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# SMART CITY DEVELOPMENT IN ZORROTZAURRE, BILBAO A CASE ANALYSIS

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## ABSTRACT

The regeneration of Zorrotzaurre is the largest current urban development project in the city of Bilbao. However, certain challenges have arisen throughout this phase that must be solved in order to guarantee further successful development of the island. These challenges can be summarised in four key factors: *Governance, Talent Creation, Real Estate and Mobility*.

This report gathers a case analysis of six city districts in order to obtain *pragmatic* and robust lessons: Waterfront Toronto (Canada), 22@ -Barcelona (Spain), HafenCity – Hamburg (Germany), Innovation District- Porto (Portugal), Kalasatama -Helsinki (Finland) and Innovation District - Rotterdam (The Netherlands). The result of the analysis leads to seven core conclusions and corresponding action lines for the development of a *Human-centric Smart City* in Zorrotzaurre:

1. Centrality multiactor spaces as governance structures for district development
2. Holistic system for a bottom-up approach and citizens' participation
3. Importance of district development facilitators and agency
4. Living lab approach for smart specialization
5. Compliance of real estate with social and environmental standards
6. Mobility as an essential part of the district development process

The analysis is part of Bilbao Next Lab, the action research project facilitated by Orkestra in collaboration with Bilbao City Council in order to advance within the smart specializatio process of the city. According to the cogeneration model of action research, this report will be one of the contributions of the team of researchers from Orkestra to the process with the aim of defining specific policy instruments and actions for the development of the Zorrotzaurre district.

## RESUMEN

La regeneración de Zorrotzaurre es uno de los principales proyectos de desarrollo urbano de la ciudad de Bilbao. Sin embargo, el proyecto también cuenta con varios retos a abordar con el fin de asegurar un desarrollo satisfactorio de la isla. Dichos retos se agrupan en las siguientes dimensiones: *gobernanza, talento, gestión inmueble y movilidad*.

Este cuaderno recoge el análisis de seis distritos urbanos con el objetivo de extraer aprendizajes para el desarrollo de Zorrotzaurre y en relación a las dimensiones mencionadas: Waterfront Toronto (Canada), 22@ - Barcelona (España), HafenCity – Hamburgo (Alemania), Innovation District- Porto (Portugal), Kalasatama -Helsinki (Finlandia) y Innovation District - Rotterdam (Países Bajos). El análisis plantea las siguientes conclusiones y correspondientes líneas de acción con el objetivo de desarrollar un *Human-centric Smart City en Zorrotzaurre*:

1. Espacio multiagente para el desarrollo del distrito
2. Sistema holístico y pro-activo que impulse la participación ciudadana y la comunicación
3. Agencia como actor facilitador para el desarrollo de distrito
4. Aproximación living lab vinculada a la estrategia de especialización inteligente

5. Marcos regulatorios y normativos de urbanismo para el cumplimiento de estándares sociales y medioambientales
6. La movilidad como estrategia de desarrollo de distrito: cluster y modelo de distrito

El análisis es parte de Bilbao Next Lab, el proyecto de investigación acción facilitado por Orkestra en colaboración con el Ayuntamiento de Bilbao para impulsar la especialización inteligente de la ciudad. Este cuaderno es una de las contribuciones del equipo de Orkestra al proceso de investigación acción con el fin de definir instrumentos de política y acciones específicos para el desarrollo de Zorrotzaurre.

## LABURPENA

Zorrotzaurre irlaren garapena egungo hirigintza proiektu nagusienetako bat da Bilbon. Badira, ordea, garapen hori baldintzatzen duten zenbait erronka. Erronka hauek honako esparrutan taldeka daitezke: gobernantza, talentua, higiezinaren kudeaketa eta mugikortasuna.

Txosten honek sei distrituren analisia jasotzen du: Waterfront Toronto (Canada), 22@ -Barcelona (España), HafenCity – Hamburgo (Alemania), Innovation District- Porto (Portugal), Kalasatama -Helsinki (Finlandia) eta Innovation District - Rotterdam (Herbehereak). Analisiaren helburua, aurretik aipaturiko esparruetan Zorrotzaurren garapenerako ikasketak identifikatzea da. Honakoak dira, Zorrotzaurren *Human-Centric Smart City*a garatzeko bidean, analitik ondorioztaturiko ekintzarako lan-lerroak:

1. Distrituaren garapenerako agente-anitzeko espazioak
2. Hiritarren parte-hartzea eta komunikazioa sustatzeko sistema holistiko eta proaktiboa
3. Distrituaren garapenerako agentzia fazedorea
4. Espezializazio adimendua bultzatzeko living lab-a
5. Gizarte eta ingurugiro helburuak lortzeko hirigintzako arautegia
6. Mugikortasuna garapen estrategia modura: klusterra eta distritu eredua

Analisi hau Bilbao Next Lab, ikerketa ekintza proiektuaren parte da. Orkestrak fazedatu eta Bilboko Udalarekin batera garatzen duen proiektu honek hiriko espezializazio adimendunerako estrategia bultzatzea du helburu. Txosten hau ikertzaileek ikerketa-ekintza prozesuan egiten duten ekarpenetako bat da eta horren bitartez, Zorrotzaurren garapena ahalbidetuko duten politika-tresna eta ekintzak bideratzea da xedea.

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## LIST OF ACRONYMS

UN	United Nations
S3	Smart Specialisation Strategy
OECD	Organisation for Economic and Co-operation and Development
KIBS	Knowledge Intensive Business Services
CCI	Culture and Creativity Industries
WT	Waterfront Toronto
BIT Habitat	Barcelona Institute of Technology for Habitat
PEMB	The Barcelona Metropolitan Strategic Plan (Pla Estratègic Metropolità de Barcleona)
HCH GmbH	HafenCity Hamburg GmbH
RID	Rotterdam Innovation District
IoT	Internet of Things



## OBJECTIVE AND CONTENTS OF THE REPORT

For the past century, urban regions have grown in size substantially. Since 1950, the global urban population has increased from 751 million to 4.2 billion people (United Nations, 2018), and this development has not ended yet: according to the UN Development report (2018), around 2.5 billion more people will be living in cities by 2050.

Deductively, cities and urban areas have gained and will further gain in importance, not only in demographic, but also in social, cultural, economic and political parameters. Naturally, this entails a list of challenges that need to be addressed in order to satisfy a city's citizens, including infrastructure and facilities (educational, cultural, economic), the environment, city services and citizens' personal situation (European Commission, 2013).

This report focuses on the case of Bilbao (Basque Country, Spain) and, specifically, on Zorrotzaurre, the new Urban Innovation District of the city. For the city of Bilbao - which is increasingly being perceived as a cultural and economic hotspot of Northern Spain on the other hand (Gimeno, 2019) - the challenges mentioned previously are of the utmost importance to meet too. As a next major step towards an internationally recognised role in terms of urban competitiveness, the city of Bilbao is striving to develop a former industrial area by the name of Zorrotzaurre into an economic and social powerhouse of the city: the objective is to transform the district into an "island for living, working and enjoying" (Zorrotzaurre, 2019).

The approach of the 'Smart City' development has gained widespread popularity in this sense and will therefore be introduced as one of the central theoretical frameworks of the report. However, there is no compelling *definition* of the term 'Smart City' in current literature. The main framework in this report is the one put forward by Hajer and Dassen (2014), who refer to the Smart City as a holistic human-centric system and describe the 'Human-centric Smart City' based on six pillars: Smart Economy, Smart People, Smart Governance, Smart Mobility, Smart Living and Smart Environment.

The Human-Centric Smart City framework is described after details of the methodology used for the case analysis have been provided. Later, the challenges being faced by the development of Zorrotzaurre are presented followed by an analysis of each of the cases. Finally, the last section contains specific conclusions and lessons learnt.

## 1 METHODOLOGY

This report is part of Bilbao Next Lab, the action research project facilitated by Orkestra in collaboration with Bilbao City Council in order to advance within the smart specialization process of the city. The authors of the report (belonging to Orkestra) arranged a workshop that took place on 15th March 2019, which

focused on discussing the challenges facing the development of Zorrotzaurre. By the time of the workshop, the City Council had already progressed in developing Execution Unit 1 of the district.<sup>1</sup>

The challenges defined within the workshop with policy makers were mainly related to the development of Zorrotzaurre's Innovation District as a space for smart specialisation, so as to contribute to the urban Smart Specialisation Strategy (henceforth S3). Four city councillors, one member of the Board of Directors of Bilbao Ekintza and three researchers from Orkestra participated in the workshop facilitated by researchers. The Orkestra researchers and policy makers agreed on developing this case analysis in order to identify lessons to solve the challenges discussed. Researchers proposed the 'Human-Centric Smart City' concept as a conceptual and analytical framework for the case analysis. The prioritized challenges and focus areas that were pursued in the workshop were revisited in further ongoing discussions with city representatives as part of the research process for this report, in order to obtain in-depth refinements for the specific wording and specific approach towards the case analysis. These meetings were held between April and May 2019.

Within the framework of action research, the case study is used as a method for this analysis to provide tools to study complex phenomena s within the contexts studied (Baxter and Jack, 2008). Certain districts were then selected to be analysed in detail. The districts needed to have an exceptional reputation in at least one of the four defined focus areas corresponding to challenges facing the development of Zorrotzaurre. The selection process started with an analysis of official documents - either published by the respective city administration itself or by agencies in charge of district development- or through communication with city policy makers and researchers from Orkestra.

Throughout the research it became apparent that the comparison should include different city districts with a wide variety of approaches and sizes in order to be able to provide a holistic response to the challenges defined. This procedure is in line with very in-depth knowledge and the explanations given by Hakim (1987), in that the case-study methodology should provide a richly detailed portrait of a particular phenomenon. In accordance with this approach, in total six city areas were selected that have different main priorities in their strategy, but that are attached to the challenges facing Zorrotzaurre in an overall holistic framework.

A research approach solely based on statistics and a quantitative method would miss out on the ability to interpret the results and the holistic view in order to gain a better contextual perception. This is why a more detailed and non-statistical comparison got underway based on interviews with policy makers of the six cities and corresponding districts (see Figure 1). Interview appointments were suggested and arranged, followed by an introduction to the challenges defined and the specific objectives subject to discussion.

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<sup>1</sup> This first Execution Unit covers an area of 389,995m<sup>2</sup> and includes the entire right bank of the Deusto Canal and the northern and southern ends of the future island (Zorrotzaurre.com, 2018)

**Table 1** Calendar of interviews for case analysis

City/District	Interviewed persons	Organization	Date	Format	Involved persons from research side
<b>Toronto/ Waterfront Toronto</b>	Aaron Barter, Innovation and Sustainability Manager	Waterfront Toronto, public development agency	May, 22nd	Phone conference	Eva Salcedo (Bilbao Ekintza), Miren Estensoro (Orkestra), Martin Jacobs (Orkestra)
<b>Barcelona /22@</b>	David Martínez García. Project Director 22@. Pau Planelles Oliva, Technical. Project Management	BIT Habitat / 22@ coordination committee, public innovation agency	May, 27th	Phone conference and mail communication	Eva Salcedo (Bilbao Ekintza), Miren Estensoro (Orkestra), Martin Jacobs (Orkestra)
<b>Hamburg/ HafenCity</b>	Kerstin Fröhlich, assistant to the executive board	HafenCity Hamburg GmbH, public management agency of the Hafencity	May, 20th	Direct meeting in Hamburg and mail communication	Martin Jacobs (Orkestra)
<b>Porto/Innovation District</b>	1.Interview: Qian Wu Antunes Ribeiro, Project Manager 2.Interview: Ricardo Valente, City Councilor for Economy, Tourism and Commerce	InvestPorto, public economic Development agency	May, 29th and July, 15th	Phone conference and mail communication	Eva Salcedo (Bilbao Ekintza), Miren Estensoro (Orkestra), Martin Jacobs (Orkestra)
<b>Helsinki/ Kalasatama</b>	Kerkko Vanhanen, programme director Smart Kalasatama	Forum Virium, city innovation company	June, 27th	Phone conference	Miren Estensoro, Martin Jacobs (both Orkestra)
<b>Rotterdam /Innovation District</b>	Hendrik-Jan Bosch, political coordinator for city	Urban development department of the city of Rotterdam	June, 21st	Phone conference	Miren Estensoro, Martin Jacobs (both Orkestra)

Source: Authors' research (2019)

The post-interview phase was filled with a further exchange of relevant documents and with questions that arose in the aftermath of the meeting. The final analysis of the entire case study was developed through a structure-based comparison of the different cases, as this procedure allows the researcher to *look at the responses to each topic and specific question individually* (O'Connor and Gibson, 2003: 63).

Specifically, the comparison structure for this case was split into the four topics according to the challenges defined together with policy makers: *Governance, Talent Creation, Real Estate* and *Mobility*. Answers were therefore integrated into one of these topics and utilised in order to create a clear comparison between the six respectively analysed districts (see Section 5 and 6).

According to the cogeneration model of action research, this report will be one of the contributions of the team of researchers from Orkestra to the process with the aim of defining specific policy instruments and actions for the development of the Zorrotzaurre district. Specific workshops, arranged by researchers, will take place in 2020 for such purpose.

## 2 THEORETICAL FRAMEWORK: HUMAN-CENTRIC SMART CITY

Smart City concept is one of the main approaches when discussing urban competitiveness (Gargiulo and Tremitterra, 2015; Organisation for Economic, Co-operation and Development 2019, henceforth OECD). Thus, a reflection of the Smart City approach is also required when considering the right framework for urban competitiveness.

According to James (2014), a comprehensive competitiveness strategy for each city or town or village is based on its own critical issues and actions. Deriving from this individual approach, the framework is not intended as a universal guideline, although an analysis of the standard of theory will illustrate trends that will certainly have an effect on urban development projects.

Urban areas are defined by Eurostat as the sum of cities and towns and suburbs. In accordance with this explanation, Smart Cities are geographically a part of urban areas, as they are located in city regions (Eurostat, 2018). The actual meaning of the paradigm Smart City is, however, not defined within a consistent framework, as multiple approaches use different wordings. There is a lack of “a clear and sound definition, (...) not only in academic studies, but also in empirical applications of smart concepts and projects”, as Dameri (2013) explains in her search for a comprehensive definition of smart cities (Dameri, 2013, p. 3).

In most definitions, the term contains a significant focus on the use of technologies, specifically Big Data and the Internet of Things (henceforth IoT). Nevertheless, the term goes beyond technological integration, steering towards a holistic concept that addresses the rest of environmental, social and economic challenges (Albino, Berardi and Dangelico, 2015). Thus, the concept of the Smart City “is far from being limited to the application of technologies to cities” (Albino, Berardi and Dangelico, 2015, p. 4). Primarily, smart technology should be understood as a tool, rather than being an approach itself.

In order to provide a Smart City definition that takes on a more holistic approach, Hajer and Dassen (2014) use six pillars that fill a mixed-use concept of a Smart City inspired in a human-centric approach:

- Smart Economy: Focus on innovation and entrepreneurship and the living lab approach<sup>2</sup>

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<sup>2</sup> Living lab is a concept that is described to be open in terms of legislation and rich in shared facilities in which companies may foster a testbed environment, providing major exchange of communication and a great diversity of people acting and living within it (OECD, 2019)

- Smart People: The “contributions to social and human capital, including educational attainment, lifelong learning, openness to what is ‘new’, and integration into public life”
- Smart Governance: Related to citizens’ participation, well accessible local administration and public services
- Smart Mobility: Local and international accessibility and “innovations towards sustainable mobility”
- Smart Living: Overall quality of life for citizens, including amongst others health care, cultural diversity, security and social cohesion
- Smart Environment: Focus on environmental protection and resource management, e.g. preservation of green spaces

According to Hajer and Dassen, it is of the utmost importance that such framework furthermore should have a specific target – specifically, it should revolve around the citizen at the centre (Hajer & Dassen, 2014).

### 3 THE CASE: ZORROTZAURRE IN BILBAO

#### 3.1 Zorrotzaurre: history and evolution

The former peninsula of Zorrotzaurre – which was transformed into an island to ensure the non-floodability of the area in 2018 - is located “in the heart of Bilbao”, closely connected to the central city area of Abando and the central bus station of San Mamés, and situated on the banks of the Nervión river (Bilbao City Hall, 2018).

Around 500 people are currently living on the island, partly between industrial ruins and an area of wild flora and fauna among building rubble. Just one century ago, the area was full of industrial and water activities that put Bilbao onto the map of commercial activities worldwide. However, during the industrial crisis of the 1970s, the city’s economic activity decreased and no investments were made in order to revive the area. In a further development, the district was often used as a site for car lots, parking spaces for trucks, vehicles from the Bilbao public transport system and even from large discotheques (Diez, 2017).

According to Diez (2017), with the new century starting, citizens were receiving rumours that there was supposed to be a new plan of use for the Zorrotzaurre peninsula. Due to such information, citizens were suggesting a room for debate with regards to the future development of the peninsula, resulting in an initial forum in 2004 that consisted of politicians, citizens, experts and representatives of the economic sector as well as well from the team of Zaha Hadid, the potential future designer of the district (Diez, 2017). This forum was set up permanently, resulting in the organisation of the European Awareness Scenario Workshop that should shed light on common visions for the Zorrotzaurre district. This workshop managed to set out three focus areas that the 59 members commonly agreed upon: The terms ‘eco-ciudad’ (eco-city), ‘Zorrotzaurre verde’ (green Zorrotzaurre) and ‘Barrio pensado para el peatón’ (District devised for the pedestrian) (Diez, 2017, 9). Also in 2004, Zaha Hadid launched the official Master Plan for the district, which was renewed in the year 2007 and included the re-opening of the Deusto canal and the plan to cut the peninsula off from the mainland (Zorrotzaurre, 2019). In both plans, Hadid integrated certain ideas and conclusions from the forum that was first established in 2004 – for example, more car-free green spaces and streets (Diez, 2017). The ideas and conclusions were also based on the findings of the city

administration, identifying challenges in 2004 such as land pollution, the many private owners within the district and the need for a new public transport and infrastructure system. The final plan was approved by the Bilbao City Council in 2012 (Zorrotzaurre, 2019).

### 3.2 Project description: General overview and current objectives

The island of Zorrotzaurre is the latest urban expansion area of Bilbao, the aim of which is to turn the above described abandoned industrial area into an 'island for living, working and enjoying'.

Since approval of the final plan in 2012, the area has been re-developed constantly: old industrial buildings (in total 19) are making room for new spaces with different uses, while two thirds of the new Zorrotzaurre are envisaged for public use. The Master Plan recovers more than 800.000 m<sup>2</sup>, creating a renewed area of opportunity in Bilbao, including 154,066 km<sup>2</sup> of open spaces and 93,537 km<sup>2</sup> set aside for public facilities for educational, health, sport and cultural uses (Bilbao Ekintza, 2019).

The main theme of the largest inner-city project was to transform the area from an industrial peninsula into a *creative island* (Bilbao City Hall, 2018). It will include a comprehensive mixed use of the land – involving residential, secondary, tertiary and public facilities – and focuses on the “fields and priority sectors of smart specialisation for the municipality of Bilbao” (Bilbao City Hall, 2018, p. 8). Four paradigms are of relevance: a sustainable, knowledge-based, innovative and living island.

The first pillar - sustainability - incorporates a flood risk reduction system, zero emission buildings, facilities for electric cars, a 100% electric public transport system and rainwater tank pumping and cleaning systems. A 20 metre-wide footpath alongside one of the banks, three bridges to the mainland and one main street connecting the north and south of the island, are supposed to form the core of the public transport infrastructure system (Bilbao Ekintza, 2019).

The second pillar - knowledge - is based on an entire ecosystem of universities and higher education establishments. This corresponds to a talent attraction strategy and to the 'creative island' approach. The third pillar - innovation - focuses on the promotion of economic activity and especially on the Knowledge Intensive Business Services (henceforth KIBS<sup>1</sup>) sector, related to digital and technological business sectors. In this regard, the island will be divided up according to content into the North Innovation Urban District – which will bring together Culture and Creativity Industries (henceforth CCI)- and the South Innovation Urban District – which will bring together Internet Digital Technology and other Advanced Service Industries (Bilbao City Hall, 2018).

The aim of the fourth and last pillar - living - is to enhance the best possible environment for coexistence, specifically involving parameters such as housing, sports facilities, green spaces, preservation of the industrial heritage, student accommodation, culture and creative spaces as well as health facilities. The old area representing the industrial character of the island will be maintained.

The expected impact of this district development process is based on multiple layers: the “reinforcement of innovation, creativity, creation of job opportunities and capacities” is of great importance, in which new uses of the district's historical heritage are exploited (Bilbao Ekintza, 2019, p. 7). In total, 6.000 jobs will be created via development of the island. Furthermore, new co-created plans for the regeneration of historic urban areas into innovation hubs are central, including an improved quality of life and greater social cohesion of citizens within the city (Bilbao Ekintza, 2019, p. 7)

The Execution Unit 1 (which covers an area of 389,654 m<sup>2</sup> and is divided into 208 plots which belong to 59 different owners) is the southern part of the island and more advanced while Execution Unit 2 and 3 remain less developed (Bilbao City Hall, 2018).

### 3.3 Governance model for Zorrotzaurre

La 'Junta de Concertación' (Contracting Board), set up on October 15th 2013, is responsible for "the drawing up and processing of the land reorganisation project and the urbanisation project and any other projects necessary to achieve the urbanisation objectives of the area" (Zorrotzaurre, 2019). Originally, the board comprised the Basque Government, the Bilbao City Council, Visesa (a public organisation engaged in the promotion of urban living areas), Vicinay Cadenas S.A. (a firm located in the district and one of the main landowners) and Margen Derecha (a firm and landowner). To date, four more owners have joined the Board: the Spanish Government, FCC (a firm, infrastructure and environmental solution provider) and two further private owners (Zorrotzaurre, 2018). These nine public and private owners hold 78.6% of the entire 389,654 m<sup>2</sup> in Execution Unit 1. Execution Unit 2 comprises the inner part of the island, plus the northern and southern riverbanks, and land ownership is divided up into a large number of small owners. Nevertheless, in total, the whole district is 51% owned by public administration, with 40.4% owned by the Basque Government and 10.6% by the City Council of Bilbao (Bilbao City Hall, 2018).

Despite the management committee consisting of nine different actors, there are more stakeholders involved in the development of the island. Universities such as Digipen and Mondragon University which are developing the 'AS Fabrik project' (Urban Innovative Action, 2019), vocational training centres (Tknika or Kunsthal), cluster associations (Gaia), technology centres (Tecnalia), private firms (Idom) and entrepreneurs related to CCI (Open Space, ZAWP and Pabellon 6) are involved in the different initiatives and projects being pursued in the area (Bilbao Ekintza, 2019).

### 3.4 Challenges facing the development of Zorrotzaurre

As described in section 2, the case analysis presented in section 5 forms is related to the list of challenges and focus areas discussed and agreed with city policy makers participating in the Bilbao Next Lab project. These challenges and focus areas are based on four core issues: *Governance*, *Talent Creation*, *Real Estate* and *Mobility*, in which the first two pillars play a predominant role due to the challenge of developing Zorrotzaurre as a space for smart specialisation. In this section, each of the challenges is described and linked to the theoretical framework developed in section 3.

The first challenge concerns the *governance* of the district. In keeping with the bottom-up approach that determines the Smart City framework, the challenge is whether this approach is also transferable to the district of Zorrotzaurre. This would include public participation (of citizens and companies) and an accessible local administration and service network. Likewise, the importance of constructing a governance model within the City Council, including the different departments and the development of multilevel governance together with the provincial and regional governments, constitute the main focus. For the district of Zorrotzaurre, the citizen should be the centrepiece, in line with the human-centric development approach. The link to social challenge further finds ground in aspects of social cohesion. Moreover, it is related to the Smart Governance and Smart People pillars described in Section 3 (2014).

The second challenge refers to *Talent creation*: how to create knowledge and attract/retain talent to/in Zorrotzaurre. This is linked to the importance of creating an innovative environment including educational



establishments and a diversified employment structure. The 'living lab' approach included in the Smart Economy approach (Hajer and Dassen, 2014) is in turn linked to this challenge. The focus is on increasing knowledge within and between different industries and stakeholder groups as well as on the creation of a diversified, entrepreneurial and talented environment that provides a high-level quality of life.

The potential to develop a talented environment is also linked to the appeal of the districts and consequently to the third focus area: *Real Estate*. The mixed-use approach is essential to ensure the quality of life for citizens and the district's appeal. Likewise, sustainability should also be the core approach in planning processes. According to Hajer and Dassen (2014), the preservation of open and green spaces is furthermore important to ensure sustainability in the district and the quality of life of citizens. However, urban planning processes also depend on the ownership status of the real estate and, as is the case with Zorrozaurre, the use of ground floors can be decisive.

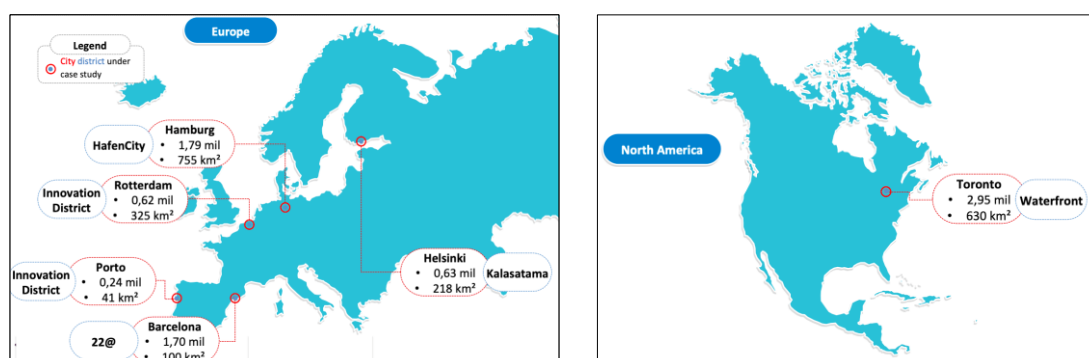
The right *mobility* approach in the district is the fourth and last focus matter. As identified in section 3, mobility within the Human-Centric Smart City framework focuses on local and international accessibility and fosters "innovations towards sustainable" paths.

#### 4 SMART CITY DEVELOPMENT – CASE ANALYSIS

The following case analysis enables lessons learnt and specific recommendations to be identified in order to inspire solutions to the focus areas described previously. The six selected city districts included in the case analysis are described according to these focus areas and later compared.

Figure 1 also gives an overview of the geographical location of the cities and respective districts subject to case study. While five of the cities are located in Europe, the city of Toronto is in Canada, in North America. This information is completed by some relevant information about the district in Table 2.

**Figure 1 Map of districts subject to case study**



Source: Author's research (2019)



**Table 2 District Overview**

Infrastructural setting	Districts						
		Barcelona 22@	Waterfront Toronto	Hamburg HafenCity	Porto Innovation District	Helsinki Kalasatama	Rotterdam Innova. District
	Size	198 hectare	800 hectare	317 hectare	100 hectare (Asprela) + Campanha (>300 hectare)	157 hectare	-
	Population	>90.000	7.000	Around 15.000	Around 35.000 (mostly in Campanha)	3.000	-
	Jobs	>90.000 installed jobs	40 000 targeted jobs	>43 000	-	Targeted > 10.000	-
	Clusters	ICT, Media, Bio-Medical, Energy and Design	Media, film, ICT, Cultural arts	Construction and logistics, media and service sector	Advanced Engineering, Technologies and Materials; Creative Industries; Health and Life Sciences; Mobility Industries; Nearshore Services	Energy, mobility, waste and geothermic	Medical technology, food, clean tech and maritime

Source: Authors' research (2019)

#### 4.1 Waterfront Toronto

In 2000, a Waterfront Revitalization Task Force was launched in order to revive the district, which was an industrial brownfield area at that stage. Its goal: to "turn hundreds of acres of undeveloped and underutilized waterfront property into a vibrant mix of new residential neighbourhoods, parks, public spaces, and commercial areas" (Eidelman, 2013, p. 3). Not many people lived or still live there – the area currently comprises 7,000 inhabitants, with a long-term objective to house 16,000.

#### Governance

The governance approach is implemented via a three-fold system: the country of Canada, the state of Ontario and the municipality of Toronto have an equal share in the Waterfront Toronto (henceforth WT) area. This model is facilitated by the local development agency WT and is led by twelve board members who also form part of the Canadian, Ontario and municipality government. The board was funded by these three entities in 2001 and it provides a strong balance in terms of decision-making and investments that go beyond the typical electoral cycle. The knowledge structure of WT is very diverse: it comprises a significant 'Construction Management' area, a 'Planning and Design' area and a 'Development' area, and acts as a land development authority. Once the lands have been prepared for development (legally and infrastructurally), WT brings them to the market through a competitive process, and WT leads the public outreach to individual citizens and the community on behalf of governments. Furthermore, they are developing a bottom-up and top-down approach at the same time, due to an ongoing dialogue with community associations, but a relatively vertical decision-making competence on the other hand. A steering committee, which is of an intergovernmental nature consisting of senior public servants, also looks for alignments with policies in specific activities and topics.

Generally speaking, citizens' engagement is on a low level within the Waterfront area. The reason behind this is that it is a new neighbourhood – in which not many people live so far. However, WT organises online surveys and public testing in order to engage more people in the area. The most successful tool has been to launch public events and to speak with the few associations simultaneously.

The potential setting up of Sidewalk Labs, a Google company that intends to cooperate with WT and become the leading development agency for the district, may stand as a precedent for similar projects in the future: because data is a valuable source of commercial information about customers, companies are looking increasingly closely into urban regions, in which data generation is becoming more intense. Many citizens perceive this to be critical, though, as privacy issue arises. As regards info distribution, the area has lacked a consistent list of medium-term milestones via which the public may easily assess the implementation of plans. Its website is teeming with flashy renderings (Eidelman, 2019), and associations are being involved.

### ***Talent creation***

Toronto's talent pool consists of over 50% of people who were born outside Canada. "Because of our proximity to the US we've had an incredible amount of skilled labour immigration" (Barter, 2019), also pointing out the relatively low costs of living for workers. The city administration is additionally perceived as very welcoming and further tries to enhance skilled labour immigration via programs that simplify the process of integrating foreign-based employees.

Besides, via a dense network of companies on the waterfront, WT tries to bind working people to that area for living purposes, in order to create an "18 hour day" within the district. Coherent with this, the establishment of Sidewalk labs could attract other IT companies as well, perceiving the district as a potential living lab. In 2017, Toronto was employing 241,000 workers in the technology industry, according to Wong and Marotta (2018), with a further increase to be expected.

### ***Real Estate***

In the case of new projects, 20% of each building must include social housing prospects. This objective has been achieved in all cases since the start of the strategy and has been perceived as a major success due to its mixed community in single buildings. Investors and constructors have to align with these and other obligations set by WT, which are tending to become clearer and stricter.

So far, there has been no clear regulation regarding mixed use whatsoever. Primarily, the area is being used economically or by tourists, as it is located directly next to Lake Ontario. Additionally, regarding ground floors, no clear regulation has been established yet – even though WT intends to prevent the sole setting up of multinational companies on ground floors. For this purpose, though, small firms and shops often have to be sponsored, as the rents would otherwise be too high.

### ***Mobility***

"We've struggled to set up something viable, and it's been an impediment to accessing the neighbourhood, as a 15 minute walk is too much for people" (Barter, 2019). This lack of infrastructure would result in less motivation for "people to move to the district".

**Table 3 Summary Waterfront Toronto**

Governance	Talent Creation	Real Estate	Mobility
Three-folded approach provides balance in mid- and long-term strategy	Large talent pool due to large-scale immigration of skilled labour	20% of each new building must have social housing prospects	Almost no investments into mobility infrastructure as of current status
LDA acts as a land development authority and has a holistic knowledge structure	Open legislation for labour immigration	Obligations for new real estate constructions become more strict and planned	15 way walking from city centre too long for citizens
Steering committee organizes meetings with regular forums for senior servants	Sidewalk Labs could function as a trigger for living lab oriented companies	No plan for mixed-use of buildings	Water taxis may provide a tourist attraction, but do not constitute mass transportation
Steering committee organizes meetings with regular forums for senior servants	Intention to create an 18-hour day in the district	Prevention of sole setting up of multinational brands for ground floors	Low motivation of people to move to the district due to bad connection
Citizen participation on a low level due to low amount of people living in the area			
Setting up of Sidewalk Labs as development agency increases media attention and discussions due to privacy			
Low level of information distribution			

Source: Authors' research (2019)

#### 4.2 Barcelona 22@

The area of 22@, also known as the Innovation District of Barcelona, is an urban renewal area in the district of Poblenou in the San Marti area. It was formerly dominated by industry, and was earmarked to become a technology and innovation district to connect the local community and economy with international actors and countries. The plan for the area includes an area of 198,26 hectares, approximately 2% of the whole city's area. Development of the district can be divided structurally into two phases: the starting phase from 2000-2017 and the re-initialization phase from 2017 onwards.

##### Governance

After a phase in which no specific organisation was in charge of supervision of the district (2012-2017), the Coordination Committee ("Comisión de Coordinación 22@") was created in order to facilitate the social and sustainable development of the district. It is made up of the District of Sant Martí Government, relevant city

departments, the Barcelona Institute of Technology for Habitat (henceforth BIT Habitat) and the "Comisión Ampliada de 22@" (henceforth: Extended Committee 22@) that unites neighbourhood, firms, company associations and universities.

BIT Habitat, a local innovation agency that focuses on innovation for district development, is based on and operates the building Ca L'Alíer (a communication and innovation centre for companies) in the heart of Poblenu. Together with the Coordination Commission, BIT Habitat is responsible for the arranging multi-stakeholder meetings on a public level, and pursues competences based on four pillars: education, city government, local community and private economic sector.

Information is shared with citizens mainly via associations: since Extended Committee 22@ incorporates various local community associations, communication distance is short and of high frequency. The city also uses a sophisticated system of digital services to inform citizens and manage participation – e.g. for the 'Rethinking 22@' program or the decidim.Barcelona platform. Often processes are divided into three stages, ranging from open and round tables, via an online survey, to a final debate about specific proposals (including design competitions).

### ***Talent creation***

22@ district approaches economic development via a holistic framework based on a living lab culture and involving knowledge and education centres, innovation centres and company associations. The overall framework is the ECAT 2020, which focuses on fostering and linking the clusters of ICT, Media, Bio-Medical, Energy, and Design. This strategy is linked to the regional RIS3 and shares its main methodological approach. Specifically, 22@ is promoted as a 'Digital District', in which companies can test and create new ideas, and citizens are encouraged to use and delve into new technologies.

The city additionally intends to provide in 22@ the best platform for entrepreneurship, via a specific landing platform for foreign companies and a large network of accelerators and incubators. As described above, the Ca L'Alíer is, for example, a centre for innovation and will provide the feeling of having all the capabilities needed to form a company: space, network, services and knowledge. The facilities can be used by all companies, and the branding is fully public. Likewise, the 22@Network association is of great importance to the private sector in the district, as it works as network fostering collaboration across various sectors. It was set up in 2004.

### ***Real estate***

A current imbalance between residential and economic use will be solved by a 30% increase in residential use. In keeping with this imbalance, traditional old shops have often also vanished and been replaced by new, modern alternatives.

According to PEMB<sup>3</sup> (2018), the City Council should aim for a greater share of property in order to guarantee a more strategic approach to the sales and construction of property. Furthermore, the involvement of more actors in the design process constitutes a challenge in order to guarantee more diversified use (Barcelona City Hall, 2017).

To prevent further traditional old shops from vanishing in former industrial areas, the City Council provides support for the companies in the area to help them attract talented professionals and infrastructure. In a more mature stage of district development, the aim is to link certain old industrial areas with their conversion into a technical and innovation district.

### ***Mobility***

While the southern part of 22@ is well connected to the city centre and does not need clear improvements in public transport, the northern part is rather separated from the city centre and the rest of the district. Furthermore, the “bus and metro connection is one of the handicaps” of 22@ (Garcia and Oliva, 2019). Alternative methods are, however, already being planned - in particular, footpaths will be expanded, parking lots may be reduced, and e-scooters and bikes are being installed.

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<sup>3</sup> The Barcelona Metropolitan Strategic Plan (Pla Estratègic Metropolità de Barcelona - PEMB) is a private, not-for-profit association

**Table 4 Summary Barcelona 22@**

Governance	Talent Creation	Real Estate	Mobility
Coordination committee involving public and private stakeholders	Promotion for companies by providing a holistic service system and BIT Habitat as the primary communication partner	Imbalance of 90%/10% economic/social use while be changed to 70%/30%	Promotion of alternative transport methods such as bikes, e-scooters and footpaths
LDA based in innovation centre in the district, organizes multi-stakeholder meetings and is based on a quadruple helix	Company associations important for the system and supported by public administration	City Council aims for a larger share of property to establish more compelling strategy	Bus and metro system to be improved
Info distribution mainly via associations + digital services	Overall framework is fulfilling methods of RIS3	Promotion of traditional companies in fabric buildings to adapt digital knowledge	
Citizens' participation on a high level, as process is enhanced by BIT Habitat	Many programs to fill the RIS3 framework with action, which are linked to the Living Lab approach	Loosening up of regulations for factory real estate	
Open and round tables, online surveys and debate in associations are ways to involve citizens	Promotion of a Digital District that supports testbed environment and entrepreneurship		

Source: Author's research (2019)

#### 4.3 Hamburg HafenCity

The 'HafenCity' city development project is the major urban development project in Hamburg, and is divided into three areas: (i) The HafenCity itself, with an area of 157 hectares and which has been the first part to be developed; (ii) Billebogen with an area of 95 hectares; and (iii) Grasbrook with an area of 65 hectares, amounting to 317 hectares in total. The original Master Plan was released in 2000, and revised for the eastern part of the district in 2010.

##### **Governance**

The institutional setting of this district development process is divided into three pillars: the City Council of Hamburg, the HafenCity Hamburg GmbH (henceforth HCH GmbH) and the private sector. The Hamburg City Council is the actor in charge of setting the agenda for the project. This plan does not include the borough administration of Hamburg-Mitte, in which the HafenCity is located. There is a complementary project group

at the Authority for Urban Planning, which develops the land-use and development plan and sets guidelines for urban design and buildings.

The City Council provides the public management agency HCH GmbH with the infrastructure and public spaces, which receives state-owned land at zero costs. It acquires investors, sets new quality standards for building development, establishes contacts with the private, corporate sector and acts as an entrepreneurial master developer (HafenCity Hamburg GmbH, 2019). The functional setting of the HCH GmbH is divided into a supervisory board consisting of the mayor and five senators, control of the Ministry of Urban Development, and lastly an advisory committee of resident associations, which nonetheless acts at a low level (HafenCity Hamburg GmbH, 2019).

The third pillar - the private sector consisting of real estate firms and investors - involves the development of individual sites, creates building and public spaces and acts as conceptual urban innovators. These companies do not have any governmental power, however .

Information distribution for the district involves creating a strong brand image for the region: the HafenCity.com online platform provides details in English and German for various sectors and layers, and the "Kesselhaus" central information house provides an introduction about origin, strategy and progress of the HafenCity. In terms of citizens' participation, there was no inclusion of society in the original Master Plan. This was perceived as a problem and will therefore be changed.

### ***Talent Creation***

Construction and logistics, media and service are the most powerful industries in the district. The HafenCity, however, is more a place for multinational companies to set up base, rather than an entrepreneurial hub that fosters types of networking.

In general, there is no link to the framework of RIS3 in place, nor is there any collaboration between the educational and corporate sector (e.g. via collaboration between researchers and the corporate sector or support for vocational training centres). Neither are any innovation centres or other corporate collaboration facilities clearly supported in the district. These barriers to collaboration reduce the capability to attract companies that rely on external input and constant exchange, which has led to a different policy approach towards expanding areas, including co-working spaces and greater involvement of associations and meetings in the area.

### ***Real Estate***

100% of the land is owned by the HCH GmbH, which is still a public entity. This is perceived as an important aspect, as a compelling real estate strategy could be installed that is subject to the dimension of sustainability: construction needs to comply with levels of resource efficiency, technological openness, Co2 benchmarking, regenerative energy use and decentralised systems (HCH GmbH, 2018). In order to obtain approval for construction, the HCH GmbH assesses 30% of investor proposals in terms of finance, and 70% in terms of content aspects based on these pillars.

For ground-floor uses, there is a mixed-use share of around 11% for retail, 12% for restaurants and bars, 31% for economic activities and for 7.6% living, while the amount of retail - "especially supermarkets and discount stores - is under-represented". Furthermore, more small retailers are needed to create a diversified, more alternative culture and customer base. This is line with the social housing approach, as

there has no specific concept for affordable housing within the region yet, which has resulted in an expensive living area and low population diversity.

### **Mobility**

The mobility sector is also founded on environmentally sustainable dimensions: it follows a powerful e-mobility strategy, with the aim of ensuring 40% electric cars by 2020 and 90% by 2050. Furthermore, conventional parking lots will be reduced to 0.4 per apartment, buses in the district are already 100% electric, and at least 40% of the parking spaces will be equipped with recharging points. The second pillar of the strategy is the clear focus on car-sharing services: 30% of the parking spaces in the district will be reserved for shared services, while no fees for these sharing services apply.

Furthermore, the transformation to electric mobility (e-scooters) and walkable and bikeable infrastructures in the district are essential to the planning strategy (Norddeutscher Rundfunk, 2019). There are three metro stations that connect the district quickly to the city centre, while a fourth one is planned to connect the further expansion of Grassbrook.

**Table 5 Summary Hamburg HafenCity**

Governance	Talent Creation	Real Estate	Mobility
Public institutional governance setting divided into three pillars within city state	Focus on promotion of multinational companies	100% of land is publicly owned and processed by the HCH GmbH	Market subject to sustainability dimension
LDA executive organ of the project and 100% public	Lacking cooperation between different industries	Market subject to sustainability dimension	Fostering of alternative transport methods and sharing services
Private sector mainly consists of real estate investors	No living lab culture established	Mixed-share use of ground floors with lack of local retail shops and supermarkets	
Sophisticated district brand image and info distribution system		Social housing projects will attract young people and talent	
Lack of citizens' participation a deficit in past development			

Source: Authors' research (2019)



#### 4.4 Porto Innovation District: Asprela and Campanhã

As part of the RIS3 approach that plays a major part in the economic strategy, the city of Porto has defined two main themes in order to construct the backbone of economic and social development: a “hub for talent” approach and the social cohesion of all the territory of the city. Those goals were achieved through the following action plans:

- Asprela – “a university-driven campus-style location, with a very high concentration of higher education establishments, hospitals and R&D institutes within one km<sup>2</sup>”
- Campanhã – “hosts multiple former industrial buildings which will be transformed into a convergence space between industry, culture and consumption (...)” (URBACT, 2019)

Together, these two districts form the ‘Porto Innovation District’: while the re-development of the Asprela area started 25 years ago, the Campanhã area is currently in the initial phase of development.

#### **Governance**

One of the keys to district development in Porto lies in the horizontal coordination among different city departments, albeit especially between the urban development and the economic development departments. Meetings that regard horizontal projects with an impact on different sectors are being held on a regular weekly basis.

Within the economic department, especially InvestPorto, an agency founded in 2014 by the City Council, is responsible for economic and innovation promotion for district development. It pursues its activity with all relevant departments in the municipality, as well as with a wide range of external, public and private, national and international organisations. InvestPorto supports investors during all phases of the investment process, offering personalised services such as business intelligence, tailor-made assistance and research of business partners, locations and investment opportunities (InvestPorto, 2018).

For the initial set-up of the Porto Innovation District in the Asprela area 25 years ago, the National Government invested in the infrastructure of the district and provided knowledge institutions with facilities. Nowadays, however, the National Government is not involved in district development, although it still retains a large share of property, which makes it difficult to coordinate development for the city. Furthermore, the governance model in Portugal is being criticised due to its centralist approach and the low degree of political power of city councils. As an example, consumption and company taxes cannot be varied for specific districts, as this is solely a national government decision.

Information for citizens can be accessed mainly via associations and the InvestPorto website. Especially with regard to company promotion, precise information and swift communication is perceived as necessary, while a slow communication feedback channel would be the worst-case scenario for attracting companies. Such clear feedback and open communication has provided the city with the perception of an open and easily approachable city.

Most positive feedback on citizens’ involvement takes place via associations. Furthermore, associations constitutes one way to enhance the sense of community, as topics are pre-discussed and connect the persons involved more closely with the district.

Within the Asprela area, all public and private stakeholders were included in the development phase and its decision-making process, while specific employed managers within InvestPorto were responsible for facilitating that development.

### ***Talent Creation***

The talent creation model in Porto is based on the RIS3 framework. Likewise, InvestPorto intends to establish a 'Living Lab' environment with a view to establishing a successful innovation system: facilitating exchange of knowledge across different industries, the proximity of educational centres and the establishment of a testbed environment (including infrastructure, financing and legislation) enables there to be reaction on market movements more quickly and new ideas invented.

The living-lab approach will specifically attract young companies in the technology and innovation sector. Specific measures include a strong start-up fundraising system, establishment of multiple accelerators and incubators and the SIMPLEX programme that simplifies administrative services for citizens and companies (Talent Portugal, 2018).

Incubators as well as innovation hubs and vocational training centres are not subject to any direct intervention by the City Council, as they solely belong to the University of Porto or to private investors. This entails huge deficits for the city, however; for example, privately operated vocational training centres may not fulfil the requirements of a holistic approach, but solely for specific sectors. Through the 'Academy of Competences' programme, the city therefore intends to build up its own vocational training system, which will act as a vehicle for economic development. It focuses on digital competences for young people and the re-qualification of people above 35 years of age.

### ***Real Estate***

The ownership of real estate is both public and private, whereas the city only owns one per cent of all land - mostly private entities and in a small portion the National Government owns the land within the city. Despite the low share of ownership, the city intends to surpass the concept of "landlord guidelines" by involving all stakeholders in the design process of housing, especially public spaces. For the purpose of future development, a diversified use of buildings will provide various options for a mix of stakeholders.

Generally speaking, there is not enough space for middle-class living in the city centre of Porto at the moment, due to a 32% rise in rental prices between 2013 and 2017. This problem also affects small, mostly traditional businesses, which is why the city focuses on tackling some regulatory issues that are constraining the smooth implantation of firms from the new economy in the urban fabric.

### ***Mobility***

Mobility industries are one of the five core sectors within the national RIS3 framework. Portugal is a pioneer in the "development and adoption of new energy models for sustainable mobility" (URBACT, 2019). The continuation of this approach for the Innovation District is a clear target set out by the city: amongst other measures, an innovation centre specifically subject to mobility services offers complete solutions for the deployment and management of smart mobility services (Ceiiia, 2019).

**Table 6 Summary Porto Innovation District**

Governance	Talent Creation	Real Estate	Mobility
Horizontal coordination between city departments, Urban and economic development department most important	Based on RIS3 framework	Only 1% of land belongs to the city	Mobility services as one of the five clusters of the area
InvestPorto as part of economic dev department acts in parallel to urban dev. department	Targeting a living lab approach	Diversified use of building in order to provide various options for a mix of diversified stakeholders	Innovation Centre specifically focused on mobility solutions
One-stop shop for investors, with a precise, open and fast communication channel	Powerful incubation and fundraising programs	Promotion of middle-class income level	
Challenges derived from centrality of national government	Vocational training centres should be in line with city's demands for specific industries	Tackling of regulatory issues for firms within the urban fabric	
Associations best way to integrate citizens into participation process	Academy of Competences' focuses on digital competences of young people and re-qualification of people above 35		

Source: Authors' research (2019)

#### 4.5 Helsinki Kalasatama

Kalasatama is a former industrial and harbour area of 175 hectares in size in the North-East corner of the centre of Helsinki. It is one of the so called district development areas in the city and it functions as a 'living lab for a sustainable and technological future' (Medienservice Sachsen, 2019). Smart Kalasatama is an 'umbrella programme' for the district development process. By planned completion of the development, space for 10.000 new jobs will be created and in total 25,000 residents housed in the area (City of Helsinki, 2019). Besides, it clearly focuses on supporting citizens. One of the main targets is to co-create a smart district, with a common vision to increase the city's functions in order to give "one more hour a day" to citizens (Forum Virium, 2019).

## Governance

In the Kalasatama district, there is an existing steering group specifically in charge of area development. It consists of members of Forum Virium (the local development innovation agency) and city departments. This steering group meets four times per year and is led by the planning department. The group decides about the general strategy to be pursued by the district, while Forum Virium and individual departments of the City Council are implementing the respective activities that form part of the strategy.

Forum Virium, which is 100% public, incorporates 50 employees with major expertise in different sections that are relevant for district development. It arranges meetings with different stakeholders for the steering group and other associations. Likewise, in order to increase and retain expertise within its organisation, Forum Virium works together with researchers from universities and co-creates with the private sector. The agency also works on fostering interaction within the economic sector, especially between small and large companies, and on a high level of citizens' participation.

Information distribution is subject to complete openness and transparency. Generated data can be 100% accessed and used by citizens for their own purposes. The 'Helsinki Region Infoshare', publishes mainly statistical data, *giving a comprehensive and diverse outlook on different urban phenomena* (Helsinki Region Infoshare, 2019). The city administration furthermore intends to use social media intensively in order to engage people in the area, and has received positive feedback from citizens for this procedure.

## Talent creation

The focus industries within the district are those of energy, mobility and waste, and are connected with the aim of becoming carbon neutral by 2035. All projects are being discussed on the basis of this framework before they are set in motion and need to be in line with it. Furthermore, digital technologies play a dominant role in economic development in the district and are already being introduced in primary education. Skills that correlate with the cluster industries and the IT sector are being taught via workshops and trainings.

In line with this approach, the living lab culture is an indispensable feature of the district and is linked closely to citizens' involvement. Many of the smart solutions found in Kalasatama were initially embarked on through the Smart Kalasatama Programme for Agile Piloting ([www.fiksukalasatama.fi/en/agile-piloting/cookbook](http://www.fiksukalasatama.fi/en/agile-piloting/cookbook)), which is providing grants, space and equipment for citizens and businesses to try out smart solutions to real city challenges. Furthermore, the living lab approach is being enhanced by open legislation for future technologies, especially for self-driving vehicles. The great infrastructure of data systems (sensors etc.) as well as a pleasant policy system for testbed solutions in the real world attracts digital companies. Since 2016, testbed robot-controlled buses are already operating in the district.

## Real Estate

The human-centric approach is also clearly visible in the real estate strategy of the district: the development will incorporate housing for students, senior citizens and people in need as well as public spaces and services with a focus on a green environment. The district will provide all services that are required for daily life in the district (such as social and health care services and parks), with the target of saving one hour each day. Ground floor use is also more functional (used for living spaces and business), rather than for mixed-use of arts and leisure shops. Instead, the REDI, Suvilahti and Teurastamo centres provide the opportunity for citizens to buy many things from the same place.

Additionally, the general focus on citizens' participation is also taking shape in design processes for public spaces and buildings. There are clear policies with regard to a waste collection system and an efficient energy and water housing system (IMU Kalasatama, 2019) ([www.fiksukalasatama.fi/en/building-blocks/project-portfolio](http://www.fiksukalasatama.fi/en/building-blocks/project-portfolio)).

### **Mobility**

There are several initiatives to reduce the use of private cars. The MaaS cars and taxi service, for example, costs around €60 per month or €10 flat rate per every taxi trip. Moreover, people are able to use public transport and rent bikes. Additionally, electric cars are greatly promoted. Amongst others, REDI's car park offers 238 dynamically-controlled charging points (e-parking Helsinki, 2019). The abandoning of conventional cars is feasible due to good metro connections from the district to the city centre.

**Table 7 Summary Helsinki Kalasatama**

Governance	Talent Creation	Real Estate	Mobility
Steering group decides about strategy while LDA and single city departments implement activities	Carbon Neutral Plan 2035 of central importance, as all projects need to be in line with it	Human-centric approach: Life services all located in the centre of the district	Target to be car-free is enhanced by financial support for holistic alternative transport system
Steering group meets regularly and is led by urban development dep, while LDA organizes meetings	Digital skills are being introduced already in primary school	Infrastructure developed in order to save 1 hour a day	Large network of electric charging points
LDA works together with researchers and co-creates with universities and private stakeholders	Flexible pilot program encourages private firms about the possibility of dealing with urban problems	Despite 100% public ownership, bottom-up approach for designing processes	Test environment for self-driving cars via open legislation
Major infrastructure of data systems provides citizens with possibilities for engaging easily	Open legislation for future technologies, especially Autonomous Driving	Constructions are constrained by policies with regard to sustainability	

Source: Author's research (2019)

### 4.6 Rotterdam Innovation District

The Rotterdam Innovation District (henceforth RID) is a hybrid zone between the centre and the port of Rotterdam. Up to 2.500 residential units have so far been constructed (Stadshavens Rotterdam, 2018) in the two areas that make up the district, namely the RDM (South Bank) and the M4H (North Bank).

### **Governance**

Power distribution for development solely takes place on a public level. The city or the port provides the land or real estate, while two local public development agencies implement the specific activities and maintain communication with other stakeholders: Innovation Partner and Rotterdam Partners. The latter is

subsidised by the city and is responsible for foreign investment, events and promotion activities. It has no comprehensive role as facilitator for district development whatsoever.

Innovation Quarter is the governmental innovation agency, responsible for the South Holland region. The reason for creating this agency was that it became apparent that foreign investors don't want to enter into partnerships with the city directly. The City Council maintains a certain shareholdership in the agency although their shareholder proposal is always separate from the budget and policy goals.

There is a more informal development process taking place in district development, with no regularly organised meetings and even no communication between city administration and citizens' associations. As a result, citizens' involvement in the district remains a challenge. This may be explained by the industrial heritage of the district and the very small number of people that lived there before.

The information sharing system also provides some challenges. The Cambridge Innovation Centre, for example, which is a central hub for entrepreneurs and innovators, is solely targeting economic communication. This may be explained by the fact that all hubs are owned by private educational or economic institutions with no intention of citizens' involvement.

### ***Talent creation***

The RID specifically forms part of the Roadmap Next Economy strategy for the city and its five frameworks (Smart Digital Delta, Smart Energy, Circular Economy, Entrepreneurial Region, Next Society), which are connected to the district clusters of medical, technology, food, clean tech and maritime solutions (Maker City Innovaton, 2019). The approach of the RIS3 pursues this strategy and it is of the utmost importance in the entire city of Rotterdam and specifically for the district. Moreover, the three main universities in Rotterdam provide a complementary offer for students and companies in the district.

The southern part of the district also includes various vocational training centres. The largest one shares its facilities with the Rotterdam School of Applied Science. These shared spaces furthermore enhance the creation of a 'makers movement' in the district: expensive facilities and machineries such as 3D printers, lasers and CNC-machines can be used by private companies and will attract innovative companies and entrepreneurs (Stadshavens Rotterdam, 2018).

Furthermore, the shared premises are boosting economic collaboration and innovation, and also technological progress in the district. As an example, IoT sensors and devices are being used as part of a cooperation between the port authority and private companies in order to build the "smartest port worldwide" and to reduce CO2 emission by 50% by 2050 (Hamblen, 2018).

### ***Real Estate***

The land in the southern area is owned by the city, while the real estate itself is mostly owned by the port. This shared ownership has raised the difficulty of slow decision-making processes and no joint comprehensive strategy throughout the development phase. In contrast to this, however, sole ownership of the area (including the real estate) by the port in the northern area has provided clear advantages in terms of the possibilities of a comprehensive strategy and its attached activities.

### Mobility

The city administration aims to implement a sustainable transport approach within the district. However, specific measures are not progressively implemented. The main objectives and probable outcomes are linked to the 'smart port', while alternative methods in the district tend to be a part of the city's overall strategy. In that sense, the RID is not a designed testbed environment for new mobility solutions.

**Table 8 Summary Rotterdam Innovation District**

Governance	Talent Creation	Real Estate	Mobility
Power distribution solely takes place on a public level	RIS3 strategy of the city also finds ground in district development	City is owner of the land in the South, port owner of the real estate	No compelling strategy in place
Citizens' participation remains a challenge	Regional 'Roadmap Next Economy' fosters Smart Digital Delta, Smart Energy, Circular Economy, Entrepreneurial Region, Next Society	Sole ownership has clear provided advantages	Establishment of smart port
Two LDAs that are responsible for the city and the regional economic development	Complementary university offer for industry cluster		
LDA presented on the front-end, as companies prefer to not collaborate directly with city	Shared spaces play dominant role for collaboration		
Cities have no stake in the management of shared facilities	Makers movement		

Source: Author's research (2019)

## 5 LESSONS LEARNT FROM THE CASE ANALYSIS

The case analysis conducted has focused on the detection of relevant lessons learnt linked to the challenges and focus areas in Zorrotzaurre. In this section, these results are summarised and linked to the theoretical framework described in section 3.

### Governance

#### 1. Recognising the role of the city in multilevel governance systems

The cases have shown that multilevel governance for city development can only be successful when the role and corresponding power on a city level is assumed by the other government levels. The theoretical analysis in section 3 outlined the fact that city governments can use the major possibilities for communication and

networking in urban regions in the best way (OECD, 2015). The case study adds the findings of involvement by other government levels to this theory.

The case of the city of WT shows that the tri-governmental system creates advantages in balancing a long-term strategy. However its success may be based on the interest and goodwill of the respective national ministry to invest in and develop the city. Still, power distribution among different governmental levels as well as within a city council was deemed to be important.

In Porto, the municipality or city level lacks certain political power over land and economic activities, as the National Government owns most of the land. Experiences from this city emphasize that greater planning and implementation of power on a city and municipal level would be appropriate, as these levels have a closer insight into the actual needs in the city. Experiences gained from Porto may also lead us to presume that the leading role of the city in urban development processes must be acknowledged by the national government or 'higher' government levels in order to be successful.

For the other cases, the national government did not play a role in governmental power distribution, as development processes either included regional public government levels at most RID and Barcelona and 22@) or were completely based on the respective city government (Helsinki Kalasatama and Hamburg HafenCity).

## **2. *Facilitators of district development***

As an entity that acts on behalf of such public governmental administrations, city development agencies have proven to be successful in facilitating district development processes via constant communication among the different stakeholders involved. These agencies are characterised by expertise and collaboration capability, and may be branded with different names (e.g. Innovation agency or Local Development Agency).

The agencies analysed are - apart from the one in Hamburg - closely connected to, or even part of the economic development department of the City Council, which outlines the need to ensure close communication with politicians and other policy makers from other councillorships. Furthermore, they appear to be most successful when there is a high level of expertise in certain in-house topics, but also in cooperating with private stakeholders or educational establishments and co-creating initiatives. This is also because of their proximity to policy makers and the private sector parallel to this. Furthermore, ensuring communication would appear to be a key issue, both online and offline.

## **3. *Multiactor spaces for district development***

Most of the cases share the existence of a multiactor space for shared vision and district development, insofar as different approaches can be identified.

The Barcelona 22@ model has shown good results by installing one district committee that brings together public and private actors, and which is formally led by the urban planning department of the City Council and in which events and meetings within the committee are organised and facilitated by the district innovation agency.

A steering group is perceived as important in the alternative models of Helsinki Kalasatama and WT: it is made up of city departments involved in district development and usually by representatives of the corporate world, education and neighbourhood associations, among others. Respective city departments



and the city development agency implement the activities of the defined strategy, while the agency is also responsible for facilitating these meetings. In any case, comprehensive feedback by the persons interviewed is leading us to the conclusion that meetings of either a steering group or a committee should be formalised and held on a regular basis, without exception.

As multilevel governance was deemed to be diverse on a public level, most cases have shown a clear tendency to involve private stakeholders in decision-making processes in such stakeholder spaces. Furthermore, findings from the case analysis add the major explanation of 'how' to involve private stakeholders in the governance process.

#### ***4. Different approaches, background and instruments for citizens' involvement***

Bottom-up and top-down approaches for district development co-exist. In this sense, the findings from the case analysis provide insights into best practice mechanisms and tools and also into challenges facing the bottom-up approach.

Even though there are control mechanisms by citizens and the media, the approach is often not entirely open to the public, as the case of Toronto with Sidewalk Labs shows. The cases of Hamburg and Rotterdam revealed that successful urban development may also be implemented without citizens' participation, although the sustainability and transformation of the district development processes may then suffer. It is important to distinguish among the different objectives set out by these districts: while Hamburg HafenCity is focusing on promoting a base of large multinational companies, cases such as Porto Innovation District, Helsinki Kalasatama and Barcelona 22@ are closer to the living lab culture and citizens' involvement.

Nevertheless, citizens' participation is also dependent on the heritage and history of the district. Districts that formerly had an industrial focus often face a lower level of citizens' engagement, as defined in the city districts in Rotterdam, Hamburg and Toronto. Conversely, citizens' engagement is already on a high level in Barcelona and Helsinki. Likewise, in districts with a lower population density participation therefore needs to be stimulated more than in high-density urban areas.

Regarding policy instruments that may foster citizens' participation, apart from the districts in Rotterdam and Hamburg, the approach taken by all the districts analysed is a rather holistic one, ranging from online surveys to public events and associations. In the cases, associations have proved to be the most successful mechanisms, due to their solution approach. Furthermore, citizens may perceive associations to be more trustworthy, as they are not politically engaged, and may feel more in tune with the respective area due to contact with other people from the neighbourhood. The case of Hamburg HafenCity clearly shows that merely a body controlled by a citizens' association is not sufficient if the aim is to ensure greater residents' involvement and affinity to the district.

Within the governmental system, the Barcelona 22@ model seems to provide the most sophisticated version, insofar as it integrates various neighbourhood associations (brought together in the "Extended Committee of 22@") into a broader coordination committee that links it to other private and public entities. For certain projects, it would seem more appropriate to provide associations with a timeframe for providing feedback, as implemented in the Porto Innovation District.

In accordance with explanations provided by the OECD (2019), open transparency makes public administrations more accountable and promotes business creation and innovative, citizen-centric services.

This guideline could be confirmed in the case analysis, as the case of WT clearly shows this too : an analysis of the district development showed that not only long-term, but also medium-term targets need to be clearly communicated. More open communication on their website are furthermore targeted for the next episode of development. Additionally, in Porto Innovation District, clear and open communication in this case to economic and citizen stakeholders - is thought to be one of the core factors for the city's open-minded culture and image.

In line with digital evolution, online platforms and surveys that also inform citizens and provide an option for participation and re-use of data - such as decidim. Barcelona and Helsinki Region Infoshare - seem to be of the utmost importance in dealing with the digital life of the population.

### *Talent creation*

#### **1. The living lab approach**

The creation of a skilled and striving talent hub in a district is not only dependent on physical infrastructure and cluster effects, but also on the culture and social environment, as this attracts young people and companies alike. In keeping with this finding, most of the cities in the case analysis target the concept of a *living lab* – a concept that is described as being in terms of legislation and rich in shared facilities in which companies may foster a testbed environment, providing major exchange of communication and a great diversity of people acting and living within it (OECD, 2015). Overall, the RIS3 framework in combination with a living lab approach has proven to be a successful driver for economic activities in the respective districts. The case of the Kalasatama district in Helsinki underlines the fact that the establishment of one clear content framework – ‘Sustainability Action Framework’ - may create a ‘buzz’ around the area that attracts companies from this specific sector. The ‘Digital District’ in Barcelona 22@ also supports this assumption.

This content framework may even be enhanced by very open legislation for technologies and business models, by picking one specific topic that can be accelerated in the district as a testbed environment. In general, this open legislation has been mentioned by interviewees in Helsinki, Porto and Toronto as having a great impact on the creation of a dynamic atmosphere in the area. The example of Helsinki, in which the city provides an open legislation for self-driving car technology, has gained a fine reputation within companies. Other cities also intend to create an environment with testbed- conditions – such as the ‘makers movement’ in Rotterdam, or the setting up of the innovation centre for mobility services in Porto. It appears to be usual to select one specific sector or topic that is firstly also to the overall economic industry framework of the district, and secondly one of the potentially disruptive technologies.

Furthermore, the involvement of companies in the development process of the district is a major aspect for a living lab culture and highlights positive results for the respective district infrastructure. If the environment furthermore allows companies to act as in a laboratory – as is the case with Barcelona 22@ and Helsinki Kalasatama - the district as an economic location is more likely to remain on one level with the newest market movements. The Porto Innovation District intends to create this laboratory approach in particular, as they perceive companies to be the closest actors to market movements.

#### **2. Alignment of educational system to cluster needs in the city and district**

The case of the RID showed how the educational system is aligned to the demands and needs of the core clusters, as described in the ‘Roadmap Next Economy’: the three main universities as well as vocational

training centres are also offering a complementary system in all relevant subjects, which is highly appreciated by the economic sector. In the Helsinki Kalasatama district, the educational framework with the focus on the core industries is combined with the provision of teaching of digital skills, starting already in the primary school.

The city of Porto perceived the negative results of an imbalance between supply and demand of employees in the Innovation District, because the educational framework is *not* founded on a holistic, complementary approach.

The analysis of the 22@ district in Barcelona further outlines the fact that the studies offered should not only be in line with the clusters' content, but also with that of the district environment: As the city uses the living lab approach that focuses on the establishment of young and dynamic companies, simultaneous entrepreneurship studies at local universities are of the utmost importance.

### ***3. Immigration-friendly districts with 'open' and 'sharing' culture***

A high tolerance for labour immigration, as is the case in the Porto Innovation District and WT, is thought to be beneficial for the talent market and the greater demand on the part of companies for digital skills. In Toronto, the city provides simple integration of skilled labour for companies, in keeping with effective policy use in order to unleash potential of skilled immigrants (OECD, 2019). As the living expenses are also relatively low compared to other cities in Canada and the US, this strategy has attracted many workers especially from the US, which has resulted in Toronto gaining an image as the new developing North American centre in the technological start-up scene.

### ***4. Shared facilities***

Furthermore, in terms of an open culture, shared facilities prove to be an essential factor in the communication process and the innovation capability within the district. Those shared facilities for economic use can be categorised into three parts: shared buildings belonging to the education sector, such as the combination of a vocational training centre with the University of Applied Sciences in Rotterdam; innovation hubs that provide consulting for innovation topics and the free use of specific equipment and multimedia spaces such as the Ca L'Alie in Barcelona 22@ or in the makers district within the RID; and co-working spaces, which often also include a link to accelerator and incubator hubs. The city of Hamburg has identified the lack of shared facilities, especially of co-working spaces, as a critical problem in the original masterplan of the HafenCity Master Plan, and will increase the number for further expansion of the district.

### ***5. Infrastructures for entrepreneurship and collaboration***

A dense network of accelerators and incubators, as in the case of Porto Innovation District, proves that is also important for the start-up scene in guaranteeing the best conditions for setting up a business. However, those accelerators and incubators are mostly only a result of an already-active economic hotspot within the district.

Besides, the establishment of company associations has obtained significant positive feedback from the local development agency in Barcelona: the 22@Network association has proven to be a strong player in the district, which also may enhance the impression of companies as forming part of the design process that fosters the living lab culture.

The case of Porto outlines how a 'one-stop-shop' for companies is important to establish their business in a certain region. InvestPorto has received successful feedback due to very open communication, a clear strategy for the district and a full set of competences. This full set of competences can also be fulfilled via cooperation with other stakeholders in the system, as the case of Helsinki underlines.

The example of Hamburg shows, however, how a different concept has a different outcome on the district culture and dynamic. The city promotes large companies via a luxury location while at the same time does not provide enough affordable housing capacity for citizens; thus, the district lacks small businesses and a start-up atmosphere, where new ideas are promoted and financed by accelerators.

### *Real Estate*

#### **1. The benefits of entirely public ownership**

Throughout the case analysis, it became apparent that solely public ownership of the land and real estate is beneficial for the development process, as over-diversified ownership disrupts a consistent and compelling real estate strategy.

In the case of Hamburg, land in the HafenCity is owned 100% by the (public) agency, which is creating an easier environment towards a clear strategy and guideline possibilities, but also lower diversity. In the rethinking process pursued by the 22@ district in Barcelona, a larger share of the city is recommended in order to guarantee a more strategic approach to sales and construction, even though the free design options by private owners were partly perceived to be positive in order to prevent a district that could become too standardised by real estate. Furthermore, in the Porto Innovation District, the greatest possible share on the part of the city hall is proposed, as this administrative level has the best insight into all urban projects and needs in the area. In Rotterdam, sole ownership of the port in the northern area of the district has provided advantages compared to the shared ownership in the southern area, which leads to the conclusion drawn.

#### **2. Different approaches for the design process**

The lessons learnt from the structure of ownership are not necessarily linked to the share of competences in the design process whatsoever. The example of Barcelona 22@ showed that the greatest possible number of actors should be involved. The case of Helsinki Kalasatama confirms this assumption, as the city integrates citizens into the design process, even though ownership is 100% public. Integration takes place mainly in shared spaces, such as parks or public buildings, which are owned by public administration in both city cases.

The cities of Hamburg and Rotterdam have used completely different approaches for district development, as the 100% ownership of one public stakeholder (city or port) was also not changed to accommodate competences in the design processes. However, also in Hamburg, the more diversified design process (resulting in changed ownership in the district's expansion) is deemed positive.

#### **3. The importance of fixed regulations**

Despite an open design process, private and public owners still need to be obliged to pursue certain policies or even a framework (e.g. a sustainability concept). E.g., in order to achieve a clear share of social housing in

a district, either linked policies have to be put in place, or real estate owned by public stakeholders has to be used for this purpose, as is the case in Porto.

#### **4. Mixed use of ground floors for 'creative' districts**

As regards mixed use, especially on ground floors, the HCH GmbH noticed a lack of local retail shops and supermarkets in the HafenCity, which is at 10.9% of ground floor use. Furthermore, the setting up of a set of multinational brands as retail stores is not sufficient, as this does not attract a creative neighbourhood. This implies the establishment of more retail shops and supermarkets, and support for traditional stores from the district- in line with market trends in terms of shopping behaviour nowadays.

### *Mobility*

#### **1. Mobility as a central strategy and cluster development opportunity**

The case of WT has shown the importance of the right mobility strategy for district development. The struggle to set in motion a mobility plan has prevented many people from coming to visit this district so far. To combat this, the Porto Innovation District has even established mobility services as one of their core clusters in the area, and has enhanced this focus by setting up a central innovation mobility centre.

#### **2. Green mobility**

Mobility services tend to veer in the direction of sustainable and renewable features. In keeping with this trend, specific guidelines and/or action plans have resulted in a clear strategy and image for the district (as in Helsinki Kalasatama), tantamount to a positive reputation and awareness being gained among private stakeholders.

All districts focus on further establishing footpaths and cycle tracks instead of parking lots, and are striving to reduce the emission of greenhouse gases in the mid and long term. The city of Hamburg uses a sophisticated system to support these features, which shows that there need to be specific guidelines and regulations in order to foster these alternative services.

As an example of the progress made in alternative mobility solutions, e-scooters have been established in all of the cities assessed. Even though there are various starting issues, this shows that urban society will follow trends in alternative methods of transportation.

The most progressive use of sustainable transport is being implemented in Helsinki Kalasatama: Combined tickets for public transport, bikes, shared mobility solutions and e-scooters obtained very positive feedback, while the district is also a testbed for autonomous driving solutions. Progressive development is possible due to two factors: the Sustainability Action Plan and open legislation (which may also influence mobility services) for the relevant new technologies. Table 9 shows the link between the focus areas and the results obtained from the case analysis.

**Table 9 Results of the case analysis**

Governance	Talent Creation	Real Estate	Mobility
Recognition of the city level	Living lab approach framed in priority setting	Compliance of real estate with social and environmental standards	Part of the district development process
District development facilitators (e.g. LDAs)	Institutional setting for innovation environment	Citizen participation in real estate design process	Alternative transport methods
Multiactor spaces	Shared facilities for innovation and entrepreneurship	Services for citizen's daily life	Test-bed approach for sector development
Instruments for citizen involvement	Instruments for a test-bed approach	Involvement of citizens to living lab environment	Sustainability
Holistic information distribution	Implication of educational centres	Coherence to human-centric approach	Importance of metro station
Role of community associations for social cohesion	Facilities for skilled labour immigration		

Source: Author's research (2019)

This result shows that a holistic approach for district development is necessary. In fact, the four focus areas defined for Zorrotzaurre correlate with each other, as policies would always affect not only one specific pillar, but change the overall picture of the development.

## 6 CONCLUDING REMARKS

The report is part of the action research process that is being developed within the Bilbao Next Lab project. City policy makers and researchers are participating in the project with the aim of developing the S3 for the city. This report contributes to a new reflection-action cycle with the aim of dealing with the challenges facing development of the Zorrotzaurre Innovation District within the urban S3 strategy. Orkestra's team facilitating this action research process contributes to reflection and corresponding definitions of actions through theoretical and analytical frameworks or analysis such as this one.

In the context of this report, the theoretical framework provided an overview of 'what' the essential factors for a successful Human-Centric Smart City development are, while the case analysis provided detailed insights into 'how' these factors can be specifically developed (see figure 11). It was argued that every city and its respective district has a unique heritage and population, and so also requires a unique approach for development (James, 2014). However, these unique development approaches also underlie certain parameters that need to be stressed when discussing district development processes and the results obtained from the case analysis described previously :

1. Centrality of multiactor spaces as governance structures for district development
2. Holistic system for a bottom-up approach and citizens' participation
3. Role of district development facilitators and agency
4. Living lab approach
5. Compliance of real estate with social and environmental standards
6. Mobility as a mechanism for the district development process.

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