The Waterfront Development in Europe: Between Planning and Urban Design Sustainability

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Abstract

This paper analyzes the different possibilities of acting on natural infrastructures in order to guarantee a safe environment experience for citizens, especially in congested urban centers close to rivers. The paper identifies the urban policies and funding through which urban regeneration comes to life for waterfront development. In particular, different kinds of case studies are presented in two blocks. The first one acts on sustainable projects not linked by a general strategy, but which produce positive effects on the city in terms of safety. The second block collects experiences linked to general strategies that secure and encourage slow mobility, in order to regenerate the entire city network. The waterfront development can be implemented in several ways. Nevertheless, the collection of the case studies demonstrates that sustainable urban policies play a key role to regenerate, renew and innovate the natural infrastructures and that sustainable urban design has the tools to transform the routes in roots, turning the habit of passing through a city onto the practice of living through the city.

Keywords

Natural infrastructure • Waterfront • River • Planning and urban design • Sustainability

1 Introduction

This paper analyzes the different possibilities of acting on waterfront development in order to guarantee a safe city environment experience for citizens, especially in urban centers close to rivers. In these cases, there are various declinations of urban routes that aim not only to offer a safe crossing of the city but above all a new way of living it. The paper seeks to understand and identify projects, urban policies and funding through which these paths come to life, with strengths and weaknesses, and the new possibilities of action along unexplored paths. The waterfront, the object of this study, is a place that represents the historical memory of the cities' development. All the major cities have sprung up along sea and river networks for their utility in agriculture, food, connection with the rest of the territory, trade, spaces of worship, meeting and reflection, recreation and enjoyment, and also have been neglected by these very useful patterns (Cialdea, 2020; Jacobs, 1961; Sairinen & Kumpulainen, 2006). The attention to rivers as integral elements of city life has undergone many changes over time, without however losing sight of their commercial role. Waterfront sites had a decay period in the post-industrial age, as many industrial sites have been decommissioned for a change in more profitable economic activities, production technologies, environmental regulations for the aquatic environment protection and a shift of production sites to Third Countries (Carta, 2007; Carta & Ronsisvalle, 2016; Marshall, 2016). It is precisely when the waterfront lost this commercial and industrial role that different functions arose for their new use and a different function. In particular, the theme of waterfront transformation, together with the brownfield regeneration process, is actually linked first of all to the combination City-Port. Several port cities can be identified: the medieval port city, characterized by a strong functional and spatial relationship between port and city; the nineteenth-century port city characterized by the introduction of several significant technological innovations; the modern and industrial

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port city characterized by a clear spatial separation between city and port; the contemporary and post-industrial port city, characterized by the phenomenon of waterfronts redevelopment and by the rediscovery/reconquest of their public civic dimension (Cialdea, 2019a; Clemente, 2011; Hoyle & Pinder, 1992; Vincenti, 2011). The factors that have contributed to the resurgence of waterfront development, both fluvial and coastal, are different. The first is that the abandoned waterfront led to depressed land values, attractive redevelopment schemes and cheaper available land. The second is that beginning in the 1970s and 1980s, environmental regulations and remediation to guarantee cleaner water and land made the land appealing. The third one is the naissance of Preservationists' Movements that took to preserving historic abandoned industrial structures along waterfronts and riverfronts. The fourth factor is the leadership citizen activism in reclaiming "lost" waterfronts and historic regions. The fifth is that with residential developments with supporting services, waterfronts have become prime real estate (Fisher et al., 2004). In particular, the contemporary waterfronts recovery and regeneration processes also arise for the international competitiveness of the cities in terms of productive investments, new governance, evaluation and management strategies of the territory, and enhancement of share capital. Therefore, the process of urban transformation and requalification of the waterfront creates competitive opportunities, capable of attracting productive investments, cultural events, increasing the tourist offer and the positive image of the city. It is a network of places, functions and flows, an osmotic interface, an intersection of infrastructural beams, a creative synthesis of space and community, an active place of production and commerce, a fruitful synthesis of identity and perspectives and a place where people can be involved in the analysis, planning and design of the river public dimension (Carta & Ronsisvalle, 2016; Cialdea, 2019b; Cialdea & Pompei, 2020; Van Der Knaap & Pinder, 1992; Vincenti, 2011). The waterfront, therefore, both coastal and river, take on a very important catalyst role to revitalize and transform the cities affected by deindustrialization into cultural centers for a renewed relationship with water and new urban spaces of multiple functions. Another essential aspect to consider when talking about the waterfront is the river or the sea that it overlooks. The ecological aspect of the river/sea as a whole must be considered, as it is made up of water which, as Garett Eckbo says, "is integral to life processes, to the natural shape of earth and landscape" (Eckbo, 1990) and therefore it needs to understand how the waterfront transformations affect this network, what impact they have. Disciplinary advancements in the field of environment and ecology have been made significantly over the past two decades, especially at the European level. These highlight one of the essential issues facing river and coastal cities: the risk of flooding. In fact, due to climate change, the more frequent occurrence of flood phenomena and low-flow emergencies have directed attention to the necessity of adopting urban river spaces. The first directive has been the Habitats Directive 92/43/EEC that ensures "the conservation of a wide range of rare, threatened or endemic animal and plant species" (European Commission, 1992). Subsequently, the Directive 2000/60/EC, for the redevelopment of surface and ground waters, establishes a framework for community action in water management, identifying the river basin as the correct territorial reference. It prioritizes ecological objectives and requires to "protect, enhance and restore all bodies of surface water" (European Parliament & Council, 2000). Then the Directive 2007/60/EC on flood risk was issued for watercourses and coastlines at risk from flooding "to map the flood extent and assets and humans at risk in these areas and to take adequate and coordinated measures to reduce this flood risk" (European Parliament & Council, 2007). With urban regeneration and sustainable development, there is the need to achieve and synthesize all the cultural, economic and ecological elements of the cities. So, in relation to the water-city, due to the multifarious nature of urban rivers and coasts, the waterfronts become an interdisciplinary challenge field (Cialdea & Quercio, 2017; Fusco Girard et al., 2004; Prominski et al., 2017; United Nations, 2017).

Therefore, when it comes to waterfront development, planning and design must guarantee in a sustainable, integrated and interscaling way the safety of citizens through the implementation of interventions, projects, strategies and policies that transform the waterfront into a place of life, commerce, job and leisure, to contribute to the improvement of the quality of urban life in social, economic and cultural terms.

2 The Methodological Approach and Samples Selection

The work is part of a research, conducted for some years by the authors, on the theme of rivers and their relationship with the city (Cialdea & Pompei, 2018a, b, 2019a, b, 2020). Therefore, in this work some cases are shown, with the aim of researching elements and tools that achieve objectives linked to sustainability (criterion of representativeness), with attention to the 11th (Sustainable cities and communities) and the 13th (Climate action) Sustainable Development Goals of the Agenda 2030 (United Nations, 2015). For the samples, reading sheets have been created, to allow more direct comparison (opportunities and limitations of the policies adopted).

The reading sheet created in this work is divided into the first part of general data, where basic information is collected to locate the intervention geographically. Then, there is an

interpretative-reading part of the urban center evolution in relation to the river that crosses it. Finally, there is a third synthetic-interpretative part divided into inputs, represented by the boundary conditions, and outputs, represented by the results—which will be analyzed in the discussion section. In general, the inputs were the guidelines for the selection of the samples and they consists of five. The first one is the presence of river regeneration projects implemented or partially implemented, thus excluding cases in which there is an unfulfilled forecast. The second input is the position of the river in relation to the city center. Case studies were selected in which the river centrally crosses the urban center or laps the municipal border, positioning itself however in close relationship with the urban center of the city. The third input is the type of the river and the riverfront. Case studies have been chosen in which the riverfront has urban or mixed features since it is in these situations that the river and its banks, as well as ecological elements of a wider network, are configured as real public urban spaces. The fourth input is the type of the area where the project is carried out, and mainly external or central areas with medium and high-density areas have been chosen. The fifth input, on the other hand, concerns the type of policies that have made it possible to implement river regeneration, encouraging municipal or regional/national policies. These boundary conditions seek to identify selective elements to describe the importance that the proximity to the riverways represents since by lapping or crossing the urban space they represent a plus in terms of cultural and touristic attractiveness for the urban center itself.

The collection of images and plans of the realized projects has been developed in order to highlight the sustainability issues with a graphic structure useful for comparison, especially through the design tools part of the reading sheet.

By analyzing different situations, in our ongoing research, it was possible to identify two large blocks of interventions that have in common, in addition to the elements mentioned above, the will to be planning and urban design sustainable and it allowed us to select four emblematic case studies, which highlight current trends in the design and sustainable planning of riverfronts. The first acts on riverfronts projects which are linked by local planning policies and decisions and the second block collects the experiences linked to national and regional sustainable and economic planning policies.

2.1 The First Block: Projects Linked to Local Planning Policies

The first block of interventions collects the experiences of riverfronts projects which are not linked to a national sustainable planning strategy but to strong municipal policies for the development of river and port areas that produce positive effects on the city in terms of safety and urban design.

2.1.1 Germany

The first experience is in Germany. Here, widespread flooding in 2002 caused many damage costs to river areas and mark a reorientation toward an integrated flood risk management system in the whole of Germany. In particular, many cities have set in motion projects for the safety of the city and riverfronts, even after other widespread flooding events (Thieken et al., 2016). Among these is Hamburg. Hamburg is located in the north-west of Germany and is located at the point where the Alster and Bille rivers flow into the Elbe. It is crossed by a dense network of canals called Fleete and the city center surrounds two artificial lakes formed by Alster: Lake Binnenalster (the part of the river that was inside the ancient city walls) and Lake Außenalster (external Alster). It is a city-state, the second-most populous city in Germany and here there is the second largest port in the European Union. In 2002, Hamburg decided to strengthen its flood protection infrastructure and enhance the Elbe river as a public city network. The Elbe is a navigable basin that touches the cities of Berlin, Hamburg, Prague, Dresden and Leipzig (International Commission for the Protection of the Elbe River, 2016; Vitillo, 1997). In particular, the most representative interventions for the development of the riverfront are those of the port. The first analysis of the port urban peripheries regeneration was commissioned by the Hamburg architect, Professor Volkwin Marg. The study presented in 1996 clarifies many of the development issues that are the urban structure and the principle of mixed uses. Then, in 1997, Henning Voscherau presented “Vision HafenCity” to the public as an opportunity for the inner city to regain its waterfront (Clemente, 2011; Mazzoleni, 2013). In the same context, an interesting project to regain the waterfront is represented by the Promenade Niederhafen. The Promenade Niederhafen is located in the north-west of HafenCity, in the same area as the flood protection project which saw a barrier, of 7.20 m above sea level, built between 1964 and 1968 on the banks of the river. In the last decades following inspections of Niederhafen’s existing flood barrier in 2006, the municipality of Hamburg determined that supporting elements of the existing structure were overburdened and its foundations needed significant reinforcement. The city of Hamburg organized a competition to design the existing flood barrier, and Zaha Hadid Architects’ project was selected in 2006. The redevelopment project aims to reconnect the 625 m river walk with the urban fabric surrounding, acting as a popular river walkway and at the same time creating connections with the nearest neighborhoods. The linear structure is 8.60 m above sea level in the eastern part and 8.90 m

above sea level in the western part, to protect the city from the highest winter storms and extreme high tides. The river promenade is divided into different spatial qualities. The west zone—at a larger scale—offers wide views downstream of all shipping activity. The east one creates a long ramp alongside the amphitheater, leading visitors down to the water's edge. The walk is located at the top of the barrier and develops like a staircase-amphitheater from which to observe the port and the river with broad riverbank steps, moored ships, floating jetties, dike steps and promenades, superdikes, and marinas. The riverside promenade's width offers generous public spaces for different city users. Shops and public utilities are also accommodated within the structure at street level facing the city (Benelli, 2019; Castro, 2019; Prominski et al., 2017; Zaha Hadid Architects, 2019) (Fig. 1).

2.1.2 The Netherlands

The second experience is in The Netherlands. The Netherlands means lower countries in reference to its low altitude and flat topography, with about 50% exceeding 1 m above sea level and almost 17% falling below sea level. Most of the areas below sea level are polders. It is crossed by several rivers, there are many lakes and has an extensive system of waters within canals, many of which are navigable. The region is crossed by flood phenomena for which the entire planning, both national, and above all local, is solid in tackling the flood protection system (Voorendt, 2015). Among the most interesting waterfront redevelopment interventions, both naturalistic and urban, there are those relating to the IJssel river, a branch of the Rhine that is characterized along its entire course by alluvial landscapes in the agricultural expanses and urbanized waterfront when it

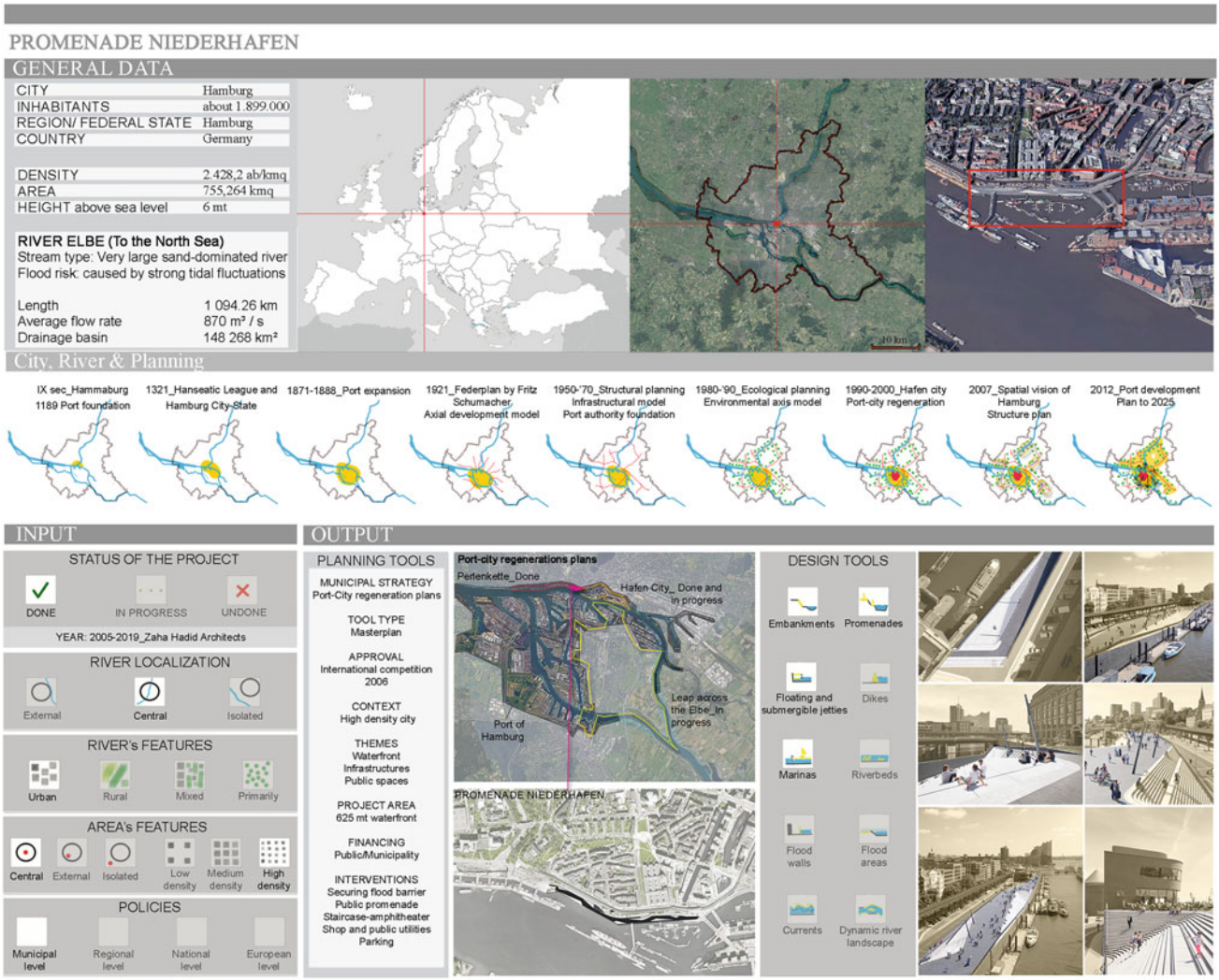

Fig. 1 Promenade Niederhafen Project: **General Data Section**: (*Source* Google Earth 2020); **City, River and Planning Section**: Historical Evolution; **Input–Output Section**: Project Analysis (*Source* Google Earth 2020, https://www.zaha-hadid.com/architecture/hamburg-river-promenade/, Authors own elaboration, 2020)

crosses the cities. Among the waterfront projects of the IJssel, there are those of the city of Doesburg, which has variations in water levels up to 5 m and which is surrounded by anti-flood barriers arranged in a radial shape for flood protection. The selected project area is located on this barrier between the city center and the river. In the past, there was also a moat which was then filled and industrial activities were carried out on it, thus losing the relationship with the river. Following the disposal of these areas, it was planned to locate residential functions here and re-establish the relationship with the river. It is called the IJsselhade Residential Area and was commissioned by the municipality of Doesburg in collaboration with Watershap Rijn en Ijssel and Johan Matser Projectontwikkeling BV of Hilversum. The project, an area of 1.5 hectares for a budget of about 8 million euros, consists of two parts, an architectural one for the construction of new residences, entrusted to the architect Adolf Nicolini, and a landscaping one, entrusted to the OKRA landscape Studio of Utrecht. Between 1997 and 2005, about 150 housing units and a hotel were built on the anti-flood barrier, 6 m over the river level, which reconnects to the lower level by a staircase, at the end of which the old moat was also restored. The city and river are linked to each other through a framework bridge consisting of two arched tubes 18 m in length. The development leads to the creation of an inner and an outer riverfront on the IJssel. Like the IJssel quay, the former moat parts are treated as waterfronts. The wall represents a water defense and has water and electricity for ships and on this barrier the promenade was then designed to admire the landscape. The highlights of the riverfront are formed by the grandstand stairs with natural seating at the port basin and a peninsula, where there is the "Doesburg panorama", an observation tower on a pontoon on the peninsula that has yet to be developed. The promenade has two levels, one floodable and the other dedicated to the public space, with a series of canals and bridges connecting the various parts. The layout of the riverfront is contemporary, with reference to the historical city center (Knuijt, 2002; OKRA, 2010) (Fig. 2).

2.2 The Second Block: Projects Linked to National and Regional Policies

The second block of interventions collects the experiences of general strategies and policies at the national or regional level that include encouraging the sustainable regeneration of the entire city network and the economic development of an attractive city.

2.2.1 Portugal

The first experience is in Portugal. Here in 2001, the POLIS program (*Programa de Requalificação Urbana e Valorização Ambiental das Cidades*/urban redevelopment and environmental valorization of cities) was launched, with the main objective "(…) to improve the quality of life in the cities, through interventions in urban and environmental aspects, improving attractiveness and competitiveness of urban centers that have an important role in structuring the national urban system (…)" (MAOT, 2000). Among the intervention strategies, there is the creation of new urban centralities within metropolitan areas, the regeneration of abandoned industrial areas, the urban and environmental regeneration of riverfront and waterfront, and the enhancement of factors generating new identities, with a forecast investment of 800 million euros. In 1999, at the wish of the Minister of the Environment, a working group was established that defines the *Cidades program* to concretize what has been defined at the national and regional economic strategic level. The POLIS program was designed taking into account the deep changes in Portugal in the last three decades reflected with great intensity in spatial planning, particularly in the urban structure resulting from the economic development, based on industrialization. It is very interesting to underline that this program is a management process of collaboration between the State and municipal administrations. The cities that participate are called *Polis*, which become joint-stock companies with 60% of capital belonging to the state and 40% to municipalities. In most cases, the interventions were carried out within 38 consolidated cities, leaving the suburbs to play a marginal role (Fedeli, 2006; Partidário & Correia, 2004; Pelucca, 2010). Among the most extensive waterfront projects are those built in the city and the metropolitan area of Porto—among the most industrialized cities in the country of around 1,700,000 inhabitants, which is also called the Northern Capital. The Porto Metropolitan Area (AMP) is made up of 16 municipalities, occupies an area of 1.885,10 km^2 and is located on the northern bank of the Duoro River—a riverfront of approximately 35 km, not far from the Atlantic Ocean. In terms of territorial macro-structure typology, the AMP is classified as an urban region, a territorial entity with a strong population density, businesses and services, which has undergone intense transformation processes and strong territorial interactions. Thanks to the POLIS program, various plans and projects are implemented, both in Porto and in the nearby city of Gondomar. In Porto, with the POLIS Program in 2001 interventions on the waterfront are implemented in *Vila Nova de Gaia*. This one represents a vast urban and environmental redevelopment operation and the main objectives include the recovery of the Douro riverfront through the design of a new road section capable of making the car flow compatible with the needs of pedestrians, cyclists, fishing-bulls and tourists; the urban recovery of the fishing village of the Afurada through the expansion and redevelopment of the port (Pelucca, 2010; Vincenti, 2011).

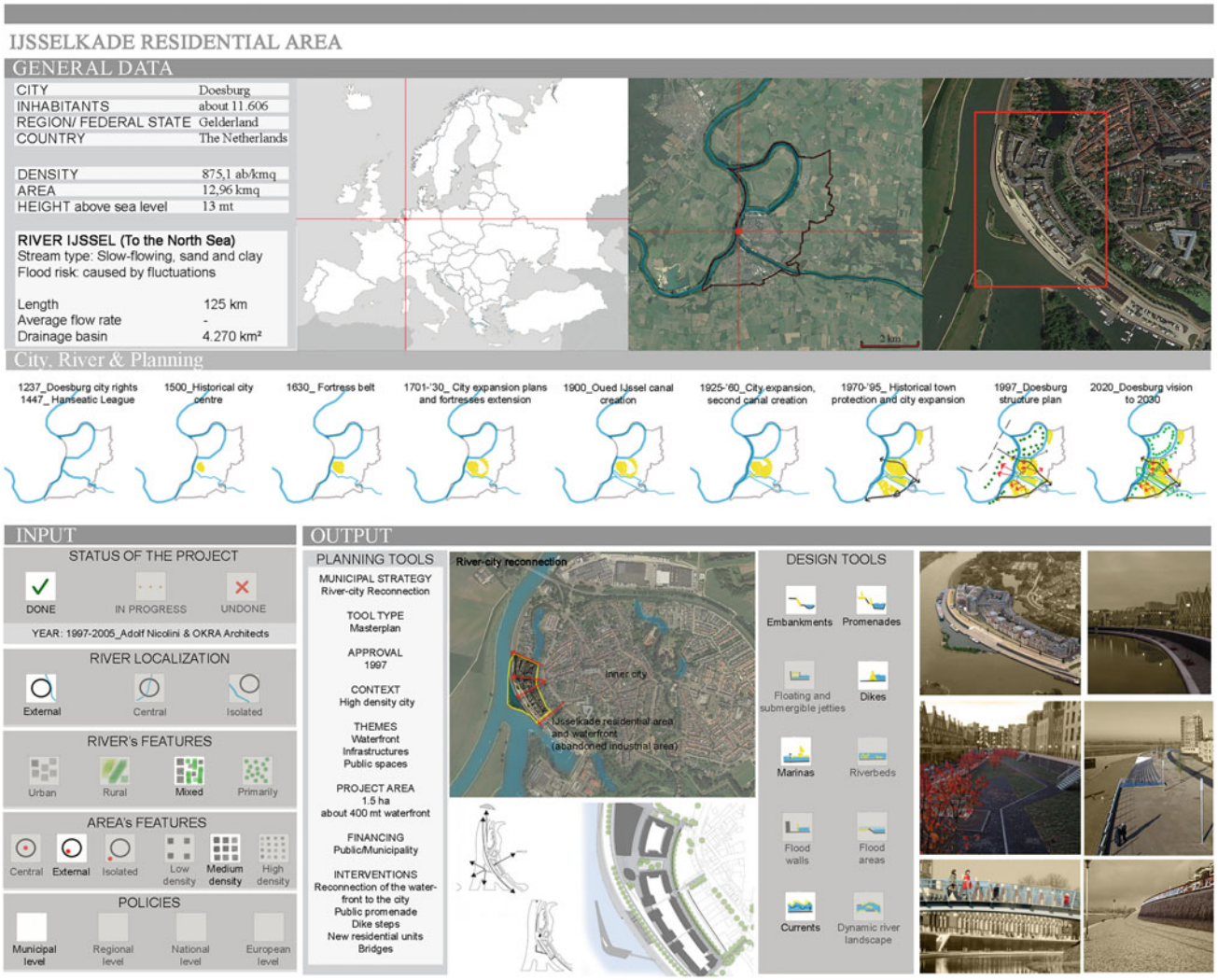

Fig. 2 IJsselkade residential area Project: **General Data Section**: (*Source* Google Earth 2020); **City, River and Planning Section**: Historical Evolution; **Input–Output Section**: Project Analysis (*Source* Google Earth 2020, http://landezine.com, Authors own elaboration, 2020)

The Municipality of Gondomar instead is to the East of Porto. Comparatively to the other municipalities of the Porto metropolitan area, Gondomar tries to redevelop the 4.5 km riverfront of the Douro in order not to lose its continuity with the nearby Porto. The problems encountered by the municipality concerned the stronger and stronger urban growth, the pressure generated by the leisure phenomenon and the private ownership of the land. This riverfront is one of Gondomar's major environmental opportunities to improve the quality of life. Aware of these opportunities and threats, the municipality defined a Strategic Plan covering 4.5 km of this margin, which was executed in 1999/2000 and which had as main objectives to control the urban sprawl, requalify the area in a sustainable way by saving environmental qualities and improve at the same time the economic and social level of the local inhabitants. The riverfront requalification projects are promenades, both naturalistic and urban, the rehabilitation of Gramido Historic House, the construction of Gramido Nautical Centre and Gramido car parking, bridges, floating jetties, green corridors and little park and naturalistic rest areas (Camara Municipal de Gondomar, 2016; Flores, 2012; Marcolin et al., 2015). The project thus gave Gondomar an attractive and dynamic new pedestrian promenades, panoramas and paths (Fig. 3).

2.2.2 The United Kingdom

The second experience is located in the United Kingdom. Here the water development operations are being carried out according to regional public and private policies and investments to obtain places of strong economic attraction and prime properties, with the conversion of large areas waterfront, along the sea, rivers and canals, in new city centers inspired by art and culture, innovation and technology. The roots of this operation are to be found in the

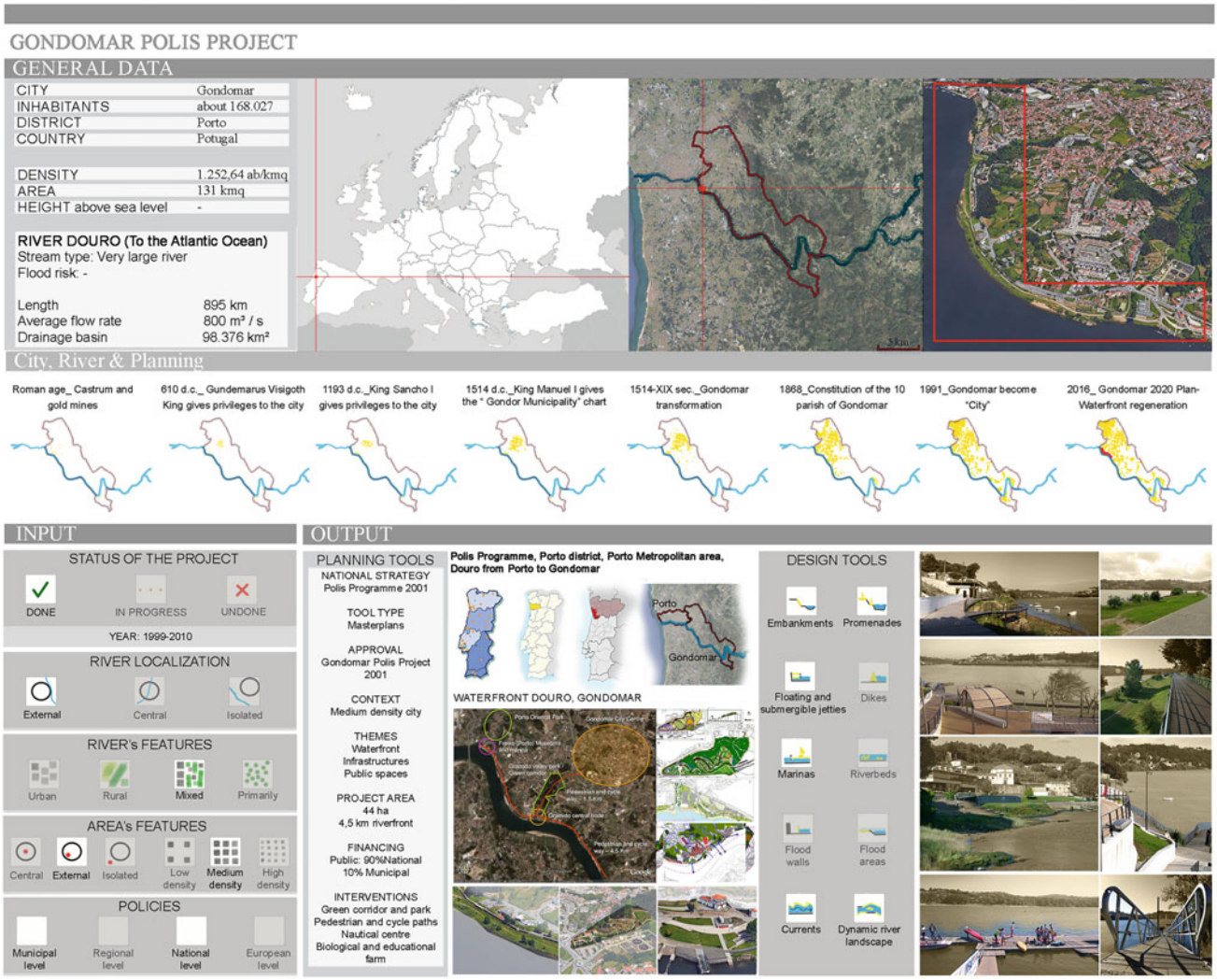

Fig. 3 Gondomar Polis Project: **General Data Section**: (*Source* Google Earth 2020); **City, River and Planning Section**: Historical Evolution; **Input–Output Section**: Project Analysis (*Source* Google Earth Pro 2020, Authors own elaboration, 2020)

English planning system (European Communities, 2000). After several reforms, regional planning is responsible for economic development as well as for the issues of requalification and competitiveness (Spaan and De Wolff, 2005; Cuturi, 2006). To ensure the development of cities defined as metropolitan areas and new regional poles, the operation that is defined as "Waters" is applied to various English cities including Liverpool and Manchester, the two English regional poles economically stronger as indicated in the UK Regional Scheme Strategy to 2021 (Government Office For the North West, 2008). The program relies on different development companies, guided by Knight Knox Unique Property Consultancy company. It offers delivering prime rental accommodation to high-growth cities, primarily in the north of the UK, with leading developers, and it specializes in land acquisition, design, marketing, financing, lettings, property management and sales. Liverpool is the second leading center in the north-west of England and it is fundamental to the economic growth of the City Region. It forms a strategic hub with retail floor space, leisure, cultural and tourist facilities. Within the 2015's Liverpool City Region Devolution Agreement, Liverpool City Region has control over transport, skills, business support and other areas, and the Liverpool City Region Combined Authority is established. The Liverpool City Region is crossed by the River Mersey developed as a key asset for tourism and trade. For this reason, the government recognizes that the River Mersey and Liverpool Bay area can drive growth within the Northern Powerhouse (GOV.UK, 2015; Liverpool City Region, 2016, 2019; Peel Land & Property, 2016). Then the Liverpool City Region Local Enterprise Partnership (LEP) has been constituted and working on behalf of the Liverpool City Region Combined Authority has produced the "Building our Future: Liverpool City Region Growth

Strategy" to deliver greater economic growth and prosperity for residents. The Liverpool City Region LEP's Growth Plan also sets out a long-term ambition for the City Region, with a Strategic Economic Plan (SEP). They identify five strategic projects with maximum impact that will tie together various elements of the Growth Plan's approach to deliver sustainable growth (Liverpool City Region Local Enterprise Partnership, 2016). Along the Mersey riverfront two kinds of projects are being realized: the "Liverpool Waters" in the northern part, by Chapman Taylor architect, and the "Liverpool Docks" in the southern part, by BACA architects. In particular, the project "Liverpool Waters" will transform the city's northern docks along the Mersey River into a prime and investment attractive quarter. The project is going to regenerate a 60-hectare site for a mixed-use waterfront quarter. Together with Wirral Waters on the West bank of the Mersey, the project will benefit the structure and economy of Liverpool City Region and the LEP (Liverpool City Council, 2002, 2010, 2017, 2018; Peel Land & Property, 2016). The project, after several analyses, underlined Liverpool as a place of cultural and social heritage and landscaping, ecological and economic interest. The project site is located on the eastern bank of the River Mersey, in the north of Liverpool's Pier Head. The urban design objectives take into account the need to create a place with identity, where public and private spaces are distinguished and where there is variety and choice. Most part of the land use will be used for commercial offices, residential and tourism purposes. The area development considers five neighborhoods: Princes Docks, Central Docks, Clarence Docks, Northern Docks and King Edward Triangle. Princes Dock is characterized by an existing hotel, office and parking uses. The project will activate additional residential and hotel land uses, with cafes, restaurants and promenades spaces. The Central Docks are focused to create open spaces for business, entertainment and leisure uses around the Leeds and Liverpool Canal extension. Here the cruise liner will be the new landmark. Clarence Docks are characterized by the presence of two World Heritage sites, the Clarence Graving Docks and the Victoria Clock Tower, and it will be a residential area with night-time activities. The Northern Docks is going to form a medium-rise residential area with a strong visual connection with the riverfront. The King Edward Triangle is a transition area from the City center and the riverfront, and it is dominated by the Shanghai Tower and will be characterized by primary tall buildings cluster (Liverpool Waters, 2011). All the interventions focus on realizing different design elements, such as streets, promenades, marinas, new residences, water spaces, squares, parks and gardens to define a public framework to link all the neighborhoods and transform the riverfront into a key asset to attract business investments on a regional context (Fig. 4).

3 Discussion

Each city has benefited from the waterfront regeneration in its own way. The analysis has tried to underline the positive and negative outcomes of different planning and design tools, to respond to the 11th and 13th Sustainable Development Goals and their targets, which are related to Sustainable cities and communities and Climate action. In these goals, there is the aim to individuate policies, strategies or actions that can achieve the sustainable transformation of the cities in balance with the environment and all the society. For this purpose, the third synthetic-interpretative part of the reading chart allowed the comparison through the inputs, represented by the boundary conditions (physical and political), and the outputs, represented by the results (the projects and the spatial transformations), which can be divided into the economic, social and environmental dimensions.

As far as the general considerations represent, a common analysis basis and feature, positive aspects have been underlined in the planning, economic, social and environmental dimensions that can be achieved with this kind of waterfront regeneration processes.

- *The inter-scalar capacity of intervention*. All the waterfront projects are part of a large area of intervention, in which the waterfront plays a key role in the enhancement of the urban quality of life. In Hamburg, the pedestrian paths and the embankments are both for the entire stream of the Elbe river and the city public spaces. In Doesburg the embankments affect the entire course of the IJssel river. In Gondomar, the POLIS program, in particular, follows four lines of intervention integrated with the metropolitan system of Porto, pursuing urban redevelopment and environmental enhancement operations, as well as cultural heritage, re-housing areas and measures to improve the urban and environmental conditions of the city. In Liverpool, the Mersey waterfront represents a great asset for regional and international tourism and trade.
- *Investments attractiveness*. Promenade Niederhafen has given a high-value attractiveness to the entire city with the provision of contemporary public space in the inner part of Hamburg. In Gondomar, the project board of directors is made up of public figures, but private companies are also involved on an international competition basis to guarantee the quality of the projects and respect for the process times. Liverpool Waters has a strong focus on physical and economic requalification through specific programs to promote partnership between the public, private and voluntary sectors. Furthermore, the policies pursue an improvement in the quality of life of the

Fig. 4 Liverpool Waters Project: **General Data Section**: (*Source* Google Earth 2020); **City, River and Planning Section**: Historical Evolution; **Input–Output Section**: Project Analysis (*Source* Google Earth Pro 2020, https://liverpoolwaters.co.uk/, Authors own elaboration, 2020)

residents, in terms of crime, traffic and environmental pollution, raising standards for residence and education, and offering economic opportunities.

– *Social gathering in public spaces*. Promenade Niederhafen allowed the creation of promenades and new public and panoramic spaces for citizens. The community of Doesburg has acquired a new large open public space, a reconnection with its territory and a rediscovery in a contemporary key of its relationship with its historical origins, with the creation of panoramic promenades and new public spaces. Gondomar has expanded much more in the north part far from the river with panoramic naturalistic promenades and new public spaces through the conservation of more significant historic buildings and commercial, touristic and service activities. Liverpool Waters gives public spaces and promenades to citizens along the Mersey river which was once a private port space.
– *Environmental improvement and mitigation of climate change*. Promenade Niederhafen allowed the embankments to be secured with the strengthening of engineering work for the protection from the Elbe river flood risks as well as in the case of IJssel river in Doesburg. In Gondomar, the planning contained within itself sustainable planning and design guidelines, in particular with the aim of strengthening the relationship between city and river and the link between urban activities and cultural and economic dynamization of the riverfront. In Liverpool, the Mersey transformation in environmental performance aims to commit to the cleanest river standard by 2030 and a discharge-free Mersey by 2040.

Negative aspects can be defined along with all these processes, and divided into the planning, economic, social and environmental dimensions. They share problems related to the integration between natural infrastructures and historical cities linked to brownfield regeneration.

- *Influence of private stakeholders in the planning transformation*. In all the case studies, the private stakeholders (investors or property owners) influenced through planning, application or financial resources during the project implementation. In this case, the public stakeholders have been able to seize the private income, to achieve also collective outcomes. In particular, in Liverpool, the real estate company Peel Land & Property decides to submit to the Liverpool City Council an outline planning application for the development of the riverfront of its property. The Liverpool City council had already approved the Unitary Development Plan in 2002, but it implemented and modified it.
- *The city branding consumerism model*. The great economic investments of huge and international private companies lead the public administrations to invent a model of city that if not managed for the public interests risks to jeopardizing the city and the planning processes to allow the market processes, as in Liverpool or Hamburg.
- *Gentrification*. The waterfront regeneration of these cases, except for Gondomar, is often linked to the phenomenon of gentrification, in terms of concentration of social categories or development oriented towards prime functions, which expel cultural and recreational activities related to the medium-level community or even the residents themselves. In fact, the regeneration increases the surrounding living costs, privileging the "prime" society.
- *Decrease of the river's naturalistic features*. In Hamburg, Doesburg and Liverpool the design tools for the riverbanks securing transformed the riverbed into high engineering embankments, removing the naturalistic features of the river.

In general, several considerations have to be introduced, which are the background of these positive or negative outcomes.

For planning tools, which are the first type of outputs, the most used tools for waterfront regeneration are national or regional policies, local plans, economic development strategies and master plans. In this case studies analysis, it has emerged that the inner difference between the national planning system of the European states considered is not a limitation for waterfront regeneration. There are no more efficient or less efficient policies or strategies. Despite their differences—local for Germany and The Netherlands, national for Portugal and regional for the United Kingdom—all the policies have achieved waterfront regeneration. The difference itself is a great opportunity to understand how it is possible to invest, in different ways, for the same purposes. Nevertheless, it is important to underline that the achievement has been possible, thanks to the presence of an up-to-date strong legislative system that allows planning and design transformations, disposing of financial resources or partnership opportunities, throughout the planning and design level processes.

Among the design tools, which represent the second type of output various types of intervention are highlighted, ranging from the creation of dams or barriers for the safety of riverbanks, to the creation of paths and pedestrian areas designed to rediscover and enhance urban and landscape resources, as well as to satisfy a request by citizens for spaces reserved for pedestrians and cyclists. In particular, these interventions lead to the creation of embankment walls, promenades, dikes, floodwalls, currents, marinas, public spaces as floating and submergible jetties and currents. Therefore, there is a high risk of loss in terms of naturalistic features, instead of valorizing the river itself. In all the case studies, the design interventions have been related to the securing of the riverbanks—from the flooding and the pollution in all the samples—and the cultural and social reconnection with the river.

4 Conclusion

The discussion tries to demonstrate how urban policies for the territory allow to reconfigure, regenerate, renew and innovate natural infrastructures as urban spaces or networks for safer urban spaces. The collection of case studies highlights various guiding trends underway in the development of river and coastal fronts. The paper underlines several trends as the redevelopment for safety and protection from flooding and fruition by citizens (Germany), the reconnection between the city center and the abandoned industrial riverfront (The Netherlands), the redevelopment to enhance the historical and environmental resources through the riverfront (Portugal) and the development of real estate riverfront operations to produce economic attractiveness for the prime market, touristic and commercial uses (United Kingdom). In each case, there are positive effects, such as the creation of new public spaces and the securing of the riverbanks, but there are negative effects too because there is a high risk of gentrification, especially in the structured economic riverfront operations. This kind of comparison can help to produce interventions evaluation not only by identifying possible inputs–outputs combinations but also by identifying the conditions that produce negative effects,

trying to minimize them. So, in ongoing research, evaluation parameters can be implemented both from a professional point of view and from the point of view of citizens who benefit from new projects. In the first case, these parameters should consider the effectiveness of the interventions in relation to the procedures, funding and techniques used, and in the second case, the appreciation of citizens for the functionality, fruition and perceived beauty of the interventions must be considered. In fact, the action on the infrastructures should have the objective to transform the routes in roots, the aim to modify the habit of passing through a city in the practice of living through the city.

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