidim together with the *Barcelona + Sostenible Network*. The first one is a consultative and participation city sector body acting in domains related to the environment, which also acts as a promoter of new strategies for engagement, co-responsibility and participation of citizens' organizations (Ajuntament de Barcelona, n.d.-a). This Council for Sustainability will have a key role in offering a permanent space for coordination and collective learning. The platform Decidim, on the other hand, will facilitate participatory processes at all levels, providing a flexible space for engagement by associations and individual citizens. Moreover, autonomous citizen action will be fostered, especially by providing financial assistance to climate projects initiated by civil society. In this sense, it is needed to point out that Decidim was already used for the creation of another climate plan, namely the Climate Plan 2018-2030[50] published during the Colau's administration.

Regarding cooperation at the State level, this will be enhanced through *CitiEs* and the Spanish platform of the Mission. Elaborated under the framework of the European Missions and Horizon Europe, CitiEs is a collaborative and innovative multi-stakeholder platform designed to support the transition of Spanish cities towards climate neutrality. So far, the cities involved are 17, among which there is Barcelona. The goal for the CCC is to share best practices and carry out joint projects that will lead to greater and faster progress in the different Mission areas. At the international level, involvement in city networks like Eurocities and the Covenant of Mayors will be consolidated. Participation in European projects like Sun4All will also be fundamental in order to increase applied research on climate change and climate policies.

The Climate City Contract of Barcelona clearly shows a strong model of participative and multi-level governance central to the smart city framework in achieving climate neutrality. The active collaboration among different stakeholders, from the private sector to local communities, to national and regional governments, not only advanced the city's smart city agenda but also established itself as a model for inclusive and coordinated urban transformation towards sustainability.

[50] Climate Plan 2018-2030 https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://www.barcelona.cat/barcelona-pel-clima/sites/default/files/climate_plan_maig.pdf&ved=2ahUKEwjbz42fg4yLAxXYg_0HHQFuH0QQFnoECBQQAQ&usg=AOvVaw2SRsBZq3lxC3B3PHGDcCxr

CHAPTER 5 – THE EUROPEANIZATION OF BARCELONA IN THE CONTEXT OF SMART URBAN EUROPEAN GOVERNANCE

As explored in Chapter 3, the Europeanization of urban governance can be understood as the results of top-down, bottom-up, and horizontal interactions, as well as the result of varying degrees of institutional change, ranging from inertia to full transformation (Börzel, 2005; Wiktorska-Święcka, 2015).

Using the three key dimensions of analysis individuated in the theoretical framework presented in Table 3.1, namely participation in EU smart city projects, alignment with EU smart governance principles, and the depth of governance transformation, this chapter evaluates whether and how Barcelona has internalized EU norms and governance models, answering the following research question: *Has the city of Barcelona become Europeanized in the context of smart European urban governance? If so, how? Which factors can help explain the Europeanization process?*

5.1 The Context and Initial Conditions of the three Administrations of Barcelona

Barcelona's smart city trajectory has been shaped by a combination of historical urban innovation, governance shifts, and evolving political priorities. Each administration, Trias (2011–2015), Colau (2015–2023), and Collboni (2023–present), inherited distinct urban challenges and opportunities that shaped their approach to smart governance and their vision of a Smart City. Table 5.1 comprehensively shows the main differences between the context that influenced the strategies adopted and the political parties of the three administrations.

Table 5.1: Context and Political Orientation of the three Administrations

	Trias Administration	Colau Administration	Collboni Administration
Administration Period	2011-2015	2015-2023	2023-present
Political Party and Orientation	*Convergència i Unió (CiU)* Christian-Democratic and liberal orientation	*Barcelona en Comú* Left-wing orientation	*Partit dels Socialistes de Catalunya (PSC)* Center-left, social-democratic orientation
Context and Initial Conditions	Built on the legacy of the Olympic Games of 1992, 22@ innovation district, Hereu's former partnerships with big tech companies (Cisco).	Born out of social movements resisting the growing influence of corporate-led urban policies and privatization of governance.	Inherited a citizen-centric digital model but tried to institutionalize and align smart city policies with EU governance and goals.

Xavier Trias, representing *Convergència i Unió* (CiU) a party with a Christian-Democratic and liberal orientation, inherited a Barcelona already deeply engaged in urban innovation and economic transformation. The city had long embraced large-scale public-private partnerships, a model that had already pushed the Catalan capital onto the global stage. The 1992 Olympic Games had not only reshaped Barcelona's urban landscape but also enforced its reputation as a city open to bold infrastructural investments and global visibility. Following these steps, the 22@ project in the neighborhood of Poblenou sought to transform former industrial zones into a hub for technology, knowledge industries, and economic growth, attracting international firms and research institutions. Within this context, the Trias administration adopted a business-friendly, technocratic approach, positioning smart city policies as a logical evolution of Barcelona's established economic strengths.

Ada Colau, leader of *Barcelona en Comú*, was guiding a party born out of social movements that had mobilized in response to growing economic inequality and the

housing crisis that affected Spain after the financial crisis of 2008. By the time she took office in 2015, there was growing concern that smart city initiatives had become too corporate-driven, benefiting multinational tech firms rather than ordinary citizens. Colau's administration was, therefore, a reaction to this perceived imbalance, aiming to shift the focus of digital governance from corporate-led initiatives to citizen empowerment and public interest.

Jaume Collboni, representing the *Partit dels Socialistes de Catalunya* (PSC), inherited a governance model that had already been reshaped by Colau's emphasis on digital rights and citizen participation. Collboni's administration, therefore, did not seek to radically redefine the city's smart governance model but rather to consolidate existing strategies while enhancing Barcelona's engagement in global sustainability and digital transition efforts, ensuring continuity with a reinforced strategic direction.

5.2 Comparative Analysis of Barcelona's Smart European Urban Governance under the Three Administrations

By using Table 3.1 developed in the theoretical framework in Chapter 3, Table 5.2 will be applied in the comparative analysis of the Trias, Colau, and Collboni administrations, identifying how each has engaged with European projects, with smart European urban governance principles, and the outcome of the Europeanization process. By analyzing these developments over time, an evaluation of whether Barcelona has undergone a process of Europeanization in its approach to smart urban governance and what factors have influenced these shifts is carried out. Table 5.3 will then include the different EU projects implemented by the administrations, the diverse approaches in the application of the EU's smart urban governance principles, and the different degree of Europeanization of the administrations

Table 5.2: Comparative Analysis of the three Administrations of Barcelona from 2011 until now

		Trias Administration	Colau Administration	Collboni Administration
Participation in EU projects		X	X	X
Application of Smart Urban European Governance Principles	Subsidiarity		X	X
	Systematic approach	X	X	X
	Integrated action	X	X	X
	Citizens orientation		X	X
	Public participation		X	X
	Enabling and empowering environment		X	X
	Management approach	X	X	X
Results of the Europeanization process	Inertia			
	Absorption	X		
	Accommodation		X	X
	Transformation			

5.2.1 Participation in EU projects of the three Administrations

The participation of Barcelona in EU-funded projects and initiatives has been a fundamental aspect of the city's smart city evolution. Each municipal administration engaged with European projects differently, reflecting different governance models and political priorities, which led to distinct impacts on the city.

During the Trias administration, Barcelona established itself as a leading European smart city, integrating EU policies and funding mechanisms into its governance model. The administration aligned closely with Europe 2020 (Nesti, 2018) and the Digital Agenda for Europe, which emphasized sustainability, technological innovation, and digital governance. A key element of Trias's approach was Barcelona's involvement as a lighthouse city in GrowSmarter, a Horizon 2020 initiative focused on implementing smart energy solutions, optimizing urban mobility, and enhancing data-driven governance. The project offered the opportunity to pilot innovative solutions and export them to other European cities (Growsmarter, n.d.). Additionally, the Sentilo project, an open-source sensor platform aligned with the EU's vision for interoperable urban data, reinforced Barcelona's integration into the European smart city agenda (Sentilo, 2024). Moreover, the administration actively participated in the European Innovation Partnership on Smart Cities and Communities (EIP-SCC), the EU-led collaboration platform, which connected cities, businesses, and researchers to develop replicable smart city models. The city contributed insights from its 22@ innovation district, which had already established Barcelona as a leader in tech-driven urban development.

With the election of Ada Colau and Barcelona en Comú, the administration decided to leverage EU projects to promote citizen empowerment, participatory urbanism, and social inclusion, instead of continuing previous European initiatives implemented by the Trias administration. A defining characteristic of Colau's approach was her focus on technological sovereignty and citizen control over data: this led to Barcelona's active participation in D-CENT and DECODE, two Horizon 2020 projects designed to promote digital democracy, open-source governance, and citizen data ownership. D-CENT played a pivotal role in transforming Barcelona's approach to digital governance (D-CENT, n.d.), as it led to the creation of Decidim, an open-source participatory democracy platform that allowed citizens to propose, debate, and vote on municipal policies. The

DECODE project, instead, focused on data sovereignty and citizen control over personal data. It reinforced Colau's strategy of challenging corporate dominance over urban data by experimenting with privacy-protecting, open-source data governance models, again aligning with progressive EU digital governance policies (DECODE, 2020). Colau's administration also used EU funding to support sustainability and urban justice initiatives, particularly in areas such as mobility, climate action, and housing. Through participation in NetZeroCities and Sun4All, Barcelona secured financial and institutional support from the EU for initiatives aimed at reducing carbon emissions and promoting energy justice, reinforcing EU goals for energy-efficient urban design and community-led climate action. The administration also engaged in URBACT networks, fostering collaboration with other European cities on innovative urban governance practices. Regarding the Superblocks project, despite being a local initiative, it later received EU funding for sustainable urban planning.

Collboni's administration continues Barcelona's engagement in NetZeroCities but also expands collaboration on digital governance, mobility, and urban sustainability projects. By continuing its participation in NetZeroCities, the city is ensuring continuity in climate and sustainability policies initiated under Colau. Another related project is ReGreeneration, a new EU-funded project focused on green urban renewal and circular economy policies, integrating Barcelona into European efforts for sustainable urban transformation (Digiotouche, n.d.). At the same time, Collboni's administration has also expanded EU-backed public-private partnerships, reintroducing economic development and business collaboration into Barcelona's European strategy. This is evident in new partnerships with Cisco, Huawei, and the Mobile World Capital Barcelona initiative, which aim to position the city as a European leader in AI, digital transformation, and urban innovation, thus aligning with the EU's Digital Decade Strategy.

The participation in EU projects and initiatives underscores the shifting priorities, governance models, and strategic objectives that have shaped the city's smart city trajectory. During the Trias administration, Barcelona positioned itself as a leading European smart city, aligning closely with EU digital and urban innovation strategies. The city's engagement in European projects was primarily motivated by economic growth, global competitiveness, and technological advancement. For this reason, the administration focused on EU projects (ex. GrowSmarter, Sentilo) that reinforced

Barcelona's role as an experimental hub for urban innovation. A defining aspect of Colau's engagement with EU projects was her focus on technological sovereignty and citizen empowerment, as D-CENT and DECODE showed. Beyond digital democracy, Colau's administration also leveraged EU projects for sustainability and urban justice initiatives. These projects marked a radical departure from Trias's business-oriented approach by prioritizing public-commons digital infrastructures over public-private partnerships (Tomàs, 2023). Under Jaume Collboni, Barcelona's engagement with EU projects combined elements from both Trias's economic and technological approach and Colau's emphasis on sustainability and governance innovation: by continuing in the involvement in NetZeroCities, the administration is reinforcing the city's commitment to achieving climate neutrality in line with EU objectives. However, a key difference in Collboni's engagement with EU projects is his reintroduction of public-private partnerships, such as Cisco and Huawei, to complement sustainability and digital transformation efforts. For this reason, unlike Colau, who rejected corporate-driven EU smart city initiatives, Collboni's administration embraces a balanced approach, seeking to maximize EU funding opportunities while ensuring that projects align with both economic development and social sustainability goals.

5.2.2 Application of EU's Smart Urban Governance Principles

The governance evolution of Trias, Colau, and Collboni demonstrates three distinct approaches to EU smart urban governance. Each administration's approach can be assessed through the seven smart urban governance principles, which emphasize subsidiarity, systematic planning, interdepartmental coordination, citizen-oriented policies, public participation, social empowerment, and management approach (Wiktorska-Święcka, 2015, pp.50; Integrated Urban Governance, 2011, pp.11).

The first aspect analyzed is *subsidiarity*, in other words, decisions made close to citizens. In this sense, the Trias administration followed a technocratic, top-down model, where municipal institutions and corporate partners led urban policymaking. Decisions regarding smart city policies were not decentralized to local communities, and while projects like Sentilo and GrowSmarter improved urban services, they did not integrate neighborhood-based governance structures.

On the contrary, Colau decentralized decision-making by implementing neighborhood-driven governance models: the Decidim platform allowed citizens to propose, debate, and vote on municipal policies (Monge et al., 2022, pp.9). Moreover, the Superblocks represented an example of neighborhood-scale urban interventions, ensuring that urban planning decisions were made at a localized level.

Collboni's administration reinforces subsidiarity through the continuous use of Decidim, but also through direct and physical engagement with local communities through the "El Alcalde Cerca de Ti" initiative which helps address issues at the district level. Additionally, due to the NetZeroCities project, the administration is embedding district-level sustainability officers, ensuring that climate policies are adapted to local needs.

The second principle relates to the adoption of a *systematic approach*. The Trias administration developed the Barcelona Smart City (2013) strategy, which ensured a cohesive policy framework, aligning multiple smart city projects (ex. GrowSmarter and Sentilo) under a single governance vision. In this sense, the BSC was not created from scratch but was built upon existing institutional frameworks, particularly Barcelona's legacy of public-private partnerships (PPPs) dating back to the 1992 Olympic Games and the development of 22@ in the early 2000s.

On the contrary, Colau's approach moved away from the previous business-driven smart city model, introducing the Barcelona Digital Plan (2016) that redefined the administration's approach. In this sense, rather than following an economic growth-based smart city vision, her administration developed a smart city strategy aimed to support social justice and sustainability.

The Collboni administration has not introduced an entirely new smart city strategy yet but built upon previous governance frameworks. In fact, taking into consideration the NetZeroCities project, most of the initiatives included in the CCC project were already part of the Climate Plan 2018-2030 published under Colau, which are also aligned with the Metropolitan Strategic Plan 2030. In addition, he partially builds on Trias's smart city model by collaborating with major tech firms and PPPs (ex. Cisco, Huawei).

Regarding *integrated action*, Trias ensured cross-sectoral coordination through Habitat Urbà, which centralized urban planning, smart city initiatives, and infrastructure development (Bolici & Mora, 2016, pp.7). In addition, the Project Management Office (PMO) simplified the implementation of SC initiatives by functioning as a central

coordination unit for managing large-scale urban and smart city plans. Together, they provided an integrated governance framework, ensuring synergies between technology, data governance, and mobility.

Colau emphasized holistic policymaking by integrating digital democracy, sustainability policies, and social housing. This ensured that housing reforms (Pla Viure), open-data governance (DECODE), and urban sustainability (Superblocks) were interconnected. Collboni's integrated action can be seen in the NetZeroCities project, where his administration ensures that urban sustainability is not fragmented into isolated projects but is coordinated through a climate governance framework that includes various government levels and stakeholders, ranging from the creation of a municipal coordination team and district-level sustainability officers to the collaboration with the AMB, private stakeholders, and partnerships with other Spanish cities organizations (Ajuntament de Barcelona, n.d.-a).

Concerning the fourth principle, *citizens orientation*, Trias's governance model prioritized technological efficiency and business investment, treating citizens as users of smart city services rather than active decision-makers. The Smart City Campus (22@) and public-private partnerships reinforced a corporate-driven approach rather than a citizen-first perspective.

Colau's administration was strongly focused on citizens' needs, and restructured governance to prioritize housing, climate justice, and digital rights, tailoring policies to citizens' requests. In this sense, Decidim institutionalized citizen input in urban policymaking.

Collboni maintains citizen-driven policies through the continuous use of Decidim, as well as prioritizing affordable housing and combating the negative effects of mass tourism: the second most financed area of the Municipal Action Plan (PAM) is social housing, and to address the impact of mass tourism on the housing market, the administration has announced the removal of all tourist apartments in the city by November 2028 (Catalan News, 2024a). This is also shown with NetZeroCities, as the project emphasizes a citizen-first climate governance model, ensuring that climate-neutrality efforts align with local demands and participatory decision-making processes.

Public participation is the fifth principle taken into analysis. During the Trias's administration, citizen participation was basically absent and was not institutionalized.

Citizens could only participate in a few FabLabs and Urban Living Labs (ULL), but these places were primarily aimed to involve tech stakeholders rather than the general public (Tomàs, 2023; Nesti, 2018).

This changed with Colau, which made public participation the cornerstone of her SC vision. Colau's administration institutionalized public participation through Decidim, the participatory democracy platform of the city that enabled residents to propose, debate, and vote on municipal policies.

Collboni builds upon Colau's participatory platform (Decidim), which was also used for the NetZeroCities project, ensuring that climate policies include not only residents. Moreover, as stated before he introduced "El Alcalde Cerca de Ti" which introduced direct engagement mechanisms, where the mayor visits districts to address citizen concerns (Ajuntament de Barcelona, 2024).

The sixth principle is *enabling and empowerment*. Contrary to Colau and Collboni, Trias's governance prioritized corporate-led innovation and economic competitiveness, with less focus on empowering vulnerable communities. In this sense, while smart city projects improved infrastructure, there were no major policies specifically designed to empower lower-income residents or marginalized groups.

Colau's administration strongly supported the empowerment of the population, highlighted through the social housing and the construction of about 15,000 new social residences, and through the construction of new Superblocks which gave back public areas to citizens. In addition, the administration empowered citizens through digital sovereignty: through DECODE Colau promoted citizen-controlled data governance, ensuring that urban digital policies benefited the public rather than private corporations, and with Decidim it enhanced the involvement of all the population.

Collboni builds on Colau's attention to the empowerment of the inhabitants, especially in regards to housing policies by increasing the stock of affordable homes, by eliminating tourist apartments from the city, and through NetZeroCities by enhancing urban climate resilience at the local level. This underscores his will to prioritize residential needs over tourism profits, thus benefiting residents of the city.

The last principle relates to the adoption of a *management-oriented approach*. The Trias administration's management approach was highly structured through Habitat Urbà and the Project Management Office (PMO). The former coordinated urban planning,

infrastructure, and smart city projects, ensuring that policies were executed efficiently and in synergy with digital innovation and mobility strategies, while the latter was responsible for executing large-scale initiatives, ensuring structured implementation (Nesti, 2018). Moreover, the administration prioritized collaborations with tech corporations (ex. Cisco, GDF Suez), leveraging private-sector expertise.

This changed with Colau, who introduced new governance bodies to institutionalize municipal control over digital policies and smart city governance, like the Digital Innovation Office and the Municipal Data Office (Morozov & Bria, 2018, pp.27; Monge et al., 2022, pp.6). By doing so, the administration reinforced public-commons management models, which embedded digital democracy, data sovereignty, and social justice, rather than private-sector efficiency models.

Collboni's management approach is aligned with broader urban, metropolitan, and European frameworks, particularly in the NetZeroCities framework, the Barcelona Metropolitan Strategic Plan 2030, and the European framework. At the municipal level, the administration strengthened municipal service coordination for public spaces, ensuring that urban management operates more efficiently and effectively. At the same time, by strengthening the economics and central services of the City Council, Collboni's governance model focuses on optimizing internal management efficiency while advancing Barcelona's e-administration capabilities. Moreover, the creation of a Commissioner of Mayor's Office for European Affairs and the establishment of a permanent office in Brussels (Sans, 2025) shows the commitment to integrate Barcelona into European policy frameworks. This is also highlighted by the involvement of the city in CitiES, the collaborative and innovative multi-stakeholder platform designed to support the transition of Spanish cities towards climate neutrality.

Overall, each administration adopted a distinct approach, highlighting Barcelona's evolving governance strategies and their alignment with EU priorities. Trias prioritized technocratic efficiency and corporate-driven smart city development, ensuring structured project execution through Habitat Urbà and the PMO. While his administration was highly structured and results-driven, it lacked subsidiarity, client-orientation, public participation, and enabling and empowerment principles. Colau redefined governance by decentralizing decision-making, prioritizing participatory democracy, and embedding social and digital justice in municipal policies. Her administration institutionalized

Decidim, dismantled Habitat Urbà and the PMO, and introduced the Digital Innovation Office and Municipal Data Office (MDO). Collboni represents a hybrid model, combining structured management efficiency with participatory and multi-level governance, as specifically showed with the participation in the NetZeroCities project. In conclusion, Barcelona's governance evolution reflects a progressive transition from a technocratic smart city model to a more participatory and institutionally coordinated urban strategy: Trias established a foundation of structured, efficiency-driven governance, Colau reoriented the city's priorities toward social inclusion and citizen engagement, and Collboni seeks to institutionalize a balance between organized administration, multi-level coordination, and citizen participation. Particularly, even if in different ways, Colau's and Collboni's administrations showed the full integration of EU smart urban governance principles.

5.2.3 Results of the Europeanization Process

The Europeanization of Barcelona's governance has followed different trajectories under the Trias, Colau, and Collboni administrations, shaped by a combination of political will, prior experience with EU frameworks, institutional capacities, and broader governance objectives. In fact, although each mayor integrated elements of EU smart urban governance into their policies, the depth of this Europeanization process varied significantly.

Trias's Europeanization process can be classified as Absorption. A key feature of his administration was the absorption of EU projects like GrowSmarter and Sentilo, and the participation in the EIP-SCC into Barcelona's pre-existing governance model. In fact, these projects were primarily seen as a means to reinforce the city's global competitiveness in urban technology and infrastructure development already in action. This was a consequence of two reasons: first, the administration was facilitated in integrating these projects and initiatives because Barcelona already had a strong foundation of public-private partnerships (PPPs) from the 1992 Olympic Games and the 22@ innovation district. As highlighted by Ansell and Gash (2008), here the prehistory among various stakeholders was strong. Second, the political will of the administration itself played a major role as the main objective of Trias' government was to enforce the

smart city brand as a promoter of a new economy of urban services (Gascó-Hernandez, n.d., pp. 52). Trias' vision of a smart city was in fact more market-driven, emphasizing technocratic decision-making and corporate partnerships as seen in the Smart City Campus at 22@, where companies, startups, and academia implemented technological solutions for urban challenges (Gascó-Hernandez, n.d.). As a consequence, the EU was seen more as a further opportunity for development and innovation: the administration integrated the EU's presence into an already existing strategy and governance model, and leveraged its funds in a strategic way to position the city as a global smart city leader. This even led the city to win the European Capital of Innovation (Gascó-Hernandez, n.d., pp. 53), but this prize recognized the city's technical and infrastructural advancements rather than deep institutional Europeanization. In fact, Trias didn't restructure its governance framework, decision-making remained centralized within Habitat Urbà and the Project Management Office (PMO), and did not really include some of the EU's smart governance principles like subsidiarity, public participation, client orientation, and enabling and empowerment.

Colau's Europeanization process falls under Accommodation. Instead of continuing the market-oriented approach to smart city development of her predecessor, Colau's administration prioritized participatory governance, social justice, and digital democracy. This shift significantly reshaped Barcelona's relationship with the EU, leading to a selective accommodation of European policies and principles. Rather than leveraging EU projects for economic and technological growth that characterized the Trias administration, Colau's administration used EU initiatives to strengthen social inclusion, housing rights, and participatory democracy. In this sense, the participation in EU projects like D-CENT and DECODE was fundamental because these projects laid the groundwork for the creation of Decidim, the city's participatory platform and one of the cornerstones of Colau's *Barcelona Digital City (2016)*. Related to this, her administration embraced more smart urban European principles than the predecessor: after dismantling Habitat Urbà and the PMO, Colau created the Digital Innovation Office and the Municipal Data Office (MDO), both influenced by EU projects. In addition, the participation in NetZeroCities and Sun4All showed the will to intentionally include EU sustainability goals in municipal policy in a participatory way, as the CCC was developed through Decidim and the Citizen Council for Sustainability (Ajuntament de Barcelona, n.d.-a).

The relationship with the EU was then strongly ideologically driven, certainly influenced by her political party since Barcelona en Comú intensely focused on citizen empowerment and the democratization of technology. In this sense, Colau's Europeanization was shaped by her administration's ideological objectives, which at the same time strongly aligned with the principles of smart urban European governance.

Like Colau, Collboni's administration also falls under Accommodation. However, his administration represented the most advanced stage of Europeanization in Barcelona's governance trajectory. In fact, the administration found itself with a city that was already aligned with the European Union in terms of projects and initiatives (ex. NetZeroCities), and smart urban governance principles inherited from the Colau administration, which may have facilitated the Europeanization process. In fact, by looking at Table 5.2, the smart urban European governance principles are present both in Colau's and Collboni's administrations. Nevertheless, it can be stated that Collboni's Europeanization relates to the third stage of Börzel (2005), but differently from Colau who leveraged the EU based on her ideological vision, the political will of the administration of Collboni reflected a clear political commitment to *institutionalize* the EU into his governance strategy; in addition to engaging with the EU on a project-by-project basis, Collboni's administration has embedded European governance principles into Barcelona's policymaking structures in many ways. By creating a Commissioner of Mayor's Office for European Affairs, and the future opening of a permanent office in Brussels to closely monitor European opportunities in areas like housing and climate change policies (Sans, 2025), the administration shows that Barcelona is not just a recipient of EU funding but an active player in European policymaking. Moreover, the participation of the administration in the *Declaration of European Cities for European Policy-Making and Democracy* reinforced Barcelona's ambition to shape EU urban governance beyond financial engagement. Another key example of how Collboni's administration institutionalizes Europeanization can be seen in Barcelona's engagement with NetZeroCities. Although the participation in the project happened during Colau's administration, the CCC developed by Collboni shows an extension of multi-level governance reinforcing a metropolitan-scale approach to climate neutrality through the Barcelona Metropolitan Strategic Plan 2030, and a strong involvement with national climate governance networks like CitiES, ensuring knowledge-sharing, joint projects, and coordinated urban strategies across multiple

Spanish cities. As a consequence, Collboni ensures that multi-level governance is fully integrated into city planning, reflecting a broader structural alignment with EU governance principles.

In conclusion, Barcelona's governance has undergone distinct phases of Europeanization under the Trias, Colau, and Collboni administrations, shaped by varying political priorities, institutional capacities, and engagement with EU frameworks. Trias adopted an Absorption approach, integrating EU projects into an existing market-driven smart city model without altering governance structures. Colau shifted to Accommodation, selectively aligning with EU principles that resonated with her ideological focus on participatory governance and social justice, using EU funding to reinforce her agenda. Collboni, while also following an Accommodation path, represents the most advanced stage of Europeanization, institutionalizing EU engagement through governance reforms and strategic alignment with European policymaking. This evolution highlights that pre-existing governance structures and contexts have shaped Barcelona's Europeanization trajectory. However, what stands out is the political will of each administration. As seen in the cases of Trias, Colau, and Collboni, the political will dictates whether European initiatives are merely leveraged for financial support, selectively accommodated to align with ideological goals, or fully institutionalized into governance structures. This underscores that smart city governance is not only a technical or financial process but a deeply political one, where leadership decisions determine the depth and direction of Europeanization.

Table 5.3: Comprehensive Comparison among the three Barcelona's Administrations from 2011 until now

		Trias Administration (2011-2015)	**Colau Administration (2015-2023)**	**Collboni Administration (2023-present)**
Participation in EU projects		- Active participation in EU projects like GrowSmarter, Sentilo, and EIP-SCC. - Focused on technological and economic positioning.	- Participated in D-CENT, DECODE, NetZeroCities, and Sun4All. - Focus on digital democracy, citizen empowerment, and sustainability.	- Continued participation in NetZeroCities. - Introduced ReGreeneration and CitiES. - Reintroduced public-private partnerships.
Application of EU's Smart Urban European Governance Principles	Subsidiarity	- Top-down, technocratic governance - No neighborhood-based governance structures - Corporate-led urban policymaking	- Decentralized governance (Decidim) - Superblocks ensured neighborhood-based planning.	- Continued Decidim & introduced 'El Alcalde Cerca de Ti' for district-level citizen engagement. - NetZeroCities embedded district-level sustainability officers.
	Systematic approach	- Barcelona Smart City (2013) - Built on existing public-private partnerships from 1992 Olympics and 22@ innovation district.	- Barcelona Digital Plan (2016) - Focus on social justice and sustainability.	- Built on Trias's tech partnerships & Colau's climate policies. - NetZeroCities aligns with Climate Plan 2018-2030 & Metropolitan Strategic Plan 2030.
	Integrated action	- Habitat Urbà & PMO centralized urban planning, smart city, and infrastructure coordination	- Integrated digital democracy, sustainability, and housing policies into a	- Institutionalized multi-sector collaboration through NetZeroCities, Pla Viure, and

		- Focus mainly on technology and corporate actors.	holistic governance approach.	metropolitan governance mechanisms.
	Citizens orientation	- Prioritized technological efficiency and business investment. - Treated citizens as users rather than active decision-makers.	- Prioritized citizens' needs over corporate interests. - Digital rights, housing, and climate justice were key.	- Balanced citizen-driven policies with economic development. - Prioritized housing, climate neutrality, and digital transition.
	Public participation	- Participation only in FabLabs and Urban Living Labs, mostly targeting only tech stakeholders.	- Institutionalized public participation through Decidim. - Citizens could propose and vote on policies.	- Continued Decidim - Introduced direct citizen engagement through face-to-face meetings (El Alcalde Cerca de Ti)
	Enabling and empowering environment	- Did not prioritize citizen empowerment. - Focused on corporate-led innovation.	- Social housing focus (15,000 residences) - Superblocks to reclaim public spaces - DECODE to empower citizen-controlled data governance.	- Expansion of social housing - Elimination of tourist apartments - Reinforcing local climate resilience
	Management approach	- Highly structured governance via Habitat Urbà & PMO. - Smart city projects executed efficiently through corporate partnerships.	- Decentralized governance. - Created Digital Innovation Office & MDO to institutionalize municipal control over digital policies.	- Institutionalized multi-level governance. - Strengthened municipal service coordination & European engagement via the Brussels office and new Commissioner for European Affairs

Outcome of the Europeanization process	Inertia			
	Absorption	Integrated EU projects into existing frameworks without altering governance structures.		
	Accommodation		Selective and ideological adoption of EU principles aligned with participatory governance and social justice.	Institutionalized EU engagement, creating governance reforms, and embedding Europeanization in city policymaking.
	Transformation			

5.2 Further Considerations on Barcelona as a Smart City

Barcelona's smart city trajectory illustrates how smart governance and collaborative governance have become central to its urban policymaking. As analyzed before, the city's governance has transitioned from a technocratic, top-down smart city model under Trias, to a citizen-driven, participatory approach under Colau, and now towards an institutionalized, multi-level governance strategy under Collboni. This evolution reflects a broader alignment with EU smart urban governance principles, particularly in the domains of subsidiarity, public participation, integrated action, and enabling and empowerment. Regarding the collaborative process, by taking up the definition provided by Emerson, Nabatchi and Balogh (2011) who state that collaborative governance "*include partnerships among the state, the private sector, civil society, and the community, as well as joined-up government and hybrid arrangements such as public-private and private-social partnerships and co-management regimes*" (Emerson et al., 2011, pp. 3), what transpires from the analysis of the three administrations is that in each case they all engaged in forms of collaborative governance, integrating public, private, and academic actors, following a Triple or Quadruple Helix model of innovation. The Trias administration laid the groundwork by fostering public-private partnerships, already building on the momentum created by the previous collaborations for the Olympic Games of 1992 and the 22@ project, following a Triple Helix model of innovation. The Colau administration, though, marked a shift toward a more citizen-centric approach, fostered by a strong democratic digital governance model that enabled digital tools to actively engage the population in urban governance. Her approach can then be related to the Quadruple Helix model of innovation proposed by Carayannis and Campbell, where civil society is called to be the fourth actor in the development of social and urban innovation. Collboni, building on both predecessors, expanded partnerships with global technology firms and at the same time pushed for a strong inclusion of civil society thanks to the continuous use of participatory platforms, but also by including face-to-face meetings with the population. In this case, this approach also aligns with the Quadruple Helix model of innovation. At the same time, he expanded collaborative governance by embedding it into multi-level governance structures, ensuring that smart city policies are co-developed with European institutions and transnational networks. Initiatives like

CitiES and NetZeroCities demonstrate a commitment to scaling collaborative governance beyond the municipal level.

The research also highlighted some challenges encountered. One refers to open data and governance. As highlighted in Chapter 1 and Chapter 3 by Ahmed (2020), Walravens (2012), and Zhang et al. (2017), issues of privacy and security of data are one of the main issues in smart city governance. The Trias administration pushed for more technological innovation through the use of data but did not consider any issues regarding transparency and privacy, something that changed with the advent of the Colau administration and confirmed with Collboni's government. Another issue brought up by Dvir and Pasher (2004) concerns the enablement of citizens to foster knowledge creation and innovation in a smart city. In the case of Trias, the inclusivity of citizens was limited and only referred to participation in FabLabs (Tomàs, 2023), or Urban Living Labs (Nesti, 2018) but increased during Colau and Collboni when civic participation intensified in terms of active policymaking for the city. Regarding the concept of collaborative inertia (Vangen and Huxham, 2013) and power dynamics (Dvir and Pasher, 2004), these issues could be individuated in NetZeroCities: due to the number of actors involved in the project, the Collboni administration might have faced challenges in terms of slow policy and decision-making, balancing different goals and attitudes, but this should be further analyzed. Moreover, the issue of power dynamics in collaborative governance can be analyzed in the three administrations. Under Trias, the power of large tech companies and the central government may have overshadowed the voice of the population. With a more participatory and progressive approach, Colau might have attempted to mitigate this, while Collboni by focusing more on business development might face similar issues in trying to balance economic interests and local needs.

CONCLUSIONS

This thesis aimed to analyze the Europeanization process of smart urban governance in Barcelona, assessing the extent to which the city has aligned with EU guidelines and policies on smart urban European governance. By using Barcelona as a case study, the dissertation investigated how local governance has evolved in response to European frameworks, focusing on the comparative analysis of the Trias, Colau, and Collboni administrations, as well as the role of the EU NetZeroCities project. In this sense, the study's theoretical framework of Europeanization provided a lens through which to assess the influence of EU norms, policies, and governance models on the city's urban development.

The smart city concept has evolved significantly over the past two decades. Despite the absence of a universal definition, smart cities generally integrate technological, human, and institutional dimensions. In this sense, a smart city can be understood as an "*open innovation ecosystem in which local administrations, businesses, civil society organizations, and citizens collaborate to define a local development strategy and a series of projects aimed at expanding ICT-based infrastructure and services, implementing environmental sustainability measures, adopting a new approach to city governance, and promoting initiatives to improve the quality of life for residents while actively involving them in the creation of the smart city*" (Nesti, 2018, p. 100). The European Union has played a pivotal role in promoting this paradigm among its Member States, offering strategic frameworks, financial resources, and knowledge-sharing platforms and networks. From early initiatives like the SET-Plan and the Covenant of Mayors to more recent frameworks such as the European Green Deal and the Digital Decade, the EU has sought to integrate smart and sustainable urban governance principles into local policymaking.

Against this backdrop, this thesis explored the research question: *Has the city of Barcelona become Europeanized in the context of smart European urban governance? If so, how? Which factors can help explain the Europeanization process?*

The city of Barcelona has a long history of urban innovation, from the Plan Cerdà which introduced modern urban planning, to the 1992 Olympic Games which transformed the whole city and revitalized its global image, to the 2000s when the 22@ project redirected

the industrial district of Poblenou into a hub for technology and knowledge industries. The 22@ innovation district was a fundamental turning point for the city, as it induced the idea that innovation could be linked to urban development. From this belief, Barcelona began embracing the smart city paradigm, integrating technology, sustainability, and citizen participation into urban planning. The city's transition into a smart city has been shaped by varying governance approaches across different administrations. In this sense, the comparative analysis of the Trias, Colau, and Collboni governments highlighted distinct strategies in aligning with EU smart urban governance principles and Europeanization outcomes.

Trias' administration largely followed a top-down, technology-driven approach, emphasizing public-private partnerships and urban infrastructure improvements. While its policies aligned with EU priorities for innovation and economic competitiveness, the governance model remained primarily business-oriented, with limited citizen participation. This phase reflected a partial Europeanization, as the adoption of EU frameworks focused more on economic and technological convergence rather than governance transformation. The Europeanization process under Trias can be classified as Absorption, as his administration integrated EU projects into Barcelona's existing governance model without significant structural changes. Colau's administration marked a shift toward a more participatory and socially oriented smart city model, emphasizing data sovereignty, citizen engagement, and digital rights. Her policies aligned with EU efforts to promote digital democracy and inclusive governance, signaling a deeper Europeanization of Barcelona's smart city governance. The administration's participation in EU-funded projects related to digital governance further reinforced this alignment. However, rather than fully internalizing EU frameworks, Colau's administration selectively integrated principles that aligned with its ideological focus on social justice and participatory governance. As a result, the Europeanization process under Colau can be classified as Accommodation. The Collboni administration seems to be guiding Barcelona toward a hybrid model that balances technological innovation with a citizen-centric governance approach. His administration's reinforced engagement with the EU, including the establishment of a Brussels office, participation in CitiES, and alignment with projects like NetZeroCities, suggests an increased institutionalization of Europeanization. The Barcelona Climate City Contract exemplifies how the EU fosters

multi-level and collaborative governance, reinforcing Barcelona's role within the EU's 100 Climate-Neutral and Smart Cities Mission. Unlike Colau, whose Europeanization was shaped by ideological priorities, Collboni's approach reflects a deliberate political strategy to integrate Barcelona into European policymaking structures. His Europeanization process also falls under Accommodation, but it represents the most advanced stage, as governance reforms and new institutional mechanisms have been introduced to ensure long-term alignment with EU frameworks.

While the findings highlight a clear trajectory of increasing Europeanization, Chapter 5 also underscores certain challenges in this process. The balance between public-private partnerships and citizen-driven governance remains a key issue, as Collboni's administration reintroduces economic development strategies alongside participatory governance. Additionally, collaborative inertia and power dynamics within EU-funded projects such as NetZeroCities could slow policy implementation due to the complexity of multi-stakeholder coordination. For this reason, future research should examine whether Collboni's administration will fully consolidate a smart city strategy that integrates EU frameworks with local governance priorities. Additionally, the long-term impact of NetZeroCities on Barcelona's governance structures and climate policies remains an open question.

Overall, this dissertation highlights that Barcelona has indeed undergone a process of Europeanization in smart urban governance, though to varying degrees across different administrations. The EU's influence has been evident in the strategic frameworks adopted by the city, the funding mechanisms leveraged, and the governance models progressively shaped by European norms. However, the findings also suggest that Europeanization is not a uniform process but a dynamic one shaped by both supranational influences and local political choices. Moreover, all smart city strategies, initiatives, and projects developed and implemented by the three administrations underscored the importance of adopting forms of collaboration between different stakeholders, and the increasing importance given to the inclusion of citizens in the creation and implementation of urban policies to serve the population's needs. Furthermore, the use of data and technology has emerged as a crucial enabler of smart governance, facilitating citizen engagement, enhancing transparency, and optimizing urban services.

The ultimate lesson that can be drawn from this dissertation is that, beyond the role of the European Union, the smart city paradigm and the Europeanization of urban governance remains a deeply political process shaped by political will, priorities, and ideological orientation. While the EU provides important frameworks, funding, and participation in smart city projects, the way a city decides to interpret, adapt, and implement specific policies at the local level is ultimately a political decision, influenced by local realities and governance approaches. Barcelona's case illustrates that the evolution of smart city strategies and Europeanization reflects shifting political priorities, with each administration shaping governance according to its broader vision. Additionally, the analysis highlights a growing emphasis on citizen inclusion. At the same time, what emerged from the analysis is that citizen inclusion is becoming increasingly sought after. In conclusion, the thesis contributes to the broader discourse of the smart city paradigm, particularly by demonstrating the interplay between the EU and local governments. The evolving nature of governance in Barcelona highlights that future developments will depend on how future administrations navigate the balance between technological innovation, economic growth, sustainability, and inclusive governance within the broader framework of Europeanization.

BIBLIOGRAPHY

Agenzia per la Coesione Territoriale. (n.d.). *S3 – Smart Specialisation Strategy*. Agenzia per La Coesione Territoriale.

Ahmed, S., (2020). Security and Privacy in Smart Cities: Challenges and Opportunities. In: *International Journal of Engineering Trends and Technology (IJETT)*. Volume 68 Issue 2, pp. 1-8

Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart cities: Definitions, dimensions, performance, and initiatives. *Journal of Urban Technology*, *22*(1), 3–21. https://doi.org/10.1080/10630732.2014.942092

Al-Hader, M., Rodzi, A., Sharif, A. R., & Ahmad, N. (2009a). Smart city components architecture. In *Proceedings of the International Conference on Computational Intelligence, Modelling and Simulation*, Brno, Czech Republic, Sep 7-9

AMBITIOUS. (n.d.). *AMBITIOUS Advanced CoMputing Continuum Solutions for Boosting DigITalization acrOss EUropean RegionS*. https://ambitious-project.eu/about

Angelidou, M. (2015). Smart cities: A conjuncture of four forces. *Cities*, *47*, 95–106. https://doi.org/10.1016/j.cities.2015.05.004

Angelidou, M. (2016). Four European Smart City Strategies. *International Journal of Social Science Studies*, 4(4). https://doi.org/10.11114/ijsss.v4i4.1364

Ansa, A. (2022, May 26). *L'avvento delle megacittà: sette cose da sapere sui luoghi dove vivremo nel futuro - In Evidenza - Ansa.it*. Agenzia ANSA. https://www.ansa.it/sito/notizie/economia/ofc/in_evidenza/2022/05/26/lavvento-delle-megacitta-sette-cose-da-sapere-sui-luoghi-dove-vivremo-nel-futuro_e5da9101-fb25-4ae1-a4d1-c8fe11df850c.html

Ansell, C. K., & Gash, A. (2012). Stewards, mediators, and catalysts: Toward a model of collaborative leadership. *The Innovation Journal: The Public Sector Innovation Journal*, *17*(1), 1-21.

Ansell, C., & Gash, A. (2008). Collaborative governance in theory and practice. *Journal of Public Administration Research and Theory*, *18*(4), 543–571.

Anthopoulos, L. G., & Fitsilis, P. (2010). From online to ubiquitous cities: The technical transformation of virtual communities. *Springer eBooks* (pp. 360–372). https://doi.org/10.1007/978-3-642-11631-5_33

Associate Press. (2023, September 12). *The UAE's 'green city' is a cautionary tale—it's hard to build a climate haven, no matter how much oil money you have*. Fast Company. https://www.fastcompany.com/90995444/the-uaes-green-city-is-a-cautionary-tale-its-hard-to-build-a-climate-haven-no-matter-how-much-oil-money-you-have

Bache, I., & Jordan, A. (2004). Introduction: The Europeanisation of British Politics?. Paper presented at the UACES/ESRC One-Day Conference on 'Britain in Europe and Europe in Britain,' Sheffield.

Bache, I., & Marshall, A. J. (2004). Europeanisation and domestic change: A governance approach to institutional adaptation in Britain (Queen's Papers on Europeanisation No. 5/2004).

Barroso, J. (2010). *Europe 2020 – A European strategy for smart, sustainable and inclusive growth*.

Bartenberger, M., & Grubmüller, V. (2014). The enabling effects of open government data on collaborative governance in smart city contexts. *JeDEM - eJournal of eDemocracy and Open Government*, *6*(1), 36–48. https://doi.org/10.29379/jedem.v6i1.289

Batra, P. (2023, May 24). The evolution of smart Cities - GS Futures - Medium. *Medium*. https://medium.com/gs-futures/the-evolution-of-smart-cities-a64588d7d565

Bishr, A., Geray, O., El Kaissi, Z., Al Shaikh, M. (n.d.). Smart Dubai – Towards becoming the happiest city on Earth. Digital Dubai Authority: 1-3. Available at: https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://www.digitaldubai.ae/docs/default-source/publications/a-better-world-vol-5_sdo.pdf&ved=2ahUKEwjZi6uC3ceJAxW98bsIHRdzJboQFnoECBUQAQ&usg=AOvVaw0_mqPVWTD4dYD9vyJXW86X

Bisschops, S., & Beunen, R. (2019). A new role for citizens' initiatives: The difficulties in co-creating institutional change in urban planning. *Journal of*

Environmental Planning and Management, *62*(1), 72–87. https://doi.org/10.1080/09640568.2018.1436532

Börzel, T. (2003). How the European Union interacts with its Member States (IHS Institute for Advanced Studies Political Science Series No. 93). Wien.

Börzel, T. (2005). Europeanization: How the European Union interacts with its Member States. In S. Bulmer & C. Lequesne (Eds.), The Member States of the European Union (pp. 45-69). Oxford University Press.

Burman, T. (2024, August 23). Images show utopian city "Telosa" planned for US. *Newsweek*. https://www.newsweek.com/telosa-utopia-city-construction-1937126

Campbell, T. (2008). Learning cities: Knowledge, capacity and competitiveness. *Habitat International*, *33*(2), 195–201. https://doi.org/10.1016/j.habitatint.2008.10.012

Caragliu, A. A., Del Bo, C., & Nijkamp, P. (2011). Smart cities in Europe. *Journal of Urban Technology*, *18*(2), 65–82. https://doi.org/10.1080/10630732.2011.601117

Carayannis, E. G., & Campbell, D. F. (2009). "Mode 3" and "Quadruple Helix": toward a 21st century fractal innovation ecosystem. *International Journal of Technology Management*, *46*(3/4), 201. https://doi.org/10.1504/ijtm.2009.023374

Carayannis, E. G., & Rakhmatullin, R. (2014). The Quadruple/Quintuple Innovation Helixes and smart specialisation strategies for sustainable and inclusive growth in Europe and beyond. *Journal of the Knowledge Economy*, *5*(2), 212–239. https://doi.org/10.1007/s13132-014-0185-8

Castells, M. (1996). *The rise of the network society*. http://ci.nii.ac.jp/ncid/BA47167149

Caves, R. W., & Walshok, M. G. (1997). Transforming regions through information technology: Developing smart counties in California. *California County Magazine*, *Nov.-Dec.*, 29–31.

Charles, D. (2014). *The Role of Cities in Cohesion Policy 2014-2020*. Directorate-General for Internal Policies.

Cheng, H., & Hu, Y. (2009). Planning for sustainability in China's urban development: Status and challenges for Dongtan eco-city project. *Journal of Environmental Monitoring*, *12*(1), 119–126. https://doi.org/10.1039/b911473d

Chourabi H, Nam T, Walker S, et al. Understanding smart cities: an integrative framework. *In: Proceedings of the 45th Hawaii international conference on system science (HICSS)*, Maui, HI, 4–7 January 2012, pp.2289–2297. New York: IEEE.

Chun, S. A., Luna-Reyes, L. F., & Sandoval-Almazán, R. (2012). Collaborative e-government. *Transforming Government: People, Process and Policy*, *6*(1), 5–12.

Cingolani, R. (2021, November 4). 4. Un nuovo modello per le città. *La Repubblica*. https://www.repubblica.it/green-and-blue/2021/02/16/news/il_ritmo_del_progresso_-_il_progresso_che_ci_fa_regredire-287820494/

Commission 3 Manual. (2011). *Integrated urban governance. The way forward*. Berlin.

Comune di Milano. (2019, July 18). *Innovation. Milan tests the solutions financed by the "Synchronicity" project - Municipality of Milan*. Comune Di Milano. https://www.comune.milano.it/en/-/innovazione.-milano-testa-le-soluzioni-finanziate-dal-progetto-synchronicity-

Dameri, R. P. (2013). Searching for Smart City definition: a comprehensive proposal. *International Journal of Computer & Technology, 11*(5), 2544–2551. https://doi.org/10.24297/ijct.v11i5.1142

Dameri, R. P., Negre, E., & Rosenthal-Sabroux, C. (2016). Triple Helix in Smart Cities: A literature review about the vision of public bodies, universities, and private companies (pp. 2974–2982). https://doi.org/10.1109/hicss.2016.372

De Santiago Rodríguez, E. S. R. (2017). El proceso de construcción de la agenda urbana de la Unión Europea: de la declaración de Toledo al Pacto de Amsterdam. *International Journal of Urban Planning*, *10*(1), 28. https://ec.europa.eu/futurium/en/system/files/ged/410-221-pb.pdf

Digital Dubai. (2020, November 26). *Smart Dubai celebrates 5 years of accomplishments and successes*. https://www.digitaldubai.ae/newsroom/news/smart-dubai-celebrates-5-years-of-accomplishments-and-successes

Dirks, S., & Keeling, M. (2009). *A vision of Smarter Cities: How cities can lead the way into a prosperous and sustainable future*. IBM Institute for Business Value.

Dvir, R., & Pasher, E. (2004). Innovation engines for knowledge cities: An innovation ecology perspective. *Journal of Knowledge Management*, *8*(5), 16–27.

EERA. (2024, November 18). *The EU SET Plan*. https://www.eera-set.eu/about-us/eera-in-context/eu-set-plan.html

Eger, J. (1997, October 19). Cyberplace and cyberspace: Building the smart communities of tomorrow. *San Diego Union Tribune*.

Elmaghraby, A. S., & Losavio, M. M. (2014). Cyber security challenges in Smart Cities: Safety, security and privacy. *Journal of Advanced Research*, *5*(4), 491–497. https://doi.org/10.1016/j.jare.2014.02.006

Emerson, K., Nabatchi, T., & Balogh, S. (2011). An integrative framework for collaborative governance. *Journal of Public Administration Research and Theory*, *22*(1), 1–29. https://doi.org/10.1093/jopart/mur011

Etzkowitz, H., & Leydesdorff, L. (1998). Triple Helix of Innovation: Introduction. *Science and Public Policy*. https://doi.org/10.1093/spp/25.6.358

European Commission. (2000). *Communication from the Commission to the Member States of 28.4.00 laying down guidelines for a Community Initiative concerning economic and social regeneration of cities and of neighbourhoods in crisis in order to promote sustainable urban development URBAN II*. C (2000) 1100 - EN.

European Commission. (2012, November 1). *STEP-UP | Smart Cities Marketplace*. Smart Cities Marketplace. https://smart-cities-marketplace.ec.europa.eu/projects-and-sites/projects/step

European Commission. (2021, July 14). *The European Green Deal*. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

European Commission. (2024, January 21). *Investing in a sustainable and green urban future | Smart Cities Marketplace*. https://smart-cities-marketplace.ec.europa.eu/

European Commission. (2024a, April 11). *Interoperable Europe Act enters into force for better connected public services for people and businesses*. https://ec.europa.eu/commission/presscorner/detail/en/ip_24_1970

European Commission. (2024b, November 29). *Homepage of Pact for skills*. Pact for Skills. https://pact-for-skills.ec.europa.eu/index_en
European Commission. (2024c, December 3). *Climate-neutral and smart cities*. Research and Innovation. https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/climate-neutral-and-smart-cities_en
European Commission. (2024d, December 10). *European Skills Agenda*. Employment, Social Affairs and Inclusion. https://employment-social-affairs.ec.europa.eu/policies-and-activities/skills-and-qualifications/european-skills-agenda_en
European Commission. (2024e, December 12). *Europe's Digital Decade*. Shaping Europe's Digital Future. https://digital-strategy.ec.europa.eu/en/policies/europes-digital-decade#tab_1
European Commission. (2024f, December 17). *EU Missions in Horizon Europe*. Research and Innovation. https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe_en
European Commission. (n.d.). *About S3 Smart Specialization Strategy*. https://ec.europa.eu/regional_policy/policy/communities-and-networks/s3-community-of-practice/about_en
European Commission. (n.d.-a). *Urban agenda for the EU*. https://commission.europa.eu/eu-regional-and-urban-development/topics/cities-and-urban-development/urban-agenda-eu_en
European Commission. (n.d.-b). *Smart cities*. https://commission.europa.eu/eu-regional-and-urban-development/topics/cities-and-urban-development/city-initiatives/smart-cities_en
European Commission. (n.d.-c). *Smart Cities*. Interoperable Europe. https://interoperable-europe.ec.europa.eu/topic/digital-government/smart-cities
European Commission. (n.d.-d). *Wireless ICT*. https://ec.europa.eu/regional_policy/policy/communities-and-networks/s3-community-of-practice/partnership_industrial_mod_wireless_ict_en

European Union. (n.d.). *New European Bauhaus: beautiful, sustainable, together.* https://new-european-bauhaus.europa.eu/index_en

European Urban Initiative. (2024, January 3). *Affordable Housing for All - Inclusive, Attractive and Sustainable Solutions for Housing and Energy Affordability*. https://www.urban-initiative.eu/ia-cities/budapest/home

European Urban Initiative. (n.d.). *What is the European Urban Initiative?* https://www.urban-initiative.eu/what-european-urban-initiative

Evans, N. (2011). Lost in translation? – the Bristol Accord and the Sustainable Communities agenda. *EJSD*, *9*(44), 23. https://doaj.org/article/715c191785d64a3c85e75dac19269d94

Fedeli, V., Lenzi, C., Briata, P., & Pedrazzini, L. (2019). *EU Regional and Urban Policy: Innovations and Experiences from the 2014-2020 Programming Period*. Springer. https://link.springer.com/content/pdf/10.1007/978-3-030-34575-4.pdf

Ferrero, E. (2015). Le smart cities nell'ordinamento giuridico. *Il Foro Amministrativo*, *4*, 1267–1286.

Florida, R. (2002). *The rise of the creative class: And how It's Transforming Work, Leisure, Community and Everyday Life*. Basic Books, New York.

Florida, R. (2003). Cities and the creative class. *City and Community*, *2*(1), 3–19. https://doi.org/10.1111/1540-6040.00034

Gargiulo, C., Pinto, V., & Zucaro, F. (2013). EU Smart City Governance. *TeMA - Journal of Land Use, Mobility and Environment*, *6*(3), 356–370. https://doi.org/10.6092/1970-9870/1980

Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanović, N., & Meijers, E. (2007). *Smart Cities: Ranking of European Medium-sized cities*. Vienna University of Technology.

Gillick, K. (2024, December 4). BDTI Pilot Story: A machine learning model to monitor tree health. *Interoperable Europe Portal*. https://interoperable-europe.ec.europa.eu/collection/egovernment/solution/big-data-test-infrastructure-bdti/news/bdti-pilot-story-machine-learning-model-monitor-tree-health

Glaeser, E. L., & Berry, C. R. (2006). Why are smart places getting smarter? *Taubman Center Policy Briefs*, PB-2006-2. Available at http://www.hks.harvard.edu/rappaport/downloads/policybriefs/brief_divergence.pdf.

Gomez, A. G. (2023, May 5). *European Interoperability Framework for Smart Cities and Communities (EIF4SCC)*. https://netzerocities.app/resource-2247

Harrison, C., Eckman, B., Hamilton, R., Hartswick, P., Kalagnanam, J., Paraszczak, J., & Williams, P. (2010). Foundations for smarter cities. *IBM Journal of Research and Development*, *54*(4), 1–16. https://doi.org/10.1147/JRD.2010.2048257

Harrison, T. M., Guerrero, S., Burke, G. B., Cook, M., Cresswell, A., Helbig, N., & Pardo, T. (2012). Open government and e-government: Democratic challenges from a public value perspective. *Information Polity*, *17*(2), 83–97. https://doi.org/10.3233/IP-2012-0269

Heinelt, H., & Niederhafner, S. (2008). Cities and organized interest intermediation in the EU multilevel system. European Urban and Regional Studies, 15(2), 173-187.

Herath, H., & Mittal, M. (2022). Adoption of artificial intelligence in smart cities: A comprehensive review. *International Journal of Information Management Data Insights*, *2*(1), 100076. https://doi.org/10.1016/j.jjimei.2022.100076

Höglund, L., & Linton, G. (2017). Smart specialization in regional innovation systems: a quadruple helix perspective. *R and D Management*, *48*(1), 60–72. https://doi.org/10.1111/radm.12306

Hohenberg, P. M. (2004). Chapter 67 The historical geography of European cities: An interpretive essay. *Handbook of regional and urban economics*, 3021–3052. https://doi.org/10.1016/s1574-0080(04)80024-5

Hollands, R. G. (2008). Will the real smart city please stand up? *City*, *12*(3), 303–320. https://doi.org/10.1080/13604810802479126

Hollands, R. G. (2015). Critical interventions into the corporate smart city. *Cambridge Journal of Regions Economy and Society*, *8*(1), 61–77. https://doi.org/10.1093/cjres/rsu011

Hooghe, L., & Marks, G. (2003). Unraveling the central state? Types of multi-level governance. American Political Science Review, 97(2), 233-243.

Hoon Lee, J., Phaal, R., & Lee, S.-H. (2013). An integrated service-device-technology roadmap for smart city development. *Technological Forecasting & Social Change*, *80*(2), 286–306.

Horizon 2020. (2017). SynchroniCity: Delivering an IoT enabled Digital Single Market for Europe and Beyond. In *Cordis*. https://doi.org/10.3030/732240

Ilyas, M. (2023). Smart cities: challenges and opportunities. *Journal of Systemics, Cybernetics, and Informatics/Journal of Systemics Cybernetics and Informatics*, *21*(4), 1–6. https://doi.org/10.54808/jsci.21.04.1

Ingenio. (2024, May 15). Telosa, la città tecnologica e sostenibile progettata nel deserto che sfida l'utopia. *Ingenio*. https://www.ingenio-web.it/articoli/telosa-la-citta-tecnologica-e-sostenibile-progettata-nel-deserto-che-sfida-l-utopia/

Jessop, B. (1999). The changing governance of welfare: Recent trends in its primary functions, scale, and modes of coordination. *Social Policy and Administration*, *33*(4), 348–359.

Jimenez, J., (2018). Smart transportation systems. In: *Smart cities. Springer*, Cham, 123–133

John, P. (2001). Local governance in Western Europe. SAGE.

Joshi, R., & Ahmed, S. (2016). Status and challenges of municipal solid waste management in India: A review. *Sustainable Environment*, *2*(1), 1139434. https://doi.org/10.1080/23311843.2016.1139434

Klijn, E., & Skelcher, C. (2007). Democracy and Governance Networks: Compatible or Not? *Public Administration*, *85*(3), 587–608. https://doi.org/10.1111/j.1467-9299.2007.00662.x

Komninos, N. (2002). *Intelligent cities: Innovation, Knowledge Systems, and Digital Spaces*. Taylor & Francis.

Komninos, N. (2008). *Intelligent cities and globalisation of innovation networks*. Routledge.

Kooiman, J. (2003). *Governing as governance*. SAGE. https://doi.org/10.4135/9781446215012

Kourtit, K., Nijkamp, P., & Arribas, D. (2012). Smart cities in perspective – a comparative European study by means of self-organizing maps. *Innovation the European Journal of Social Science Research, 25*(2), 229–246. https://doi.org/10.1080/13511610.2012.660330

Kozlowski, W., & Suwar, K. (2021). Smart City: Definitions, dimensions, and initiatives. *European Research Studies Journal, XXIV* (Special Issue 3), 509–520. https://doi.org/10.35808/ersj/2442

Kugleta. (2017, March 15). *What is Horizon 2020? - Horizon 2020 - European Commission*. Horizon 2020 - European Commission. https://wayback.archive-it.org/12090/20220124080607/https://ec.europa.eu/programmes/horizon2020/what-horizon-2020

Landry, C. (2000). *The creative city: A Toolkit for Urban Innovators*. Earthscan.

Lim, Y., Edelenbos, J., & Gianoli, A. (2022). Dynamics in the governance of smart cities: Insights from South Korean smart cities. *International Journal of Urban Sciences*, *27*(sup1), 183–205. https://doi.org/10.1080/12265934.2022.2063158

Lindskog, H. (2004). Smart communities initiatives. In *Proceedings of the 3rd ISOneWorld Conference* (Las Vegas, NV, Apr 14-16). Available at http://www.heldag.com/articles/Smart%20communities%20a pril%202004.pdf.

Living-in. (2023, September 20). *Interoperability going local*. Living in EU. https://living-in.eu/news/interoperability-going-local

Lobo, R. (n.d.). *Could Songdo be the world's smartest city?* World Finance. https://www.worldfinance.com/inward-investment/could-songdo-be-the-worlds-smartest-city

Luque-Ayala, A., & Marvin, S. (2015). Developing a critical understanding of smart urbanism? *Urban Studies*, *52*(12), 2105–2116. https://doi.org/10.1177/0042098015577319

Manghnani, N., & Bajaj, K. (2014). Masdar City: A model of urban Environmental Sustainability. *International Journal of Engineering Research and Applications*, *4*(10), 38–42. https://doaj.org/article/da7825616f78497ead286ebe5cad5b90

Marsh, B. N. (2023, December 5). *Forest City: Inside Malaysia's Chinese-built "ghost city."* https://www.bbc.com/news/business-67610677

Marshall, A. J. (2003). Urban and local governance: The growing European dimension. Journal of European Public Policy, 10(3), 478–485.

Marshall, A. J. (2005). Europeanization at the urban level: Local actors, institutions and the dynamics of multi-level interaction. Journal of European Public Policy, 12(4), 668-686.

Marshall, A. J. (2008). Local governance. In I. Bache & A. Jordan (Eds.), The Europeanization of British politics (pp. 98-115). Palgrave Macmillan.

Maschio, I. (n.d.). *European Innovation Partnership on smart cities and Communities*. E3P. https://e3p.jrc.ec.europa.eu/articles/european-innovation-partnership-smart-cities-and-communities

Mc.Storti. (2023, June 7). *Megacities: definition, urbanistic growth and new infrastructures*. We Build Value. https://www.webuildvalue.com/en/megatrends/megacities.html

McGirk, J. (2020, May 14). Why eco-cities fail. *Dialogue Earth*. https://dialogue.earth/en/uncategorized/7934-why-eco-cities-fail/

Meijer, A., & Bolívar, M. P. R. (2015). Governing the smart city: A review of the literature on smart urban governance. *International Review of Administrative Sciences*, *82*(2), 392–408. https://doi.org/10.1177/0020852314564308

Menotti, M. D. &. R. (2018, September 8). Il ritorno delle città-Stato nell'epoca globale. Aspenia Online. https://aspeniaonline.it/il-ritorno-delle-citta-stato-nellepoca-globale/

Monzon A. (2015), Smart cities concept and challenges: bases for the assessment of smart city projects. In: *International conference on smart cities and green ICT systems (SMARTGREENS)*, pp.1–11. New York: IEEE

Morisson, A., & Pattinson, M. (2020). *Smart Specialisation Strategy (S3)*. Interreg Europe Policy Learning Platform.

Moura, F., & De Abreu E Silva, J. (2019). Smart Cities: Definitions, evolution of the concept and examples of initiatives. *Encyclopedia of the UN sustainable development goals*, 1–9. https://doi.org/10.1007/978-3-319-71059-4_6-1

Nam, T., & Pardo, T. A. (2011). Conceptualizing smart city with dimensions of technology, people, and institutions. In *Proceedings of the 12th Annual International Conference on Digital Government Research* (pp. 282–291). https://doi.org/10.1145/2037556.2037602

Nesti, G. (2018). *Trasformazioni Urbane* (1st ed.). Carocci Editore.

Nesti, G., & Graziano, P. R. (2019). The democratic anchorage of governance networks in smart cities: an empirical assessment. *Public Management Review*, *22*(5), 648–667. https://doi.org/10.1080/14719037.2019.1588355

Nowodziński, P. (2023, March 21). *Smart Cities Challenges and Opportunities - StartSmart CEE*. StartSmart CEE. https://startsmartcee.org/smart-cities-challenges-and-opportunities/

Park, S. J. (2024, July 4). Revisit the values of Songdo Smart City - Sung Jin Park - Medium. *Medium*. https://sparksmartcity.medium.com/revisit-the-values-of-songdo-smart-city-31fbec08c707

Parkinson, M. P. (2005). Urban Policy in Europe: where have we been and where are we going? https://www.researchgate.net/publication/268354377_URBAN_POLICY_IN_EUROPE_WHERE_HAVE_WE_BEEN_AND_WHERE_ARE_WE_GOING_Draft

Peterson Institute for International Economics. (2018). *What Is Globalization? And How Has the Global Economy Shaped the United States?*. https://www.piie.com/microsites/globalization/what-is-globalization

Pierce, P., & Andersson, B. (2017). Challenges with smart cities initiatives: A municipal decision makers perspective. *Proceedings of the . . . Annual Hawaii International Conference on System Sciences/Proceedings of the Annual Hawaii International Conference on System Sciences*. https://doi.org/10.24251/hicss.2017.339

Pierre, J. (1999). Models of urban governance. *Urban Affairs Review*, *34*(3), 372–396. https://doi.org/10.1177/10780879922183940

Pill, M. (2021). *Governing cities: Politics and Policy*. Springer Nature.

Plumb, D., Leverman, A., & McGray, R. (2007b). The learning city in a 'planet of slums.' *Studies in Continuing Education*, *29*(1), 37–50. https://doi.org/10.1080/01580370601146296

Prieto, C. (2024a, July 18). *Engaging public and private partners on Portal CCC tools & indicators*. NetZeroCities. https://netzerocities.eu/2023/10/03/engaging-public-and-private-partners-on-portal-ccc-tools-indicators/

Prieto, C. (2024b, August 22). *Climate City contract - NetZeroCities*. NetZeroCities. https://netzerocities.eu/climate-city-contract/#

Quaglia, L., Neuvonen, M., Miyakoshi, M., & Cini, M. (2007). Europeanization. In M. Cini (Ed.), European Union politics (pp. 405-420). Oxford University Press.

Radaelli, C. M. (2006). Europeanization: Solution or problem?. In M. Cini & A. K. Bourne (Eds.), Palgrave advances in European Union studies (pp. 56-76). Palgrave.

Rampton, J. R. (2020). *Assessment Study of the Urban Innovative Actions 2014-2020*. https://ec.europa.eu/regional_policy/sources/studies/assess_uia_2014_2020_en.pdf

Ranga, M., & Etzkowitz, H. (2013). Triple Helix Systems: an analytical framework for innovation policy and practice in the knowledge Society. *Industry and Higher Education*, *27*(4), 237–262. https://doi.org/10.5367/ihe.2013.0165

Rhodes, R. A. W. (1996). The new governance: Governing without government. *Political Studies*.

Romanelli, M. (2013). E-city councils within Italian smart cities. *IFKAD 2013: 8th International Forum on Knowledge Asset Dynamics: Smart Growth: Organizations, Cities and Communities*, 390–406.

Rosenau, J. (2003). Distant proximities. Dynamics beyond globalization. Princeton University Press.

Ruhlandt, R. W. S. (2018). The governance of smart cities: A systematic literature review. *Cities*, *81*, 1–23. https://doi.org/10.1016/j.cities.2018.02.014

Russo, F., Rindone, C., & Panuccio, P. (2014). The process of smart city definition at an EU level. *WIT Transactions on Ecology and the Environment*. https://doi.org/10.2495/sc140832

Sánchez-Corcuera, R., Nuñez-Marcos, A., Sesma-Solance, J., Bilbao-Jayo, A., Mulero, R., Zulaika, U., Azkune, G., & Almeida, A. (2019). Smart cities survey: Technologies, application domains and challenges for the cities of the future. *International Journal of Distributed Sensor Networks*, *15*(6), 155014771985398. https://doi.org/10.1177/1550147719853984

Sans, S. (2025, January 25). Barcelona abrirá una sede en Bruselas para liderar las políticas de vivienda. La Vanguardia. https://www.lavanguardia.com/local/barcelona/20250125/10318042/barcelona-abrira-sede-bruselas-liderar-politicas-vivienda.html

Senecat, C., Bucella, A., & Kneeshaw, S. (2021). *An Overview on Cohesion Policy: Opportunities for your Cities*. https://urbact.eu/sites/default/files/2023-03/cohesion_policy_study-_final.pdf

Simonofski, A., Asensio, E. S., De Smedt, J., & Snoeck, M. (2018). Hearing the voice of citizens in smart city design: the CitiVoice Framework. *Business & Information Systems Engineering*, *61*(6), 665–678. https://doi.org/10.1007/s12599-018-0547-z

Söderström, O., Paasche, T., & Klauser, F. (2014). Smart cities as corporate storytelling. *City*, *18*(3), 307–320. https://doi.org/10.1080/13604813.2014.906716

Sørensen, E., & Torfing, J. (2016). Metagoverning collaborative innovation in governance networks. *The American Review of Public Administration*, *47*(7), 826–839. https://doi.org/10.1177/0275074016643181

Sousa, M. (2018). *CARD4ALL | urbact.eu*. URBACT. https://urbact.eu/networks/card4all

Su, K., Li, J., & Fu, H. (2011, September 1). *Smart city and the applications*. https://doi.org/10.1109/icecc.2011.6066743

synchronicity-iot.eu. (2023, November 27). *SynchroniCity - Technology & Life • synchronicity-iot.eu*. https://www.synchronicity-iot.eu/

Taratori, R., Rodriguez-Fiscal, P., Pacho, M. A., Koutra, S., Pareja-Eastaway, M., & Thomas, D. (2021). Unveiling the Evolution of Innovation Ecosystems: An analysis of triple, quadruple, and quintuple helix model innovation systems in European case studies. *Sustainability*, *13*(14), 7582. https://doi.org/10.3390/su13147582

The Future of Privacy Forum. (2018). *City of Seattle Open Data Risk Assessment.* https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://fpf.org/wp-content/uploads/2018/01/FPF-Open-Data-Risk-Assessment-for-City-of-Seattle.pdf&ved=2ahUKEwiT7uOV9rWJAxXfhf0HHchjJ8EQFnoECBgQAQ&usg=AOvVaw12_F9c7ZLB5ySixdU7_7_1

The Office of the Deputy Prime Minister. (2005). *Bristol Accord Conclusions of Ministerial Informal on Sustainable Communities in Europe*.

Thomas, D. (2021). Unveiling the Evolution of Innovation Ecosystems: An analysis of triple, quadruple, and quintuple helix model innovation systems in European case studies. *Sustainability*, *13*(14), 7582. https://doi.org/10.3390/su13147582

Tomàs, M. (2023). The smart city and urban governance: the urban transformation of Barcelona, 2011–2023. *Urban Research & Practice*, *17*(4), 588–605. https://doi.org/10.1080/17535069.2023.2277205

Van den Bergh J and Viaene S. Key challenges for the smart city: turning ambition into reality. *In: Proceedings of the 48th Hawaii international conference on system sciences*, Kauai, HI, 5–8 January 2015, pp.2385–2394. New York: IEEE.

Vangen, S., & Huxham, C. (2013). Building and using the theory of collaborative advantage. In *Routledge eBooks* (pp. 65–81). https://doi.org/10.4324/9780203752562-12

Vanolo, A. (2013). SmartMentality: The Smart City as disciplinary strategy. *Urban Studies*, *51*(5), 883–898. https://doi.org/10.1177/0042098013494427

Viale Pereira, G., Cunha, M. A., Lampoltshammer, T. J., Parycek, P., & Testa, M. G. (2017). Increasing collaboration and participation in smart city governance: A cross-case analysis of smart city initiatives. *Information Technology for Development*, *23*(3).

Wach, K. (2014). Internationalisation and globalisation as the wider context of Europeanization processes from the macro- and microeconomic perspective. Horyzonty Polityki, 5(10), 11-30.

Walravens, N. (2012). Mobile business and the smart city: Developing a business model framework to include public design parameters for mobile city services. *Journal of Theoretical and Applied Electronic Commerce Research*, *7*(3), 121–135.

Washburn, D., Sindhu, U., Balaouras, S., Dines, R. A., Hayes, N. M., & Nelson, L. E. (2010). *Helping CIOs Understand "Smart City" Initiatives: Defining the Smart City, Its Drivers, and the Role of the CIO*. Cambridge, MA: Forrester Research, Inc. Available at http://public.dhe.ibm.com/partnerworld/pub/smb/smarterplanet/forr_help_cios_und_smart_city_initiatives.pdf

Weiss, T. G. (2000). Governance, good governance and global governance: Conceptual and actual challenges. *Third World Quarterly*, *21*, 795–814. http://dx.doi.org/10.1080/713701075

Wiktorska-Święcka, A. (2015). Europeanization of urban governance: Definitions, dimensions and perspectives (chapter 3). In P. Stanek & K. Wach (Eds.), Europeanization processes from the mesoeconomic perspective: Industries and policies (pp. 37-59). Cracow University of Economics.

World Urbanization Prospects: The 2018 Revision. (2019). https://doi.org/10.18356/b9e995fe-en

Yao, F. Y. (2015). Smart Cities Policies: From Strategy to Implementation. https://eprints.aesop-planning.eu/entities/publication/47c9be64-91c1-4750-9cda-24d7f1320e13

Yin, C., Xiong, Z., Chen, H., Wang, J., Cooper, D., & David, B. (2015). A literature survey on smart cities. *Science China Information Sciences*, *58*(10), 1–18. https://doi.org/10.1007/s11432-015-5397-4

Zhang, K., Ni, J., Yang, K., Liang, X., Ren, J., & Shen, X. S. (2017). Security and privacy in smart City Applications: challenges and solutions. *IEEE Communications Magazine*, *55*(1), 122–129. https://doi.org/10.1109/mcom.2017.1600267cm

Zou, Y., Jolly, B., Li, R., Wang, M., & Kaur, R. (2017). The Internet of Things: nervous system of the smart city. In *Springer eBooks* (pp. 75–96). https://doi.org/10.1007/978-3-319-59381-4_5