

Public Waterfronts as Multifunctional Public Landscapes Comparative Analysis Study

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Abstract. Urban waterfronts have always been a great asset for cities. Their presence adds a great value to urban life and provides cities' dwellers with a variety of benefits. However, waterfronts globally suffer from many problems that require to be handled. Many waterfront development projects have tried to solve these problems by developing public landscapes along water bodies in order to enhance the quality of living via a multifunctional approach. Thus, this research aims at investigating the applicability of this multifunctionality in tackling landscape projects via studying two urban waterfront projects. This paper is a case study research that claims to offer a richness and in-depth analysis via identifying how a complex set of circumstances come together to produce a particular manifestation. It employs many tactics of data collection (literature review, observations and semi-structured interviews) in order to compare the different facets of the multifunctional approach in both case studies. The findings of this study illustrate, resolve and unfold different tactics in achieving aspects of multifunctional landscapes paving a way for investigating other tactics and aspects that adopt multifunctionality approach in developing urban waterfronts.

Keywords: Multifunctional Landscape - Urban Landscape – Public Spaces – Water Streams – Waterfront Development

1. INTRODUCTION

Urban public landscapes have various forms and sizes. Streetscapes, public squares, community gardens and public parks represent examples of these public spaces and landscapes. In particular, water bodies are precious natural resources that configure particular landscapes both by their physical and aesthetic qualities, and by the life they bring. Water is a 'former' of specific ambiances. Accordingly, waterfronts ("a part of a city orientated to a body of water (river, lake or ocean) [1]") in cities carry the opportunity of developing special spaces for people, where different types of public landscapes can be created within a waterfront development. However, water streams suffer globally due to human interventions and urban developments. Thus, it is essential to give attention to such urban element that can create unique urban public landscapes. Therefore, this research aims at exploring

transformational projects of urban waterfronts in terms of multifunctionality approach.

2. Methodology

This research is a case study qualitative research that depends on investigating two urban landscape development projects involving linear water body. The research depends on specific tactics for data collection. It is a three-phase research where literature review is carried out, at first, to study water streams and the related multifunctional landscape developments in order to set a base from which we can approach the selected case studies. Secondly, two urban landscape development projects were investigated via the different aspects of the multifunctionality approach. Two case studies from two different German cities were selected. This was due to an available opportunity through a field research scholarship to experience and study these cases directly in the field and not only through literature. The case studies were chosen due to specific considerations that can be explained as follows: each location had its special characteristics that defined the approach of their developments; the case studies represent cases of complete transformation and revival of a dead location into a multifunctional vital destination; and finally both cases have a dominant presence of a water stream that plays a vital role in their development. Data gathering tools in this phase included observation and semi-structured interviews. The final phase was a comparative analysis based on the findings of the two previous phases.

3. Water Streams as a Vital Urban Element

Through history, water streams had a role in the formation of many ancient civilizations, where the presence of rivers shaped their way of living and affected their beliefs. Many cities gained their special character from the presence of a river or a water stream. Rivers can hold stories about cities' history, their development and express an identity of a place which is formed through the interwoven social, cultural and physical aspects [2]. For a long time, rivers formed transportation routes between different places where cities developed and grow [3]. Water streams have always been a source of fresh water for both domestic use and agriculture [2]. The river and its related landscapes, like wetlands, provide habitat for a variety of organisms, including fish, and aquatic plants [4]. Along its current, a water stream transfers nutrients necessary for soil health and ensure productivity of these soils [2], [4]. Nowadays, water streams add a contrasting natural element to the dominating built structure of cities [5]. They provide city's dwellers with an opportunity of contact with nature where many recreational activities can take place due to this linear morphology such as like walking, running, cycling and other water sports [2].

With continuous development, humans introduced many alterations to the natural systems of water streams. Human's activities, development and interventions caused many problems in their performance [2]. One of the main problems associated with water streams is their environmental degradation. When ecosystems are disturbed and destroyed, runoff increases and more pollutants are carried into the water [6]. This affects both the quality of water available for human use and living organisms [2]. In addition, great amount of waste resulting from urban life and industry directly affect water streams. Engineering interventions have also their negative impacts. For example, in spite of the benefits of dams' construction, they prevent the natural flow of the streams that carry nutrients necessary for healthy soils [2]. Similarly, building walls for flood control prevents the flow of water to the banks during flood time, which in turn affects the health of living organisms living in wetlands [2], [5]. Recreating opportunities for cities through their waterfronts requires the tackling of these problems and others. Restoration of the natural balance of water streams can provide great benefits to humans by improving their environments.

4. Multifunctional Landscapes

Sustainability and sustainable development are widely discussed topics in different literature. In the context of landscape, the European landscape convention argued that well-preserved landscapes can be part of the three pillars of sustainable development. They can contribute to enhancing human well-being [7]. Sustainable landscapes should be seen as multifunctional; different landscape functions can be balanced within the same design [8], [9]. Multifunctionality is a strategy that "focuses on a shift from functional segregation towards functional integration [10]". It assumes that overcoming conflicts in usages can be through planning and design landscapes that can have multiple functions and serve various goals [10]–[12]. This can overcome the traditional approach to land use planning, where humans interfere to assign a particular single function for each area of land [13]. As a result, public landscapes can be planned to have more than the traditional view of being just a recreational or aesthetic asset [14].

According to sustainability pillars, landscapes can perform different environmental, sociocultural and economic functions. Landscapes can enhance the ecological health of a definite site through performing different environmental functions. Areas of active social and cultural life can also be provided through a landscape development. In addition, economic investments where the space can create a revenue is also a great opportunity public landscapes offer [15]. The investigation of the case studies in this research deepened upon the exploration of these three functions.

The following table (*Table 1. Landscape Functions*) explains different environmental, sociocultural and economic functions, and the landscape elements perform these functions. Landscape elements can be defined in terms of “palette” and “morphology”. Palette includes “vegetation, water, landform and structures”, while morphology includes “spaces, paths, edges, foci and thresholds” [16]. Vegetation, water, hardscape and buildings are elements defined in this table that are in the category of palette. In addition, dedicated spaces, multifunctional spaces and the overall developed quality public space are in the category of morphology.

Table 1. Landscape Functions

		Function	Landscape Element
Environmental Functions	Provide a better living environment	Provide better air quality	Filtrate air from dust, smoke and harmful gases
		Decrease heat island effect	Provide shade
			Decrease amount of heat energy transferred from surfaces to buildings and the atmosphere
	Provide better water quality	Reduce runoff and increase infiltration	Vegetation - Water
		Increase water quality by natural purification	
	Provide better soil quality	Decrease erosion and stabilize the soil	Vegetation
	Enhance biodiversity	Support creation of habitats for different living organism (Provide Shelter and food)	Vegetation - Water
Sociocultural Functions	Provide areas for active social and cultural life	Provide gathering spaces	Dedicated and Multifunctional Spaces
		Provide areas for shared events	
	Create character	Can be part of a space visual character	Special Single Element or arrangement
			Vegetation
	Express identity	Create designs that are inspired by the cultural context	Integrated in landscape morphology via water, vegetation, earth, and built elements
Allow for public participation in design and management			
Economic Functions	Provide products	Vegetables-Fruits-Herbs-Flowers	Vegetation
		Recycled products from vegetation waste	
	Promote economic activity	Create job opportunities	Buildings
		Provide attractive touristic destinations	Dedicated and Multifunctional Spaces
Increase property value			Quality Public Landscapes

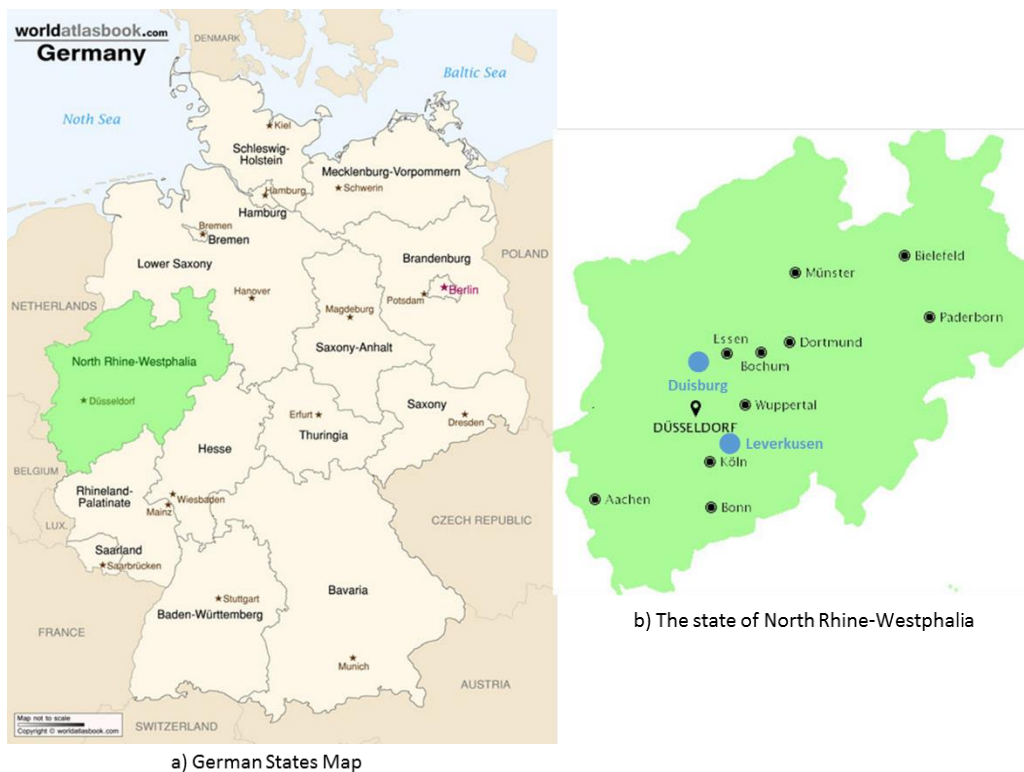


Figure 1. Duisburg and Leverkusen location in the state of North Rhine-Westphalia, From:

a) <http://www.worldatlasbook.com/germany/germany-political-map.html>, Accessed on 2/12/2016

b) <http://www.lahistoriaconmapas.com/atlas/country-map05/germany-map-nrw.htm>, Accessed on 2/12/2016

5. Case Studies

The projects from two German cities are: Innenhafen (Inland Harbour), Duisburg and Neuland-park, Leverkusen. Both cities are in the German State of North Rhine-Westphalia (Figure 1. Duisburg and Leverkusen location in the state of North Rhine-Westphalia). The two case studies will be analysed in terms of the different aspects of the multifunctionality approach.

5.1 Innenhafen Duisburg

Duisburg is a German city located in the Ruhr Valley region. During the 1950s and the 1960s, the Ruhr Valley was a region famous for being a very important industrial hub and known as “the country’s industrial heartland”. As one of the main cities of the Ruhr Valley, Duisburg shared both industrial and trading importance in the growth of the region. Duisburg inland harbour, *Innenhafen-Duisburg*, used to be a very important harbour in the Ruhr Valley region and in Europe. It was one of the largest inland harbours in Europe and known for the trade of timber and cereal and its mills and warehouses [17]. The harbour was known as the “bread basket of the Ruhr Area” [18]. When the Ruhr valley and Duisburg city were subjected to economic changes and declination, the inland harbour was affected as well. Several mills and warehouses were closed, and the port functions declined. The harbour became an abandoned site at the centre of the city.

The revitalisation of the Inland Harbour of Duisburg was initiated through an international competition in 1991. The main goal of the development was to integrate multiple new functions into the existing industrial character of the harbour; to provide a place to live and work, in addition to creating a place for leisure, social and cultural activities [17], [19]. For the masterplan, essential aims were defined [17]:

- Reconnecting the city to one of its important waterfronts.
- Considering the historical character of the site where the existing features of the old harbour should be integrated into the new development.
- Including competitions for long-term planning and architecture projects.
- Revitalizing the site ecology.

A masterplan by Norman Foster won the prize of the IBA competition. Foster and partners provided a masterplan for the inland harbour that aimed to create a multifunctional development. The masterplan provided a framework that included: the reuse of old existing buildings by introducing new functions, allowing for the development of new buildings by different architects, and providing quality public spaces at the waterfront [19]. The project included, developing transportation access,

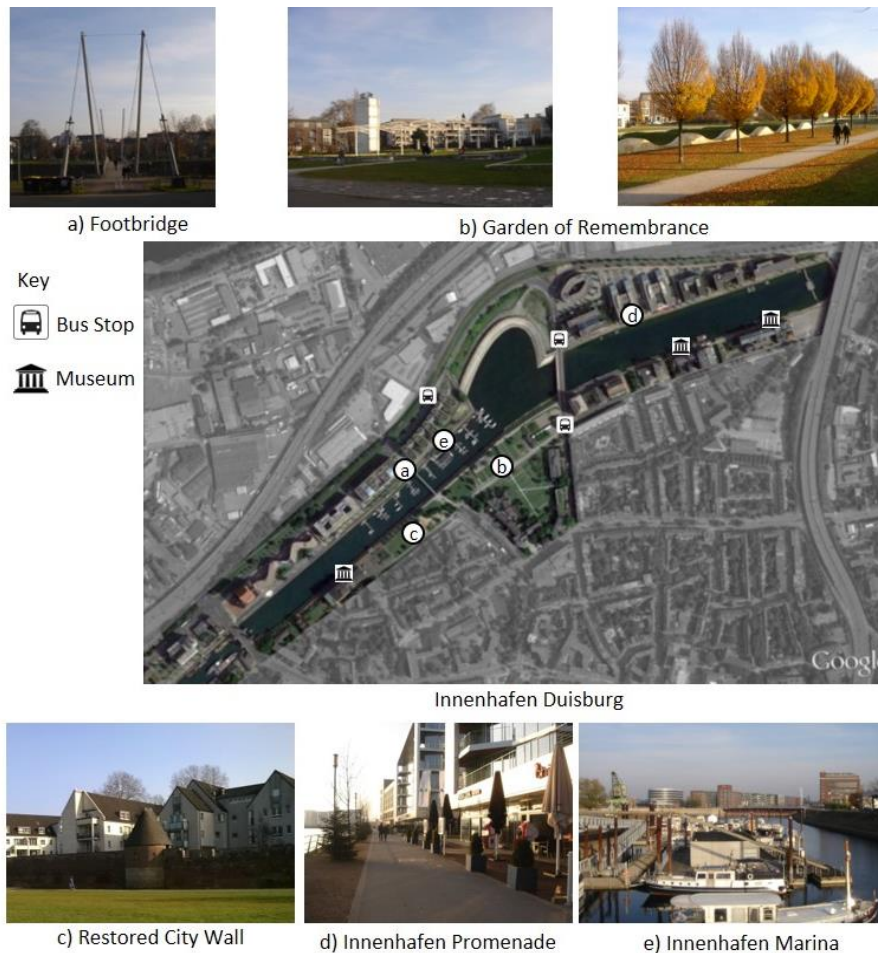


FIGURE 2. Innenhafen Duisburg

restoration of the old city walls, establishing a marina and water sports services, constructing a new promenade and remarkable mobile foot bridge, renovating old buildings into museums and office buildings, implementing an ecological water management system, in addition to the development of a new green space ‘garden of remembrance’ [17], [20]–[23] (FIGURE 2. Innenhafen Duisburg).

5.2 Neuland-Park Leverkusen

Leverkusen is a famous industrial German city located in the state of North Rhine-Westphalia, the same state where Duisburg is located. Before being founded as a city in 1930, it used to be a number of separated villages between two big cities, Cologne and Dusseldorf. The city is famous for its industrial history. It is now the location of the headquarters of the internationally well-known company Bayer AG. The site of the current Neulandpark used to be a former landfill site for Bayer AG. It had different waste materials and chemicals that reached an average thickness of 8 meters. An environmental assessment showed that the contaminated site requires being sealed in order to protect the soil and water from contamination. It was an initial step in the whole development of the area [24].

The main goal of the transformation project of the area was to change the waste dump use to “a contemporary green space” and to “link the city centre with the river panorama of the Rhine again” [25]. The Neulandpark project started in 1995. Due to the previous conditions of the site, several procedures required to be taken in order to deal with the contaminated soil and go on with the project [26]:

- Sealing the waste dump to protect the water and the soil from contamination. This process required a complicated technical structure and high cost, 110 million euros.
- Demolishing a number of residential buildings.
- Spreading 350000 m³ of infill and topsoil on an area of 150000 m² of the previous waste dump. Then it was planted with lawn and different types of vegetation.

Through an architectural competition held in the year 2000, landscape planning firm, *Brosk Landschaftarchitektur und freiraumplanung* in partnership with *studio für Architektur Agribas*, introduced their design for the park and won the international competition. In 2005, the park was opened for users as a part of a regional garden show [26]. The park is divided into three main regions. They are different in character and offer variety of usages. Region 1 is dominated with a naturalistic character especially with the natural flow of the river Dhünn through it. The river was renaturalized as a part of the project [25] The influence of design is highly observed in region 2, where geometric shapes dominate the place. It has some dedicated spaces for children’s playgrounds, a restaurant and an arena. The third region is a two level promenade along the Rhine. It also has a playground, a



FIGURE 3. Neuland-Park Leverkusen

restaurant, tour boats, a yoga club and a canoeing club. It also has a back region with plenty of dedicated spaces that are used for children’s themed playgrounds and a mini-golf, in addition to a restaurant and a horticulture club (FIGURE 3. Neuland-Park Leverkusen).

6. Findings of the Comparative Analysis

Findings of each case study will be comparatively analysed in terms of environmental, sociocultural and economic functions (*Table 2. Multifunctionality Aspects of Innenhafen, Duisburg and Neuland-Park, Leverkusen*). Shaded cells in the table represent specific entities that were not possible to be investigated within the scope of this research as they require either taking measurements using special tools or acquiring environmental and economic reports and both were not available.

Table 2. Multifunctionality Aspects of Innenhafen, Duisburg and Neuland-Park, Leverkusen

	Function	Innenhafen Duisburg	Neuland-Park Leverkusen
Environmental Functions	Provide a better living environment	A transformation of an isolated and an unused site into a healthy waterfront development	A transformation of a deteriorated landfill into a large urban park
	Provide better air quality		
	Decrease heat island effect		
	Provide better water quality	Ecological water management system	Renaturalization of Dhünn
	Provide better soil quality		
	Enhance biodiversity		
Sociocultural Functions	Provide areas for active social and cultural life	Green spaces	Green spaces
		Promenade	Promenade
			walkways
			cycling route
		Children's playground	Multiple children's themed playgrounds
	Museums	Clubs	
	Restaurants	Restaurants	
Create character	Old elements including materials and buildings are used to highlight the former use of the harbour	The design of region 2 is in strict geometric shapes to emphasize the old landfill use of the place	
Express identity			
Economic Functions	Provide products	Annual markets	Annual markets
	Promote economic activity	Marina services	Tour boats
		Restaurants	Restaurants
		Office buildings	
Increase property value	Higher average rent		

7. Discussion

Each case study has succeeded in achieving multifunctionality. The difference in achieving specific functions is due to the characteristics of each site which directed their development. Each case developed functions that were more suitable to its characteristics. The three defined functions have been achieved as follows:

- Environmental Functions

If compared with Innenhafen project, Neuland-Park has a more dominant presence of natural elements. Innenhafen used to be a harbour with existing facilities that were reused in the new developments and limited the presence of more natural elements, while Neuland-Park used to be a landfill which allowed to convert its land into a park after taking suitable procedures. However, both cases achieved a major change in the site ecological health. The two case studies are locations that used to

be deteriorated for years. They are now healthier environments that allow access to natural or semi-natural spaces that was before a source of harmful effects on the city.

- Sociocultural Functions

The two projects are vital with social and cultural life. The rich context and history of each site influenced their development. Expressing the place identity and its special character were considered in the design. That shaped each of them to be unique and significant places. Innenhafen Duisburg merged between the presence of old buildings and integrated them within new significant architectural developments. On the other hand, designers of Neuland-Park Leverkusen wanted to ensure its formal use as a landfill by a design that emphasizes human impact. The two projects included spaces for different sociocultural usages that are suitable for their site characteristics. Innenhafen included sociocultural activities more within the buildings developed in the project. It still included outdoor activities, but are less than the variety of outdoor options offered by Neulandpark, especially children's activities.

- Economic Functions

The two projects have successfully achieved economic benefits while providing people with public spaces. Economic investments did not dominate the development, but were planned to be integrated within the ability of public access for all users. Moreover, the usage of the two places makes benefit of the presence of some of these investments in the form of services for users, for example, restaurants, markets and concerts. Similar to environmental and sociocultural functions, site characteristics directed the type of economic activities included. Innenhafen with its former use as a harbour and the presence of old buildings allowed for the development of office buildings and housing units, while the economic activities in Neuland-Park are more limited.

In addition to the three functions merged in each project, it was found that efficient management from the early stages of the two projects contributed highly to their success. Continuous management and maintenance is what kept them in good conditions till present. In Neulandpark Leverkusen cleanliness and care of the park is part of its image among its users, while lack of continuous maintenance in the Innenhafen caused some deterioration.

8. CONCLUSION

The concept of multifunctionality is getting increasing attention in the landscape sciences and the ongoing debates in sustainable development. It is a useful approach to develop public landscapes that can face the pressure of other forms of developments. Multifunctionality can optimize the use of a certain space by allowing different usages to coexist and in return provide more benefits for humans environmentally, socially and economically. In this sense, water streams as a creator

element of specific ambiance in a public landscape add more values to the multifunctionality approach due to their special characteristics. This speciality can be utilized in favour of the development of more significant landscapes.

The research investigated the multifunctionality of two waterfronts projects. The case studies showed different functions that could coexist within a public landscape. However, it is important to mention that not all functions can be achieved within the same site; since functions should be selected according to their suitability for the context in order to be more successful.

For environmental functions, seeking the transformation of deteriorated sites can change them from being an environmental burden into contributors to the enhancement of human's living environments. They can become destinations of closer contact with nature within urban context and near where people live. In addition, economic functions can play a major part in the success of a public landscape. They can create revenue and offer different services to the users of any space. Creating more significant and outstanding landscapes can make use of sociocultural functions. History, culture and character of a certain context can inspire landscape design. Finally, effective management is a key for the success of any waterfront development, starting from the planning and design of a project, to the execution and then the continuous feedback and maintenance afterwards.

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