URBAN GreenUP

D1.5: Barriers and Boundaries Identification

WP 1 , T 1.4

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V2.2	Kaan Emir	DEM	27.08.2018
V2.3	Gülden Gökçen Akkurt	IZT	29.08.2018

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0 Abstract

Large scale demonstration actions in three European cities; Valladolid (Spain), Liverpool (UK) and Izmir (Turkey), which are the front-runners of the Project, are at the core of the Urban GreenUP Project. However, one of the main elements that makes the project more precious is the capacity building in terms of Nature Based Solutions by the learning link between these front-runners and the 5 follower cities; Ludwigsburg (Germany), Mantova (Italy), Medellin (Colombia), Quy-Nhon (Vietnam) and Chengdu (China).

This deliverable aims to strengthen this learning link between all cities by investigating the experiences and approaches of the cities with identifying the barriers and boundaries in terms of implementation of Nature Based Solutions.

Within this context after a brief introduction section, in section 2, there are detailed descriptions of potential barriers and boundaries, country specific barriers and overcoming barriers subsections under following categories:

- Political barriers
- Technical barriers
- Legal / Organizational barriers
- Social / Cultural barriers
- Financial barriers

In section 3, each city added the Barriers vs NBSs table belongs to their cities and provided explanation for these tables. Tables are composed of NBSs specified for each city and barrier categories. A value between 1 to 5 regarding importance of the barrier category has been provided. Cities elaborated and explained the most important categories in subsequent sections.

After this detailed evaluation of barriers for NBSs planned to be implemented in front-runner cities, in section 4, success stories and failures from front runner cities investigated under the same categories of section 2. Then, section 4 has been completed with success stories and failures from follower cities before conclusions section which given in section 5.

1 Introduction

The purpose of this task is to develop a systematic procedure that will allow an easy identification of barriers and boundaries at different levels: regulation, climate, policy strategies, budget availability, technical or social issues, etc. with the purpose of defining the limits of the Renaturing Urban Plans (RUPs). The starting point of the procedure will be the analysis of previous experiences of NBS implementation at building, area or city level, which will help in the definition of steps that have to be considered in designing the procedure. The results of tasks 1.1 and 1.2 will be used to identify the usual technical, social, environmental and economic barriers that exist, as well as to examine the role played by the different stakeholders and provide case studies illustrating both success and failure of NBS solutions that have been implemented. The outcomes will be captured in a procedural guide that can be used to help identify potential barriers and increase the future success of Renaturing Urban Plans (RUPs).

1.1 Purpose and Target Groups

The purpose of the deliverable is to show the range of possible solutions to identified barriers and boundaries of NBS solutions for replication. By using the document," follower cities will be informed about the experiences of other cities implementing NBS solutions for improved city resilience.

1.2 Contribution of Partners

Contribution of partners can be followed from Table 0-1: Table of contributions & versions of the deliverable.

1.3 Relation to Other Activities in Project

- WP1 - D1.1 NBS Catalogue: During the preparation of the tables under section 3 "NBS Specific Barriers for Cities", D1.1 is used as resource.
- WP2, WP3, WP4 - D2.2, D3.2, D4.2 Baseline definition by zone and challenge: In this deliverable, "Ecosystem Services Assessment Methodology" and "Challenges and Limitations" sections of the baseline reports of front-runner cities are used as resources.
- WP6 - T6.2 Development of a model for replication potential: The outcomes of the deliverable might be useful resources during the project duration when describing the replication strategy.
- WP7: ESA methodology which investigated under the studies of WP7 is taken into consideration during the preparation of subsection 2.5.1 of this deliverable.

2 Overview of main barriers and boundaries

After a deep analysis and examination of the results obtained from tasks 1.1 and 1.2, a broad range of potential barriers and boundaries to the implementation and scaling-up of Nature-Based Solutions (NBS) through the development of RUPs as tools for climate change mitigation and adaption were raised.

Understanding these barriers and boundaries as well as the interconnected factors that reinforce them is essential not only for gathering evidence and knowledge to overcome those that are a matter of perception, but also for finding opportunities to address them.

These potential barriers and boundaries have been clustered into the following categories and subcategories for further examination:

- Political barriers
- Technical barriers
- Legal / Organizational barriers
- Social / Cultural barriers
- Financial barriers

2.1 Political barriers

2.1.1 Disconnection between short term actions and long-term goals

There have been detected a disconnection within the public administration in the NBS implementation, which is related with problems on establishing the communication between institutions.

The disconnection between short term actions and long-term goals is often a result of a number of factors. These can include:

- Coordination between departments of the local public administration,
- Political interests in electoral campaign periods,
- Interventions construction in the short term with visible results in the long term,
- Slow periods for public tendering processes.

- Coordination between departments of the local public administration

Nature Based Solutions (NBS) projects are cross-sectoral and affect different departments in public administration. Coordination is essential for the correct management of NBS projects. The following diagram shows a typical public administration organizational chart with different departments. It is highlighted those who have competences in NBS.

Mayor's Hall	Urban planning, housing and infrastructures	NBS
	Finance, administration and economic development	NBS

	Environment and sustainability	NBS
	Education and equality	
	Security and mobility	NBS
	Culture, tourism and social services	
	Citizen participation, youth and sports	
	Innovation and sustainable growth	NBS

Figure 2-1: Typical local administration organization chart.

First of all, the municipal department in charge of the Nature Based Solutions implementation needs to be identified: Is it the Parks and Gardens department? Is it the Environment Department? Is it the Economical Issues department? Is there in the City Council an Innovation and Sustainable Growth department?

Coordinating tasks can deliver delays in the project development. For instance, some NBS can be constructed in a public park, so it is important to collaborate with parks and gardens maintenance service, but the construction might be implemented by Urban Planning Department.

- Political interests in electoral campaign periods

There can be a lack of correspondence between the NBS implementation and the political agenda.

- Interventions construction in the short term with visible results in the long term

Nature based solutions projects can be constructed in a short-medium period, depending on the complexity. Environmental benefits such as carbon sequestration or heat island effect reduction can be noticed in the short term. But social or economic benefits would be noticed in the long term. This can affect effectiveness analysis of the NBS.

- Slow periods for public tendering processes

Public bidding processes are usually long and complex since they depend on many departments. In addition, the NBS interventions are novel and innovative, so there are not many expert companies available for constructing some of them, such as green infrastructure (e.g. mobile gardens, floating islands).

2.1.2 Discontinuity between short-term actions and long- term plans

The discontinuity between short term actions and long-term plans is often a result of a number of factors. These can include:

- Frequent changes in local authority or other governing administration
- Disconnect of governance with national policy
- Disconnect of governance locally
- Austerity and funding cuts

- Frequent changes in Local Authority or other governing administration

Most of the European countries have Parliament, Government and Local Government which work together to govern the country. In some cases, these different levels of governance institutions have different governance and election periods. Along with the elections, changing governments cause disruption in projects and investments.

Local governments or councils set the overall direction for their municipalities through long-term planning. Local Government sets out area based financial plans, municipal strategic statements and other strategic plans. Setting the vision, and then ensuring that it is achieved, is one of the most important roles of local government. On the other hand, changing governments via elections are eliminating the current vision and strategic plans and bring new ones which are closer their own political view. This leads to hinder on investments and projects and decrease the efficiency of the strategies.

- Disconnection of governance with national policy

In some cases, municipality governance and country governance have different political views. For example, In Liverpool, the municipality governance is strongly Labour, while the country governance is Conservative. This disconnection of governance can create a discontinuity between national plans and how they may be locally implemented. Local municipalities of a different political grouping may feel they are disadvantaged by the ruling political party and forced to accept and make changes they do not support.

- Disconnection of governance locally

Across some municipalities local ward governance may be held by local councillors from different political groups. This can make it difficult to agree priorities and get consensus on issues. In addition, the re-election of local political representatives at a ward level can, even within the same political party, result in a shift of priorities as individuals champion the causes closest to their hearts and those of their local constituents. Local elections are typically held every 3 years.

In some countries municipal responsibilities and areas of action are divided between metropolitan municipalities and district municipalities (e.g. in Turkey). Decisions of district municipalities might not be supported by the Metropolitan Municipalities.

- Austerity and Funding Cuts

Austerity and funding cuts create difficulties for municipalities during protection of financial balance. A detailed example for this kind of austerity and funding cuts is given as following for Liverpool: In the UK there has been ongoing municipality austerity since the start of the recession in 2008/9. Cuts to local government funding have been cross country but the cuts have hit hardest in areas of higher deprivation that that were previously more dependent on state funding. Cuts have taken place across all services: transport, health, education and local authority services such as Adult and Social Care, local education support, parks maintenance etc. Local authorities have been forced to prioritise the delivery of statutory services such as

Adult and Social Care etc. above discretionary services such as parks maintenance, libraries, events, sports and leisure provision etc. In Liverpool 58% cuts have been made to local government funding since 2010 and financial support from central government is set to fall way to zero by 2020. Local municipalities are instead reliant on retaining council tax and business rates to fund the delivery of local services. In deprived areas where housing only attracts lower rate council tax contributions and in areas where there is high unemployment, low start-up of businesses, below average educational attainments etc. attracting substantial sums from business rates is not viable in the short to medium term and councils affected by these circumstances are being forced to make difficult choices on what they can continue to deliver and support. Although many municipalities are looking at innovation and future income generating schemes they are competing in a difficult market and success will take time.

In addition to dwindling budgets the previous awards of Government grants and funding for a range of added value projects and initiatives has drastically reduced and external funding has become harder to access.

Budget and project reductions have seen staff cuts and the loss of capacity, skill, expertise and experience. All these factors, together with uncertainty over the unpopular Brexit decision has made local project planning much harder in longer term with resources now focussed primarily on the delivery of statutory services.

2.1.3 Revisions of the long-term strategic plans of the city

There are a number of key long-term strategic plans for most cities. These thematic strategies tend to cover areas such as regeneration, water, transport and utilities infrastructure. The gap between local urban physical plans and larger-scale thematic strategic plans determine the size of obstacles between them.

Physical plans determine planning for the next decades of the city's growth. These local plans are mandatory requirement of city councils in which they need to set out how they intend to provide sufficient new housing, employment areas and infrastructure to meet the city's anticipated growth needs over the next 20-25 years. Therefore, local plans give 'allocation' decision of land and will to power both legal and implementation purposes.

On the contrary, thematic strategic plans set directions and give recommendations on the location choice without giving more particular spatial dimensions. With this regard, these plans such as climate change action plan, are not a legally binding document and tend to be a low-level of commitment. Due to the fact that, recommendations of thematic strategic plans have limited ability to influence local physical plans and implementation of their results are more prone to ever-changing political choices and ad-hoc decisions. In Liverpool, for instance, the Local Plan has a separate chapter on Green Infrastructure that recognises the importance of green space and the benefits it bring to a developing city. The Local Plan also promotes the concept of Green Corridors but does not specifically mention the role of Nature Based Solutions.

2.1.4 Country Specific Political Barriers

2.1.4.1 Ludwigsburg

The topic of climate adaption and therefore the implementation of Nature Based Solutions are not compulsory tasks of the administration in Germany. Compulsory tasks are all the things the administration is obliged to do for example to build schools or offer public transport. Therefore it is not that easy to convince the municipal council to give money for this topic. For this reason funding programmes are needed to implement Nature Based Solutions. To what extent a city implements things in this topic depends in Germany very much on budget of the city. But even for cities which are financially stable (and Ludwigsburg is one of these cities) it is a barrier to convince politicians to spend money for NBS.

2.1.4.2 Medellín

According to the Political Constitution of 1991 in Colombia, the periods of the municipal mayors last for four years, and are elected through a democratic vote of the citizens. The mayoral candidates present a Government Plan during the campaign, when they are elected, this plan must be approved by the Council of Medellín, and the necessary modifications should be made. Once approved, it becomes the Development Plan for the period for which it was elected. The Development Plans is the route-map of the municipality for the four years, it is embodied in the programs and projects that will be developed with the general budget, as well as the goals that must be met.

Having a Development Plan, each quadrennial generates in some cases discontinuity of the processes, since in spite of the existence of guiding plans such as the Plan and Zoning Ordinance, when an administrative period arrives, the activities that were being executed are not always continued in the previous administration, which leads to setbacks and loss of continuity.

Linked to this periodicity, the contractual processes also represent a limitation if one takes into account that most of the projects of the Mayor's Office are executed by subcontracting, which in many cases generates interruptions in the processes between each contract period, and continuous rotation of contractors.

Once the projects have been defined, there is an exhausting process for the Administration in the resolution of conflicts of ownership of the properties identified and prioritized for their intervention, this constitutes a very important barrier since they generate delays that can last for several administrative periods.

Additionally, it is necessary to include the aforementioned criteria and studies within the processes of review and updating the City’s Master Plan and Zoning Ordinance, so that the topic of adaptation and mitigation to climate change, and viability, are incorporated into the zoning exercise of the city to intervene the territory using NBS, or as they are called in Colombia, adaptation strategies based on ecosystems.

2.1.5 Overcoming Political Barriers

Capacity to act is dependent upon many things including local government having the organizational, budgetary, and jurisdictional ability to address NBSs. In Izmir, for instance, there are two tiers system in local administrations. Municipal responsibilities and areas of action are divided between metropolitan municipalities and district municipalities. Metropolitan municipalities coordinate and control the activities of the district municipalities within their boundaries. In order to expand NBSs in the city or to create new ones there need to be political consensus and collaboration between those organisations.

In Valladolid, a study conducted to identify the biggest problems and challenges facing the municipality based on economic, environmental, climatic, demographic and social issues. An analysis of the urban area has been carried out from an integrated perspective, in order get an objective weaknesses diagnosis and threats to be faced, while detecting the strengths and opportunities that can help overcome the challenge of reaching smart, sustainable and inclusive urban development. This perspective is materialised in an Integrated Strategy of Sustainable Urban Development (EDUSI) for the city of Valladolid named INNOLID 2020+[1]. As a result of this analysis, fundamental axes that should guide the growth and evolution of Valladolid have been determined.

In Liverpool, there are a number of political barriers associated with the introduction of NBS. A key potential barrier is associated with the introduction of pollinator walls, green roofs, floating and moving gardens. This is not unexpected as these are all relatively new, innovative and untried NBS solutions for the city. However, although cautious, Councillors will naturally be keen to see these succeed and gaining senior political support for the project is essential. Given the cuts to core Local Authority funding for services such Adult and Social care and Health and wellbeing it may be difficult to gain support for a green project. However, whilst the city will naturally prioritise the health and economic stability of its residents above greening projects, the NBS should help to deliver a better quality of life and a range of benefits; both socio-economic and environmental. Political understanding of the multiple benefits of NBS is therefore key for continued support. Another political barrier may be the desire to try an NBS solution that has previously failed. Previously the city has had mixed success with hard drainage pavements and some SUDs. In such cases it is important to understand why the early attempts were not successful and to be clear about what is being done differently in the new interventions.

[1] EDUSI INNOLID 2020+: http://www.valladolidadelante.es/sites/default/files/Documento%20RESUMEN%20INNOLID%202020.pdf

2.2 Technical Barriers

2.2.1 Infrastructural challenges

Infrastructural challenges for successful expansion of Nature Based Solutions in cities might be due to the following fundamental reasons.

- Current technical/operational practices of city governments

The locked-in "practice of carrying out infrastructural work". These may be in the case of İzmir, how water management is done in the city, how waterways are enveloped, the techniques used, and how these have become standard practice. This does not allow for bringing green surrounding areas back to riversides and watersides.

- Difficulties finding suitable places in the urban space

The present state of development of city centres does not allow to easy re-direction of traffic (like Madrid Rio, pushing transport completely underground) or opening up space for renaturing, greening etc. The congested city centres are not the easiest districts in the city for clearing for re-adaptation, particularly due to legal and financial dimensions of the task.

The following section 2.2.2 details the barriers related with the NBS locations.

- Buildings structural overcapacity to support the weight of green infrastructure

The green infrastructure such as green façade/green roof adds weight to the current structures. The loading capacity of the building and current structures has to be analysed as a starting point. This is essential to avoid collapse risks.

Green infrastructure has the following other technical requirements:

- The GI has to be designed in order to ease the design of the foundation and fixation in relation to the construction site.
- There is a need for material storage space during construction phase.
- Those GI interventions need space for the irrigation facilities (pump, reservoir, remote control system, etc.).
- Depending on local regulations, there might be restrictions for using chemical plant-protection products. Only biological products and biological control may be used in public spaces,

- The existence of construction companies with demonstrated experience in NBS construction in the local environment.

Nature Based Solution projects are novel and innovative that requires expertise which may not exists in the region or country.

It is recommended to implement a selection process to evaluate several technical proposals for each NBS, especially for those that are highly innovative.

- Arboreal and plant interventions technical barriers

Selected trees must foster local biodiversity, thus local and not allergenic species must be prioritized. It must be considered that tree's roots growth might have negative impact towards different pavements (streets, roads and sidewalks).

To control pest and vegetation diseases phytosanitary product must be applied, but only biological products and biological control can be used in public spaces.

In water interventions, it might be difficult to select aquatic plant species that fits the technical requirements and adapts to climate condition constrictions to different locations. This is the case of the Natural Wastewater Treatment Plant of the Electro wetland technology, as both have aquatic plants.

As an example, In Liverpool the historic general infrastructure of the city is old and not designed to support the population today. There will be many places in the city where it is simply not possible to introduce NBSs because the ground below is full of communication cables and utilities or because telephone lines cross the space above. Elsewhere there will be infrastructure challenges to retrofitting NBS as many aspects need to be considered in a compact city area, including issues such as road sight lines, CCTV, emergency access, future development etc. To overcome this, Liverpool will be working closely with partners at an early stage, selecting sites where it is felt NBS can be retrofitted without too many challenges and continuing to work with colleagues in other parts of the Council on new schemes so that NBS can hopefully be designed in at an early stage on future developments.

2.2.2 Location of the interventions in the urban space

- Lack of space in the urban environment

In urban environment, there is usually lack of space for the construction of NBSs. On the one hand, this can be understood as lack of space in the public roads, such as narrow streets, narrow sidewalks, the existence of underground car parking to avoid affecting to municipal services network such as water sanitation or electricity, etc.

On the other hand, it can also be understood as low availability of municipal plots, for the NBS that need more space such as the floodable park, or the sustainable park.

Some examples that can be mentioned are the following:

- Lack of space for the construction of the 50m^2-SUDs, for installing the Pollinator's modules, the mobile gardens, mobile trees, etc.
- There can be underground facilities installed (water pipes, electric wires, etc.), that can interfere in the proper execution of the actions planned, such as planting trees. It is difficult to plant trees in an urban environment because you cannot make holes in the subsoil.
- Analysis of the suitability of the NBS locations.

For the NBS deployment success it is very important to define the appropriate location for the interventions. Some interventions are highly technological and have specific technical requirements. This needs a multi-criteria evaluation of the locations.

Some examples that can be mentioned are the following:

- If the place selected for a SUD's installation has not the adequate soil type, the permeability of the soil addressed to the SUDs does not guarantee the filtration of the run-off water.
- The electro wetland technology needs access to a waste water source with a high organic concentration.

2.2.3 Country Specific Technical Barriers

2.2.3.1 Mantova

The main problem that Italian municipalities had to face in increasing NBSs, or technical solutions, is the availability of public areas.

In Italy, at the moment, there aren't many architects, engineers or other professionals who are able to work in this field. It can be said that there is not a real developed market in NBSs, on the other hand there are few universities specialized in this sector.

2.2.3.2 Medellín

Medellín is located in a valley surrounded by mountains where the housing development and the growth of the urban perimeter is influenced and conditioned by the topographical conditions in which there are sectors with very steep slope. This implies that the infrastructural interventions are subjected to the topography´s limitations. Additionally, there are multiple tributaries streams to the main river (Aburrá-Medellín River), with identified threat and risk conditions that in some cases are not mitigable risks, which limit the actions at the territory, but also could be great opportunities for NBSs.

In a technical but also legal context, the land ownership is identified as one of the main limitations for municipality actions in the territory, because the local government can only intervene in public properties with all legal documents.

Any project related to the green component and the recovery of stream retreats, green areas and other activities, there are barriers and constraints regarding the conformation of energy networks (wired or underground) as well as aqueduct and sewerage networks.

The city has in some sectors the development of informal and precarious settlements, which present different states of consolidation and are located in areas of high slope and high geotechnical vulnerability.

On the other hand, the lack of control in the hardening of floors, which leads to areas that may have green areas or soft or semi-soft alternative floors for better water filtration, be replaced by hard floor waterproofing the soils. Articulated to this problem is that there is not enough control on the part of the municipal and environmental authorities.

The NBS are still unknown by the technical teams that could implement them, both in the public and private sectors. In addition, there is a misconception that alternatives to conventional ones are high cost, low efficiency or that take a long time. This technical ignorance of the NBS as a viable economic and technical alternative implies that its implementation in the city is delayed.

In this sense, it is necessary to establish clear criteria for the selection of zones for the implementation of NBS, which are aimed at providing solutions to the risk problems generated by climate change and variability, as well as strengthening the health of the city's ecosystem and its associated services. Hence, it is also necessary to strengthen the studies related to the valuation of the services provided by the Municipality's ecosystem, and to generate state-university alliances, which allow the adequate decision-making that allows progress towards the implementation of NBS.

Finally, it is important to highlight the Environment Secretariat has generated valuable technical documents such as the Manual of Urban Forestry for Medellín - Management, planning and management of green infrastructure, developed in 2015, which aims to provide guidelines for the management of green infrastructure, proposed as the balanced combination of environmentally efficient, functional and useful green areas in the city. It is currently in the process of building the decree or resolution to give legal weight to this technical document.

2.2.4 Overcoming Technical Barriers

- **Valladolid**

In this section it can be found some examples of how the city of Valladolid has solved technical barriers.

- Green shady structures

The green canopies for shadow and lightning are going to be installed in a narrow street, with little road space. The canopies are going to be hung from the buildings façades, instead of using pillars. The canopies will include a new efficient lighting system, so the street lamps will be hanging.

The safety local regulations require that a fire vehicle can access. So the canopies are going to be installed above 4.5 m high.

- Floodable park

The floodable park is an intervention for Valladolid Demo. There have been selected a municipal plot to be constructed the floodable park. But this plot has other technical issues that can be mentioned. There are general technical conditions that have to be solved to build a floodable park correctly:

- The surface of the plot might not be big enough to store the required volume of water.
- There is an electric line crossing the plot where it is going to be located the floodable park. Those lines cannot be moved easily. The flooded area will avoid this electric line, which will be surrounded.
- The technical design must ensure that the retention pond is gradually emptied after an episode of flooding.
- The technical design must determine exactly the height of the spillway, so that it begins to derive part of the water flow in the moment just before the water starts flooding throughout some zones of the city of Valladolid, and might produce adverse consequences for human health, cultural heritage and economic activity.

- Since there is currently no water supply system in the floodable park area, there is a need to solve how to irrigate green zones, plants and trees of the park.

- Natural Wastewater treatment plant, SUDs, Rain garden and Green Filter area

The water interventions have the following technical requirements:

- Connection to the city sewage to conduct water to the Natural Wastewater Treatment Plant (NWTP) may be a barrier. This connection must guarantee a constant volume to the sustainable natural park, although this NBS shows certain robustness against fluctuations (in hydraulic load).
- The permeability of the soil addressed to the SUDs might not guarantee the filtration of the run-off water.
- The water capture after soil filtration may be hard to achieve. So that, different solutions must be studied: a water well, drainage system, etc.

- **Liverpool**

The planned NBS in Liverpool include many new and untried green interventions. Introducing new initiatives such as green walls, roofs, SUDs, floating and moving gardens will involve learning new skills and seeking external advice. For these types of interventions, it is possible that the city will try to overcome these by welcoming tenders from experienced companies who are willing to work with the city on design, delivery and support ongoing maintenance as we learn how to manage and maintain such structures in the longer term. This will help to ensure successful deployment of new NBS. Another technical barrier for the city is the creation of a bio app and again this is likely to be addressed through a tendering process that seeks the skill to deliver this aspect of the project and to potentially link it to other identified delivery actions. It is also possible that despite early investigative work, some schemes may prove to be technically too challenging or expensive to deliver and to overcome this the city has been compiling a list of alternative sites for consideration.

- **Izmir**

One of the important sub-demos in the Izmir case is the rehabilitation and renaturing of the Peynircioglu waterway. The present stateregarding urban water management and the accepted best-practice is based on long range flood forecasts coupled to complete barricading of urban creeks and waters into concrete channels, out of sight, out of public bother. As this approach is the standard method of waterways management also nationally, it is supported by related legislation, back-up information and most importantly engineering knowledge and culture. The sub-demo design for re-naturing initially met stiff resistance of this locked-in

approach and careful and innovative technical creativity and much problem-solving skills that satisfied the entrenched way of thinking but also allowed for re-naturing NBS to be realized.

2.3 Legal / Organizational Barriers

2.3.1 Legal Barriers

There can be several legal barriers to implementing NBS in open spaces or urban city areas. These can include:

- Compliance with local basic legislation

The implementation of NBS projects in cities requires compliance with local basic legislation. This can include the following:

Figure 2-2: Local basic legislation diagram.

- General urban planning plan / urban planning / town planning

Land-use planning is a term used for a branch of urban planning encompassing various disciplines which seek to order and regulate land use in an efficient and ethical way, thus preventing land-use conflicts.

- Municipal ordinances / city ordinance / city regulation

The municipal ordinances are general administrative provisions, drawn up by local authorities (City Councils). The ordinances have lower rank than the law; they cannot contain constrictions opposed to the laws and general dispositions.

The following ordinances may apply to NBS:

- Parks and garden maintenance ordinance,
- Water supply and sanitation ordinance,
- Land management and parking ordinance,
- Air pollution ordinance,
- Noise ordinance,
- Public lightning ordinance,
- Public administrative transparency ordinance,
- Good local governance ordinance,
- Technical building code.

- Local strategic plans

The cities can have local strategic plans for their economic, social and environmental development. The following strategic plans may exist:

- Municipal environmental education program (Local Agenda 21)
- Sustainable mobility urban strategic plan

- Municipal plan against noise pollution
- Civil protection plan
- Flood risk management plan

- Land ownership

In case of Liverpool City Council, ownership or legal access to the land that may be suitable for green infrastructure or for NBSs does not exist. In many instances land will be owned by investors and developers who are more minded to build and make larger profit than to use the land in a different way. There are some limited powers for compulsory purchase of land through a Compulsory Purchase Order. This legal function in the United Kingdom and Ireland that allows certain bodies which need to obtain land or property to do so without the consent of the owner. It may be enforced if a proposed development is considered one for public betterment; for example, when building motorways where a land owner does not want to sell. Similarly, if town councils wish to develop a town centre, they may issue compulsory purchase orders. Whilst the powers are strong, the authority must demonstrate that the taking of the land is necessary and there is a "compelling case in the public interest". Owners or occupiers can challenge this, and their objection will be heard by an independent Inspector. Compensation rights usually include the value of the property, costs of acquiring and moving to a new property, and sometimes additional payments including those of professional advice.

- Lease agreements

A lease is an agreement between the landowner, usually called a Landlord, and the user, usually called the Tenant, which allows for exclusive use of a site for a specified period of time in return for a specified amount of rent**.** This agreement can also include many other terms and conditions (such as access, uses, permitted development or change etc.).

A lease does not have to be in writing, though it is usual and preferable.

A lease protects both the landowner and the tenant, or tenant, by setting out their responsibilities and benefits clearly. Both parties can rely in law on the agreement contracted by the other party. In other words, a landowner can rely, amongst other things, on getting the rent, on getting the land looked after as agreed, on getting the land back when specified and can take court action to ensure this happens or the lease is ended. Similarly, a tenant can rely on getting sole and uninterrupted use of the land for the length of time agreed and can take court action to ensure this happens or that the lease, and their liability to pay, is ended.

- Covenants

A restrictive covenant is a private agreement between land owners where one party will restrict the use of its land in some way for the benefit of another's land. Restrictive covenants, once agreed between the parties, are placed in the title deeds to the property. They bind the land and not the parties personally.

In property law, land-related covenants are called "real covenants" and are a major form of covenant, typically imposing restrictions on how the land may be used (negative covenants) or requiring a certain continuing action (affirmative covenant). These may also "run with the land" (called a *covenant appurtenant*), meaning that any future owners of the land must abide

by the terms, or may apply to a particular person (called a *covenant in gross*). Under English law, affirmative covenants typically do not run with the land. The covenant may be shown in the deed and should be disclosed to prospective purchasers; it may also be recorded. Real covenants and easements or equitable servitudes are similar and in 1986, a symposium discussed whether the law of easements, equitable servitudes, and real covenants should be unified. As time passes and the original promise of the covenant is no longer involved in the land, enforcement may become lax.

Courts interpret covenants relatively strictly and give the words of the agreement their ordinary meaning. Generally, if there is any unclear or ambiguous language regarding the existence of a covenant courts will favour free alienation of the property. A covenant can be terminated if the original purpose of the covenant is lost. The covenant may be negative or affirmative. A negative covenant is one in which property owners are unable to perform a specific activity, such as block a scenic view. An affirmative covenant is one in which property owners must actively perform a specific activity, such as keeping the lawn tidy or paying homeowner's association dues for the upkeep of the surrounding area.

At common law, the benefit of a restrictive covenant runs with the land if three conditions are met:

- The covenant must not be personal in nature - it must benefit the land rather than an individual
- The covenant must 'touch and concern' the land - it must affect how the land is used or the value of the land
- The benefited land must be identifiable.

- Local permits for construction work

There can be delays due to permissions and validations of civil works in public spaces, which must be approved by municipality agents. Those permits can be for public or private spaces, such as private permits to affix green infrastructures to buildings façades.

The build promoters need to coordinate with the City Councils for the appropriate licenses/authorizations.

Also included here is the Public permits to occupy the public thoroughfare, because to occupy a public space and install an intervention in the street, a municipal permit is compulsory.

- Rights of Way

Historic and established rights of way can be considered in land use applications but planning systems have shown that many have in the past been re-routed to avoid conflicts of use and accommodate modern living.

- Maintenance and duty of care

Land owners have a duty of care to maintain land free from litter, vermin and unsightly etc. but not to maintain it for conservation, biodiversity or NBS solutions. In practice unless the land is causing some nuisance local authorities have little in the way of capacity or legal support to enforce maintenance.

- Possible lack of ordinances and local regulations

There might not be local regulations which manage these innovative interventions. Local legislation covers current needs; however, there may be regulatory deficiencies that apply to NBS interventions.

- Public-private collaboration

It is not easy to make an agreement between a public administration and a private company, which does not violate the public procurement laws. The laws look for open public procurement processes.

There is need an administrative coordination among the main stakeholders to implement the NBS initiatives. Local administration must ensure that the private partners fulfill with their responsibilities in time and according to tender timing. An effective and well-defined interaction public versus private stakeholders is essential.

2.3.2 Organizational Barriers

It can be indicated a number of organizational barriers that hinder the adoption and effective implementation of renaturing urban plans:

- Departmental / Institutional silos:

Working in silos is one of the major types of organisational barriers. Generally, there is conflict with regulations of different departments/sectors and lack of partnership/collaboration. Departments being organized into silos prevent the types of interaction required for municipal response to renaturing urban plans.

- Vertical/Horizontal Hierarchy, work culture:

Hierarchy stops innovation and slows down the communication - with more levels, the communication gets delayed. Vertical hierarchy requires centralized decision making and top-down communication. Therefore, this creates rigid hierarchical relationships and poor communication environment based on more written documents other than informal exchange. Weak linkages among the senior levels of organization, and weak communication between organization and its constituencies all served as barriers. Regarding to organizational/work culture, public sector institutions are risk-averting, no rewards or incentives to adopt new innovations like NBSs.

- Lack or absence of a capacity for organizational learning:

Delivering a new approach in organisations, especially in public sector, without new management structures and new work division, it will be considered as additional workload by existing workers who are often work within their comfort zone. Capacity barriers such as limited staff time and training can also be identified as significant organizational barrier to

impede learning of new implementations. Bad management of human resources (i.e. lack of incentives and career development programmes) is also a factor for capacity barriers.

- Lack of engagement with programs:

Short term planning horizons and delivery pressure and administrative burdens can create lack of engagement to specific programmes plans and projects. Definition of responsibility for NBS maintenance after the URBANGreenUP Project, for instance, is essential that the cities could support those activities, financially and with staff.

2.3.3 Country Specific Legal Barriers

2.3.3.1 Ludwigsburg

To build/implement NBSs different municipal offices have to work together and have to agree with a measure. Often there are different interests. It gets even more complicated if parts of an area are owned by the state. It is a barrier to convince all the different stakeholders.

2.3.3.2 Mantova

There are a lot of architectural ties and low restrictions especially in an UNESCO Heritage city. This is a real limit to the introduction of innovative solutions, natural or technical. On the other hand, the legislation supporting energy transition and climate change action is very recent and often not yet applied.

It is already difficult to involve other departments of the Municipality, other Public bodies and private owners in developing new strategies oriented towards resilience.

2.3.3.3 Quy Nhon

The lack of legal regulations on the implementation of NBS, specialized technical standards for applying NBS as well as financial regulations and mechanisms to enter the NBS market causes difficulties in extending NBS in Vietnam.

2.3.3.4 Medellín

The Decree 0883 of 2015 defines the functions of the agencies, dependencies and decentralized entities of the Mayor's Office of Medellín. It was determined among the functions of the Environment Secretariat: "to lead and manage the necessary actions for the protection, conservation and promotion of green public spaces, landscaping and forestry of the Municipality". On the other hand, in the same decree is defined as one of the functions of the Physical Infrastructure Secretariat: "to manage and coordinate the formulation, execution and evaluation of plans, programs and projects of Physical Infrastructure for public use necessary for the development of the Municipality".

According to the Decree, both secretariats have interference in green public spaces, so to prevent both of them from work in the same areas, they agree that the Environment Secretariat is in charge of the riverside and hills and Infrastructure of the rest of areas of public use, including parks, green areas, green corridors in road zones. This implies that the Municipality of Medellín has the green component divided into two secretariats, this condition

generates problems of coordination and requires that both secretaries have to agree when it is intended to develop projects like Renaturation Urban Plans. Additionally, there are other green areas in the city of Medellín that are managed by other entities: Empresas Públicas de Medellín - EPM, Metro, Metroplus, Sports and Recreation Institute of Medellín - INDER, this implies greater management and requires coordination between entities.

The Environment Secretariat of Medellín is not an environmental authority. The environmental authority for the urban area of the municipality is the Metropolitan Area of the Aburrá Valley. This entity is the authority for the 10 municipalities which conform the Aburra Valley (including Medellin) in its urban area; as well as, it entity is planner of the territory, metropolitan mass transport authority and executor of works of metropolitan interest.

This nature of the Metropolitan Area with multiple functions, make it an important actor in the territory. It gives the permission for pruning and felling; as well as sowing in the urban area, so its decisions directly affect the territory. One of the problems of this entity is that it lacks technical rigor in its decisions and optimizes processes to make them more efficient. These types of problems directly affect the planning and development of green component projects.

Another important aspect to bear in mind is that the administration of the municipality of Medellín is not allowed to intervene private property, as this is considered patrimonial detriment, so it is necessary to work on perfecting the bases that allow generating public-private partnerships, making the options more flexible of application of this type of strategies, but with the rigor necessary to guarantee transparency in the process.

2.3.4 Overcoming Legal Barriers

- **Valladolid**

In the city of Valladolid, no legal barriers have been identified that have not been overcome. The URBAN GreenUP project is complying with all the laws, regulations, rules and guidelines that apply to the city, at European, national, regional or local level.

In the future, after the URBAN GreenUP project, there might be implemented new local regulations, which ease the implementation of NBSs among the citizens. Those regulations might include tax benefits or a grant system.

- **Quy Nhon**

Some solutions for overcoming legal barriers in Quy Nhon city:

- Supplementing and amending policies, relevant laws and management (ensuring the long-term, flexible and participatory manner, involving the people).

- Raise responsibilities of stakeholders in implementation and supervision.

- Encourage community participation in consultations.

- **Izmir**

In most of the cases, local governments in Turkey need to take specific permissions for the investments related with agriculture, transportation and environment. As an example; parklet areas planned to be built in Izmir cover the area on roadway and to use that areas decision

from Transportation Coordination Centre (UKOME) is necessary. At this Centre, the representatives of transportation and traffic related organizations participate and decisions are made according to their opinions. In Izmir this process has been successfully overcome by the help of existence of UrbanGreenUp project, Green Infrastructure Strategy and Sustainable Mobility Plans.

2.4 Social / Cultural Barriers

2.4.1 Knowledge Gaps - Fear of the Unknown

The implementation of NBS as tools for adaptation to climate change, is a relatively early and not very widespread since human nature is conservative and any change will cause distrust and fear. The lack of information can generate rejection of the different actions, even though it implies future environmental, cultural, social and health improvements.
Lack of knowledge is one of the most important barriers that comes from all stakeholders involved, including policies, practice but also residents.

Another knowledge gap concerns the relationship between NBS and society and, more specifically, the stakeholder involvement and impact of human-nature interactions in forming or altering lifestyles, beliefs, and preferences while also considering place-impacts such as displacement and gentrification.[2]

Figure 2-3 shows a division of the main risks and barriers related to urban NBS that were extracted from the Expert Workshop on nature-based solutions for mitigation and adaptation to climate change in urban areas and their rural environment (Isle of Vilm, 10. - 11. March 2015).

[2] Expert Workshop on Nature-based solutions to climate change mitigation and adaptation in urban areas and their rural surroundings (Isle of Vilm, 10. - 11. March 2015)

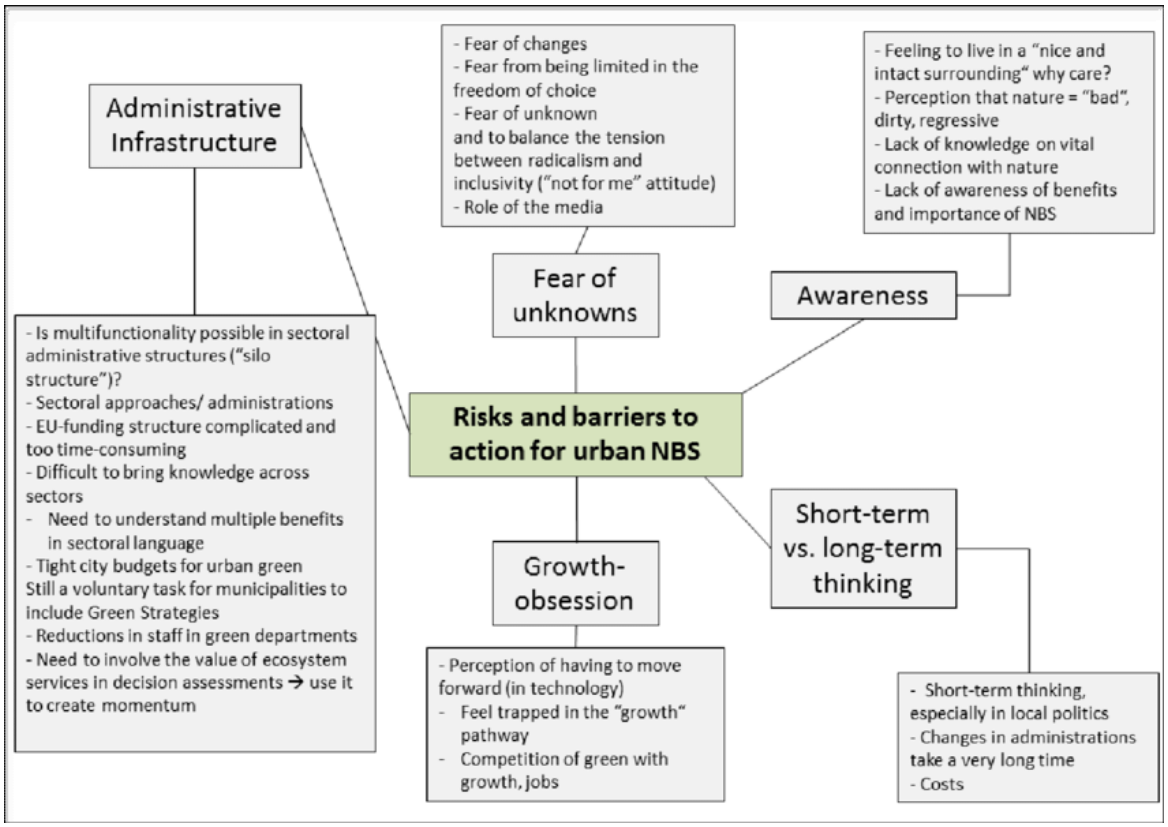

Figure 2-3: Barriers to action for NBS (Source: Expert Workshop on nature-based solutions for mitigation and adaptation to climate change in urban areas and their rural environment.)

Knowledge gaps at the social level also include unknowns of the implementation and maintenance of NBS. For example, residents may not be as aware or might even have the perception that green infrastructures on roofs and walls or pollinator modules are harmful, are "dirty and host insects" creating additional perception hurdles[3].

The fear of the unknown considers both uncertainties and risks of implementing NBS in cities, as well as the resulting changes this may induce in city planning. Due to its nature, NBS must be handled differently than other approaches and require new protocols for implementation and maintenance; these factors are perceived as an operational unknown.

[3] (Lohr et al. 2004, Kirkpatrick et al. 2013, Kronenberg 2015)

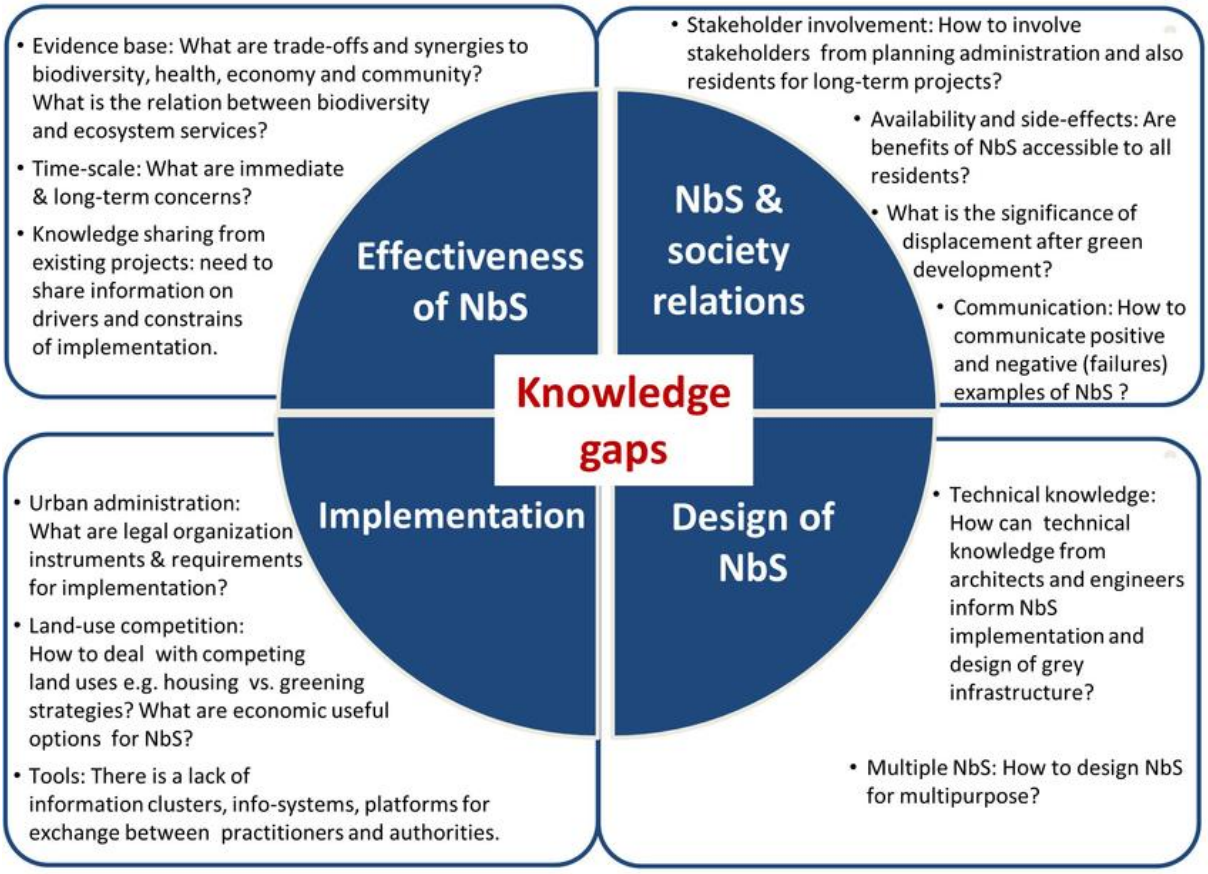

Figure 2-4: Knowledge gaps for the various dimensions NBS can affect.[4]

2.4.2 Lack of Awareness

Another identified barrier is the ***lack of awareness*** regarding climate change induced problems and the benefits NBS provide to city residents.

The lack of public awareness slows down the implementation processes of the NBS, but the reverse also occurs, the lack of implementation of actions, makes the results are not tangible for the population and does not increase environmental awareness. The main challenge to solve this point is a grassroots education for all actors, "education and awareness raising informed decision making, play an essential role in monitoring adaptation and mitigation capacities of communities, and empower women and men to adopt sustainable lifestyles "[5].

2.4.3 Green Gentrification and Social Inclusiveness

Green gentrification is a process by NBS implementations increase the real estate value of land and produce a change of social structure of the neighbourhood, and because of this situation,

[4] Kabisch, N., et al. 2016. Nature-based solutions to climate change mitigation and adaptation in urban areas: perspectives on indicators, knowledge gaps, barriers, and opportunities for action. Ecology and Society 21(2):39

[5] Climate Change Education and Awareness. UNESCO.

the original population of the affected area is progressively displaced by another of a higher purchasing power.[6]

In consequence, this kind of actions is positive for the environment and for urban degraded areas but not for the social inclusiveness of the citizens of this reconstructed areas which are pushes out. Without equity-oriented public policy intervention, urban greening is negatively redistributive in global cities.[7]

2.4.4 Paradigm of growth

The paradigm of growth is one of the main barriers identified for the implementation and up-scaling of NBS.

This barrier refers to the problem of cities that have slowed their growth, either demographic or referred to economic resources. In order to grow more quickly, these cities reduce their investment in green spaces and increase those dedicated to commercial spaces, grey infrastructures, etc. This means that the budget allocated for maintenance of NBS and green areas is affected, as well as that of the number of qualified personnel dedicated to its maintenance and correct handling.[8]

2.4.5 Country Specific Social Barriers

2.4.5.1 Ludwigsburg

Experiences of Ludwigsburg are that citizens are often very critical if something is in a testing phase. If the city spends money in new and innovative solutions they are often not perfect. Often citizens ask “why do we have to spend so much a money on such things? Aren’t there more important things to do?”.

Here the communication is very important and challenging.

2.4.5.2 Mantova

The social situation in Italy is very different, so also the social barriers are different. The North and the South in fact have different social problem, richness, lands and countryside. Maybe the developed North of Italy is ready to change the way of think the NBS, also because there are some very important and well-known projects.

While in the South there are social problems, poverty which could be an obstacle to the development of NBS.

[6] http://www.elmundo.es/grafico/madrid/2017/08/06/596cdf3ee2704e07148b45eb.html

[7] Gould, K. A., Lewis, T. L. (2017). Green Gentrification. London: Routledge.

[8] Kabisch, N., N. Frantzeskaki, S. Pauleit, S. Naumann, M. Davis, M. Artmann, D. Haase, S. Knapp, H. Korn, J. Stadler, K. Zaunberger, and A. Bonn. 2016. Nature-based solutions to climate change mitigation and adaptation in urban areas: perspectives on indicators, knowledge gaps, barriers, and opportunities for action. Ecology and Society 21(2):39. http://dx.doi.org/10.5751/ ES-08373-210239

2.4.5.3 Quy Nhon

- Low awareness, knowledge and understanding of NBS as well as its methodology,

- Conflicts of benefits among beneficiaries,

- Cultural barriers, including culture of architecture, housing etc. affect the implementation of NBS. For example, the Vietnamese prefer to build houses with flat walls, not to use raw brick wall carpentry for climbing trees.

2.4.5.4 Medellín

Medellín is a city that has been experiencing a process of continuous transformation, overcoming periods of violence and mismanagement of natural resources. Through the creation of public spaces for recreation and enjoyment, the provision of an integrated mass transport system, and the effort to provide basic services of light and water to the low-income communities, it has been possible to create a filling of ownership and respect over public spaces, within the citizens.

Despite to these efforts, given that Colombia is a country with such complex socio-cultural dynamics, with high levels of inequality and the migration of peasants to the cities looking for security and better incomes, our city receives a great deal of people who come to settle with the dream of building a better future. These people, who often arrive without enough capital to access a home or a room, choose to build by themselves, with the materials they find affordable, their homes on high-risk land, mainly on the edges of streams and in hillside areas where the chances of landslide occurrence is high.

This situation constitutes the main social barrier in the Municipality of Medellin, in the face of the implementation of the NBS, since both the majority of citizens and migrants from other cities or towns, submit to settle in these sites despite the risk, or the risk of intervening inadequately degraded spaces and susceptible to treatment with NBS.

The operational capacity of the Municipality, with its inspectors and other officials whose work is to prevent, identify, control and solve risk situations such as invasions of stream withdrawals by low-income citizens, is insufficient. The number of people arriving daily in the city of Medellin, mostly from rural villages in conflict, is very high, and although the municipal administration, through several entities such as the Secretariat of Management and Territorial Control, and the Security and Coexistence, act, the invasions reappear over time, generating a permanent conflict throughout the territory.

We need to socialize with the community the City´s master plan and the Zoning Ordinance, and the state of our territory, so that each citizen recognizes his role and duty as an inhabitant of Medellín. Under the previous complex social panorama, the confrontation between gangs in the communes of Medellin, especially in hillside areas and limits with the rural area, generates problems of interurban migration and the formation of "invisible barriers" that impact both the areas susceptible to intervention with NBS, as the execution of said interventions given the risk to the safety of the officials.

In the rural-urban perimeter, pastoral activities and other agricultural activities are developed that sometimes interfere with the implementation or conservation of NBSs.

The lack of culture of the citizens regarding the care and importance of the preservation of the trees and other plants used in NBS also represents a social barrier in Medellín. For example, in some cases the citizens take plants and other decoration of parks and public zones public to their home; additionally, in occasions that for some reason the community requests felling of a tree to the environmental authority and this is rejected, so they proceed to apply toxic substances, or to remove part of the bark of the three impeding the flow of sap and as a consequence generating death in the medium term.

Finally, the large number of street dwellers in the city also represent an important barrier and limitation in social terms, since the sites that these people choose to establish their temporary homes "cambuches" are usually located in areas of implementation of NBS. In this sense, the materials that are used for the development of interventions such as wood and gravel, are extracted and used for cooking or other survival activities of this population.

However, despite these barriers and limitations, there have been success stories in the city where NBS has been intervened in critical areas (areas of illegal storage of solid waste), with the creation of gardens generating spaces for recreation and coexistence, the community appropriates these and does not allow waste to be thrown there again, even adopting maintenance work on these spaces. Thanks to this, they have also been creating sources of employment needed in the city.

2.4.6 Overcoming Social Barriers

- **Liverpool**

There are a number of socio-cultural aspects of concern that will need consideration. Some of these will be associated with unfamiliar concepts such as wood allotments, floating gardens, carbon capture or nutrient releasing soils while other concerns may be more focussed on the visual appearance of some sites – particularly NBS such as pollinator verges which can look untidy towards the end of the season and are usually not cut until they have set seed.

Many of these barriers can be overcome by making sure that information on the schemes is shared and explained with local residents and this can also be reinforced through appropriate on-site signage so visitors can understand the landscape.

- **Quy Nhon**

Overcoming social barriers due to low awareness, knowledge and understanding of NBS:

- Strengthening communication and training on awareness and knowledge for local leaders and officials, including designing consultancy units.
- Enhancing the participation of the community.
- Strengthening information on NBS through leaflets, web, television, radio, etc.

Overcoming social barriers due to conflicts of benefits among beneficiaries:

Local government develops a co-management model, which is a long-term commitment to NBS implementation.

Overcoming cultural barriers:

- Evaluate the process of implementing NBS into architectural culture, urban housing, etc. This assessment is the basis for adjusting the architecture of housing to suit the situation of urban development and climate change,
- Change the habit of designing urban housing using NBS,
- Raising awareness,
- Proposing architectural designs of urban dwellings related to NBS according to the characteristics of each construction area and each specific implementation solution,
- Gradually reduce and proceed to stop design, architectural architecture in urban thanks to traditional culture,
- To supplement the design guidelines and specialized legal documents for implementation in a synchronous and effective manner.

- **Izmir**

In recent years, there has been a reaction by the informal civil society organization against large-scale and top-down proposed projects in urban nature conservation in Izmir. This organization is, a reactive character, with the aim of increasing and nurturing the amount of green space. Therefore it is not possible to talk about the NBSs are being innovations that have been tested and socially accepted in the city. In order to overcome this barrier, the İzmir Green Infrastructure Strategy has been established, which is called 'İzmir Doğa', coinciding with the Urban GreenUP project and more than 150 experts have contributed from various institutions. Thus, a catalog of NBSs has been introduced to the relevant institutions and the solutions that may be needed for the city have been investigated together with these institutions. For the current period, this strategy will continue to be visible in various parts of the city as urban furnishings, and NBSs such as green resting units, parklets and pollinator houses are chosen with this aim. Developing the prototypes through design workshops and co-design, taking proposals for location selection, making informants and providing social acceptance are the steps of the study.

2.5 Financial Barriers

2.5.1 Perception of Eco Services Valuation

In order to evaluate impacts and trade-offs of NBSs implemented in demo site cities the Ecosystem Services Assessment (ESA) approach will be adopted. ESA approach is based on urban ecosystem services. It will identify and assess the generation of new, enhanced, restored flows of ecosystem services promoted by urban renaturing, quantifying these flows in physical and monetary terms. A categorization of ecosystem services tailored on the urban context will be elaborated within the project.

Design and apply an innovative analytical framework to evaluate NBS based on their provision of ecosystem services explicitly tailored on the urban context will allow to assess their cost-effectiveness also in relation to alternative solutions (if necessary).

Natural Capital can be defined as the World's stock of natural assets which include geology, soil, air, water and all living things. It is from Natural Capital that human derive a wide range of services, often called ecosystem services, which make human life possible.

Ecosystem services are "*the direct and indirect contributions of ecosystems to human wellbeing*"[9]. Several classifications of ecosystem services exist including those presented by the *Millennium Ecosystem Assessment*[10], *TEEB* and the *Common International Classification of Ecosystem Services* (CICES 2013). Building on previous categorizations of ecosystem services,[11][12] the TEEB report identifies 22 types of ecosystem services grouped in four categories:

1. provisioning
2. regulating
3. supporting
4. cultural

The draft grid, identifying the ecosystems services impacted by NBS, contains affected ecosystems services depending on the nature-based solution implemented. In continuation, the sustainable urban drainage system may be related to the waste regulation, runoff mitigation air filtration, micro-climate regulation or aesthetic beauty, on the other hand, the green roofs/walls to runoff mitigation, air filtration, micro-climate-regulation, erosion control and aesthetic beauty etc. (source: UB-IEFE, 2017). A categorization of ecosystem services tailored on the urban context will be elaborated within the project.

Ecosystem Services Assessment (ESA) methodology aims to evaluate all ecosystem services provided or improved through the NBSs implementation in cities.

The ESA approach will be integrated into commonly used decision-making mechanisms, ranging from the more general trade-off analysis and scenario analysis, to specifically cost-benefit analysis, cost-effectiveness analysis. The logic behind ecosystem valuation is to unravel the complexities of socio-ecological relationships, make explicit how human decisions would affect ecosystem service values, and to express these value changes in units (e.g., monetary) that allow for their incorporation in public decision-making processes. The methodology that will be applied for the monetary evaluation of NBSs is the Total Economic Value (TEV). It

[9] The Economics of Ecosystems and Biodiversity, (TEEB). (2010). "The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations". London: Earthscan.

[10] Millennium Ecosystem Assessment, (MA). (2005). "Ecosystems and human well-being: the assessment series". Island Press, Washington DC.

[11] Millennium Ecosystem Assessment, (MA). (2003). "Ecosystems and human well-being: a framework for assessment". Island Press, Washington, D.C., USA

[12] De Groot, R.S. De Groot, M.A. Wilson, R.M.J. Boumans. (2002). "A typology for the classification, description and valuation of ecosystem function, goods and services". Ecological Economics, 41, pp. 393-408

should be emphasized that "total" TEV is summed across categories of values (i.e., use and non-use values) measured under marginal changes in the socio-ecological system, and not over ecosystem or biodiversity (resource) units in a constant state constant state[13]. Recent contributions in the field of ecosystem services have stressed the need to focus on the end products (benefits) when valuing ecosystem services. This approach helps to avoid double counting of ecosystem functions, intermediate services and final services[14] [15].

Figure 2-5 resumes the TEV methodology and the evaluation techniques that will be used to measure NBSs impacts in cities.

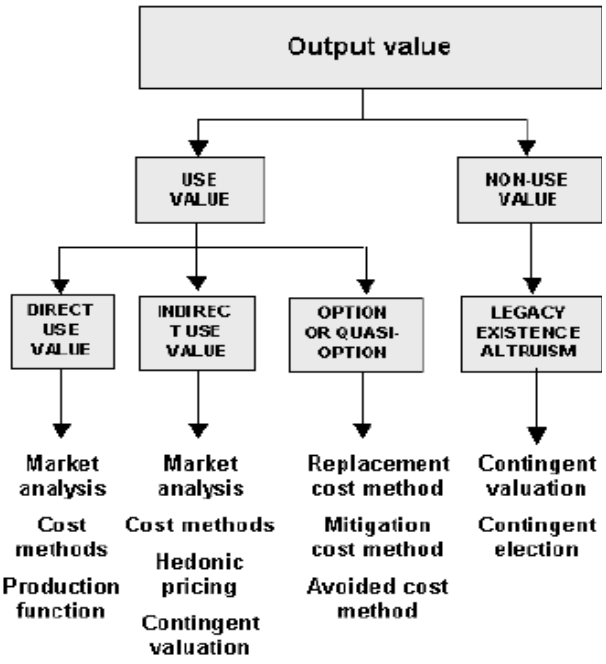

Figure 2-5 TEV methodology and evaluation techniques

In order to evaluate NBSs, a set of KPIs to assess ecosystem services state before and after the implementation of NBSs will be populated. A set of 153 KPIs has been built starting from the European project EKLIPSE and it has been modified considering several international initiatives linked with NBSs and urban sustainability:

- The Sustainable development goals (in particular SDG11, SDG13, SDG15)
- Mapping and Assessment of Ecosystem Services, MAES Urban
- European Green Capital Award
- Aichi biodiversity targets

[13] The Economics of Ecosystems and Biodiversity, (TEEB). (2010). "The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations". London: Earthscan.

[14] Boyd, J., and S. Banzhaf. (2007). "What are ecosystem services?". Ecological Economics 63: 616-626.

[15] Fisher, B., Turner, R.K., Morling, P.. (2009). "Defining and classifying ecosystem services for decision making". Ecological Economics 68, 643 – 653.

A participatory process involving partner cities has been conducted to identify and select KPIs. 21 core KPIs, common to all cities, have been individuated to evaluate regulating, provisioning, supporting and cultural ecosystem services provided by NBSs implemented by cities and to compare their performances. Additional specific KPIs will be used by cities.

Finally, the ecosystem services valuation, for business model creation provides an economic measure of a multiple benefits provided by NBS. This allows for the improvement of the governance and management of natural resources. Services delivered by NBS can be of public (common) or private nature, which has implications on how they should be governed and managed[16]. In a few cases, ecosystem services can be characterised by a market price while in most cases positive externalities exist.

Ecosystem services are "the direct and indirect contributions of ecosystems to human wellbeing"[14]. The individuation of the categories of benefiters of ecosystem services and the measurement of benefits delivered is essential to define long term schemes and agreements involving different stakeholders in order to ensure the preservation of natural capital and the implementation of NBSs.

2.5.2 Public Private Partnerships

Another identified potential barrier is the ***Public Private partnerships*** regarding climate change induced problems and the possible benefits of this type of financial method in order to create new NBS. The document "Characterizing nature-based solutions from a business model and financing perspective" from the *NATURVATION* European project[17] presents a detailed explanation on how Public Private partnerships regarding financing NBS can be seen as a barrier to the development of the Renaturing Urban Plans (RUPs).

This document explains that the role of different financial players, particularly public versus private investors, has been a frequently discussed topic in the literature on urban infrastructure investments. Infrastructure is traditionally seen as the domain of public players but lack of public funds makes the entry of private and even citizen investors attractive or even necessary for cities[18].

Furthermore, the text describes how efficiency reasoning may motivate private investment into infrastructure with expectations of smarter incentives. In line with this, user charges would create even better incentives between providers and consumers[19]. Privatization of urban infrastructure on the other hand also creates multiple challenges[19]. This fact can be

[16] Ostrom, E. (2010). Beyond Markets and States: Polycentric Governance of Complex Economic Systems. American Economic Review, 100(3), 641–672. https://doi.org/10.1257/aer.100.3.641

[17] *NATURVATION* European project: https://naturvation.eu/

[18] Helm, D. (2010). Infrastructure and infrastructure finance: The role of the government and the private sector in the current world. EIB Papers, 15(2), 8–27.

exemplified by the privatisation of London's desalination plant which led to higher water costs for London's citizens[19].

In addition, based on three Dutch case studies of large public private urban investment partnerships[20], find that although long term cooperation between public and private parties are generally set up to allow for efficient risk, cost and benefit sharing, successful partnerships are often hampered by complexity of actor composition, institutional factors and strategic choices of both public and private actors. In particular, the appetite for new (improved) solutions, such as potential urban NBS, is not naturally high. Public actors need political support for their actions which hampers their risk appetite (fear of losing the next election), whereas private bodies have a higher incentive to provide standard solutions at reliable profits than to present innovative solutions[21]. The quasi-market structure, often characterized by one buyer and a few sellers, is an imperfect substitute for internal control and requires active government involvement and citizen engagement to ensure efficient and fail-free delivery of public services and to prevent underinvestment by private parties[21]. In order for private investors to invest adequately in delivery of public services, government needs to credibly commit that investors will get their sunk costs back[19].

Other disadvantage for private investors in urban regeneration are operational and bureaucratic challenges related to real estate and infrastructural investments, such as conflicting tax and grant schemes, uncertainty regarding contamination of sites and delay in planning schemes[22]. Also, urban regeneration projects are often perceived by private investors as high risk due to a lack of information about the underlying value of assets[23]. Furthermore, volatile rental markets create insecurity regarding expected profits. In reaction to these challenges, researchers find evidence of risk reducing measures such as public loan guarantee schemes[24].

[19] Loftus, A., & March, H. (2016). Financializing Desalination: Rethinking the Returns of Big Infrastructure. International Journal of Urban and Regional Research, 40(1), 46–61. https://doi.org/10.1111/1468-2427.12342

[20] Klijn, E.-H., & Teisman, G. R. (2003). Institutional and Strategic Barriers to Public—Private Partnership: An Analysis of Dutch Cases. *Public Money & Management*, *23*(3), 137–146. https://doi.org/10.1111/1467-9302.00361

[21] Warner, M. E., & Hefetz, A. (2008). Managing Markets for Public Service: The Role of Mixed Public-Private Delivery of City Services. Public Administration Review, 68(1), 155–166.

[22] Adair, A., Berry, J., McGreal, S., Deddis, B., & Hirst, S. (2000). The financing of urban regeneration. *Land Use Policy*, *17*(2), 147–156. http://doi.org/10.1016/S0264-8377(00)00004-1

[23] McGreal, S., Adair, A., Berry, J., Deddis, B., & Hirst, S. (2000). Accessing private sector finance in urban regeneration: investor and non-investor perspectives. *Journal of Property Research*, *17*(2), 109–131. https://doi.org/10.1080/095999100367949

[24] Schilling, J., & Logan, J. (2008). Greening the rust belt: A green infrastructure model for right sizing America's shrinking cities. *Journal of the American Planning Association*, *74*(4), 451–466. https://doi.org/10.1080/01944360802354956

Moreover, creating a diverse group of partners and financiers, from state money to foundation grants and local bonds, is identified as a key enabler for successful regeneration of cities, as well as growing a project from a pilot phase into a larger scale building on initial successes[25].

2.5.3 Country Specific Financial Barriers

2.5.3.1 Ludwigsburg

Closely linked to the topic “political barriers”. There is no planned share in the city budget for nature-based solutions. Therefore, it is not easy to implement things. For an implementation phase you always need European or national funding programmes.

2.5.3.2 Mantova

There are financial difficulties for municipalities, particularly the smallest one, in order to support the access to local and European projects. The Italian Municipalities have many economic ties because they have a strictly budget to respect.

2.5.3.3 Valladolid

The Material Execution Budget (MEB) can be increased up to 60% in the Final budget, according to local legislation and technical requirements. This is important to craft final budgets correctly.

2.5.3.4 Quy Nhon

- The costs of implementing NBS in whole city are expensive, they must be implemented in a coordinated, long-term and multi-stakeholder manner, while local financial resources are limited.

- The socialization in NBS implementation is very necessary, but the mobilization of the private sectors to contribute in the NBS needs time and appropriate methods.

2.5.3.5 Medellín

In the municipality of Medellín, the annual budget is approved through a Municipal Agreement by the Council of Medellín, in accordance with the constitutional and legal powers conferred by article 313 of the Political Constitution of 1991 and other Laws.

Only the programs and projects included in the Development Plan will be those that will have financing. For this reason, the importance that projects oriented towards NBS are included within the plan, and as far as possible that one of them is a priority project for the Administration. For example, at this moment one of the preferred projects is: "30 green corridors", in which it will enrich, modify 30 green corridors of the city (including riversides and street separators) re-naturalizing the spaces with different types of species (trees and shrubs), developing green walls, changing hard floors for soft.

The budget of the municipality is constituted by different types of income (taxes, investments, etc.). Specifically, the income of resources that are used in the implementation of projects

related to NBS (such as gardening, landscaping, forestry and creek management) come from the Municipal Own Rents.

The Municipal Own Rents has different funds, for our case it applies: ordinary resources and additional surpluses of a public utility company called Empresas Públicas de Medellín. The destination of these resources depends exclusively on municipal management.

One of the problems in this moment is the significant decrease of the Municipal Own Rents. This has meant the redistribution of resources and the significant reduction of the budget for projects, among them those related to the issue of NBS.

Projects that have the NBS approach are financed 100% with resources from the municipality, do not receive resources from the national government or another from the public. In this type of project, the implementation is the most expensive compared to maintenance, but for it is difficult to allocate budget, so it becomes a problem to have a sufficient budget maintenance the existing green areas.

Under this framework, projects derived from calls or international cooperation is vital to strengthen and potentiate projects. It is also necessary to leverage them with the private sector that can be a fundamental ally in this process.

2.5.4 Overcoming Financial Barriers

- **Valladolid**

The initial planning of the budget necessary for the implementation of the interventions has been identified to be insufficient in relation to the total cost of implementation calculated in detail after the technical specifications. To solve this situation, two different and complementary measures have been implemented. On the one hand, the technical specifications of the interventions are being adapted to the available budget. In this sense, the magnitude is being adapted (surface, volume, number of trees) which is not influencing to the quality.

On the other hand, Valladolid City Council is going to finance the extra-cost of some of the interventions with municipal budget. This includes those interventions planned in the URBAN GreenUP investment plan that do not have any allocated budget: urban farming activities, non-technical activities and local communication and dissemination activities.

It's worth noting that Valladolid City Council is already co-financing the URBAN GreenUP interventions in an approximately 10%. This was signed in the Grant Agreement.

Finally, in those interventions in which the private sector is taking part, there are considering the co-financing of those external private stakeholders.

- **Liverpool**

Financially there are a number of potential barriers. In recent years as a result of austerity, Liverpool has seen huge cuts in its Government funding and Local Authorities are dealing with drastically reduced budgets. Green space maintenance is a non-statutory requirement and as such there is no direct funding and no requirement for a Local Authority to carry out this function. As a result, there is a reluctance from Local Authorities to take on any additional

future maintenance and there will be some natural hesitation about future ongoing costs associated with unfamiliar nature-based solutions such as green walls and roofs. Local Authorities will also have financial concerns about the cost-benefit of nutrient releasing soils and may hesitate over the economic argument of digging up good existing hard surfaces to install features like hard drainage pavements.

To overcome these barriers, many of Liverpool's planned interventions are local in nature, and will keep investment costs relatively low. The planned interventions are also small and easy to manage. To assist with the longer-term financial obligation for maintenance Liverpool is including some basic establishment into its NBS procurement for the monitoring stages of the project and actively working to introduce planned NBS wherever possible onto third party land or buildings where the owner understands the value of the intervention and has agreed to accept the longer-term maintenance costs once the project has completed.

- **Quy Nhon**

Provincial People's Committee has instructed Binh Dinh CCCO to coordinate departments, branches and localities in the province to develop programs and projects on climate change calling and mobilizing financial support from international organizations. As a result, many programs and projects have been funded and implemented to achieve the initial results, many natural solutions implemented to limit the increase of impacts caused by climate change.

- Solutions for Social Performance NBS:
  - Develop and implement models of public-private partnerships and jointly implement NBS, especially in the rehabilitation and rehabilitation of NMS affected by natural disasters.
  - To elaborate and promulgate documents detailing specific land, capital and tax incentive policies to effectively implement NBS.
  - Organizing propaganda, raising awareness, organizing forums for investment in implementing NBS. Strengthening the exchange of relevant information, creating favorable conditions for the private sector to participate in the socialization of NBS.
  - Establishment of new joint-venture companies providing NBS.

- **Izmir**

Izmir is trying to cope with the compulsive economic conditions of the country. Recently, it has acted on saving measures and reducing non-emergency jobs. The selection of nature-based solutions produced by the municipality, especially in areas where the municipality has previously had managerial or municipal company management experience and integrity, will have budgetary savings in this regard. For example, the selection of climate-smart urban farming precinct within the Sasalı Natural Life Park borders and its positioning as a separate thematic area will provide an opportunity to overcome financial barriers by establishing administrative and operational integrity.

2.6 Summary for Overcoming Barriers

Clear points emerge from the city administration's elaboration of handling barriers which create resistance to re-naturing in the urban context. Cities do not exist in vacuum and are a creation of their respective historical development, the social-political-organizational attributes of this developmental paths which in turn conditions their respective responses to and/or capacity for problem solving. These have been summarized in the bullet points below for simplicity:

- There are no "silver bullets" so to say, as the multitude of issues require actions that are

"unique" to their settings. However, general patterns do emerge and first and foremost, the "political setting", the actors/networks and their respective political-economic power, their willingness to put pressure in a certain direction or another, certainly weigh heavily in overcoming barriers of all fashion. A rigorous analysis of the political economy of the "renaturing transitions" is imperative from the point of view of correctly situating the actors and their capabilities. Short to long range articulation of plans and strategies and embedding them into those presently existing would appear critical. It is clear also that political conviction, popular support and the selection of the correct projects has the tendency to overcome all potential barriers.

- The very real tension between local government tenure, the need to win elections etc.

and long-time spans needed for the success of renaturing planning requires attention. The best solution would seem to be to design for successive "waves of interventions" in terms of appropriability politically by the municipality and actually produce real results.

- Once again as expected, financial constraints determine feasibility. "Green Projects"

often are also high visibility projects but the pressure by rent-seeking behaviour in today's cities and the smoke-screen over and erosion of the once esteemed term "public good" are sometimes difficult for local governments to surmount. New and creative paths to finance need to be produced (PPP's, crowd-funding, international grants etc.) once again highly differentiated due to local conditions. One important insertion here is the eco-services valuation approach which marks clearly the overall benefits of renaturing in financial terms. Despite much advance in modelling ecoservices, the obvious trap here is that of commodifying everything natural in the urban setting and marketizing all.

- Care needs to be taken (and not only lip-service offered!) to genuine participative

approaches and externalities well explained to all stakeholders but particularly the user-public. The various dimensions of nature-human interactions in urban settings, the consequences for public health, longevity and wellbeing in addition to non-human life, are only recently being researched. The "city as a metabolism" approach requires close attention to all urban material and immaterial flows and connects climate resilience to healthy lives at one end and economic feasibility to biodiversity at the other.

3 NBS Specific Barriers for Cities

In this section each city added the Barriers vs NBSs table belongs to their cities and provided explanation for these tables. Tables are composed of NBSs specified for each city and barrier categories. A value between 1 to 5 regarding importance of the barrier category should be provided. Cities elaborated and explained the most important categories in subsequent sections.

3.1 Valladolid

Table 3-1: NBS/Barriers Table for Valladolid

NBS/Barriers	Political	Technical	Legal	Social	Financial
New green cycle lane with cycle-pedestrian green paths areas, with green resting areas, and natural pollinator's modules.	5	4	2	1	4
Plantation of trees along the Green Corridor, over smart soils as substrate.	4	4	2	2	3
Installation of a tree shady place in leisure area next to Football Stadium, with new trees.	4	3	2	1	3
Construction of SUDs for the green cycle lane.	3	4	2	1	4
Installation of green noise barriers along the Valladolid Urban Green Corridor and the City Center	5	5	4	4	4
Installation of vertical mobile garden.	4	4	4	4	3
Green façade in a public building.	4	4	3	3	5
Green roof installed in the Campillo Market building, to connect this area with España Square.	4	4	4	3	3
Convert the 2 units of covering shelters of the España Square zone, in Green covering shelters, which integrate specific vegetation in the curve surface.	4	4	3	3	3
Electro-wetland, that is an innovative wetland surface which can provide electricity through microbial fuel cell technology, to be used in the irrigation of nearby gardens and illumination.	5	5	5	2	3
Urban garden bio-filter to purify polluted air in Zorrilla Square zone.	4	5	4	4	3
Installation of green-shady structures of fast-growing creepers and climbing plants	4	5	5	3	4
Installation of compacted pollinator's modules installed in mobile window boxes, with smart soil as substrate, a fountain, housing facility for pollinators and birds, bushes and aromatics species.	4	4	4	4	3

Plantation of shade and cooling trees in City Centre, over smart soils as substrate	4	3	3	4	3
Green pavement for the parking of the Zorrilla Football Stadium.	4	4	4	3	4
Construction of SUDs in the parking area, as well as Rain Gardens.	4	4	3	1	3
Plantation of trees to re-naturing Football Stadium parking, over smart soils as substrate.	4	3	2	1	3
Natural wastewater treatment plant (NWTP) based on Waterharmonica concept, whose treated water will be used for the irrigation surrounding green areas. It includes the plantation of trees in a sustainable park, using smart soils as substrate, with compacted pollinator's modules and an educational path.	5	5	5	3	5
Floodable park where the Esgueva River causes floods in storm periods.	5	5	5	3	5
Green filter area with trees, integrated into the floodable park that will filter Esgueva River water to irrigate nearby garden zones.	4	3	5	3	3
Urban Carbon Sink, that consists in the plantation of urban woodland with trees.	4	4	2	3	3
Urban orchard area in the Floodable park zone and an educational path	3	3	3	4	3
Urban orchard area in Alameda park zone.	3	3	3	4	3
Community composting facility (with educational and engagement purpose) will be installed in the urban orchard area of Alameda Park zone.	2	3	4	4	2
Small-scale urban livestock facility (henhouse) also next to urban orchard area.	2	3	4	4	2
Environmental education and awareness activities	3	4	2	3	2

3.1.1 Summary Barriers vs. NBS's Table and Evaluation

The scoring results allow determining the greatest impact interventions. On the one hand, the scores of more than 4 points have been analysed in detail. On the other hand, a global indicator has been calculated that expresses a total limitation degree, calculated as the sum of the individual values.

$$\text{Global B\&B score} = \Sigma\,(\text{Political} + \text{Technical} + \text{Legal} + \text{Social} + \text{Financial})\ \text{scores}$$

This results interpretation discusses about the individual barriers and boundaries for each category, but also provides a general interpretation value.

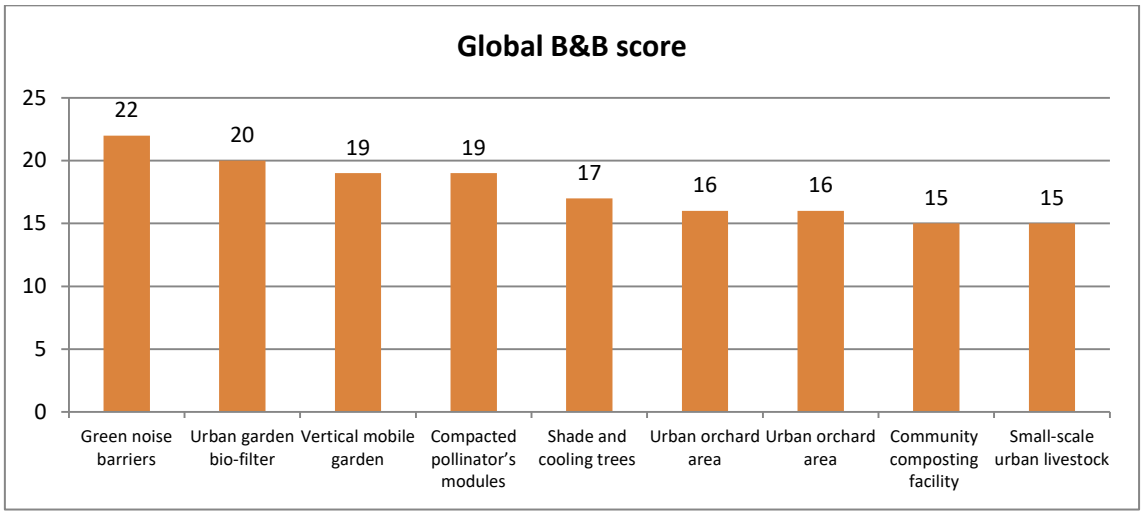

Figure 3-1: Global barriers and boundaries score for Valladolid Demonstration interventions

The interventions that reaches higher level scores are the Sustainable park with the Natural wastewater treatment plant (NWTP) and the Floodable park area. Both are water interventions of high magnitude and complexity of infrastructure and work. The following table group the average score according to the type of intervention.

Table 3-2: Global barriers and boundaries score by intervention type in Valladolid.

NBS type	B&B average	Interventions included	Barriers & Boundaries analysis
Water intervention	23,0	NWTP in the Sustainable park, Floodable park area	High magnitude and complexity of infrastructure and work, high cost.
Singular interventions	19,5	Electro-wetland, Urban garden bio-filter, Pollinator's modules	Technically advanced, very innovative, with little experience of real implementation (lab prototype).
Green infrastructure	19,3	Noise barriers, Green-shady structures, Vertical gardens, Green façade, Green roof and covering shelters, Green pavement	High need for in situ adaptation of the technical design; and generally high cost for the implementation and maintenance. High political interest.
Green cycle lane	16,0	Cycle lane with cycle-pedestrian green paths areas, resting areas, natural pollinator's mods.	Difficulty in implementing those interventions in the city center. High political interest.
Urban farming	15,5	Urban orchard area, Community composting facility, Small-scale urban livestock	High social impact. Legal issues to address (local regulations).
Water intervention	14,5	SUDs & Rain gardens	Easy technical specifications. Difficulties in finding suitable locations.
Arboreal interventions	15,3	Green filter area, Shade and cooling trees, Urban Carbon Sink, Plantation of trees over smart soils, Tree shady place	Easy selection of species, planting and average maintenance. Difficulty in the selection of locations on the urban pavement.
Non-technical	14,0	Environmental education and awareness activities	Easy implementation and high social and political impact

Political barriers and boundaries: In general, most green infrastructure interventions have a high impact on political decisions because of their visual and social impacts, like the urban

farming activities and non-technical interventions. There are high political scores in the mayor interventions, as URBAN GreenUP is a very demonstrative project with sensitive implementations for the citizens.

Technical barriers and boundaries: Singular interventions such as the electro-wetland and urban garden bio-filter have more technical B&B because they are very innovative, and there have been proved in laboratories. The real implementation in the city will be demonstrated in Valladolid for the first time. There are other interventions technically easy to implement, like arboreal interventions and urban farming activities.

Legal barriers and boundaries: Singular interventions again have high scores in legal B&B. It is worth saying that most legal barriers can be solved; although there is a quite extensive legislation to comply at national and local levels. In particular, there are special considerations for Pollinator's modules because of the contact with the bees, and urban farming activities (Composting facilities and henhouses in urban spaces), which are close to the neighbours.

Social barriers and boundaries: Urban farming activities have a huge social impact as they are settled in Valladolid for unemployed people and communities. Pollinator's modules have also social impact as well as the non-technical interventions. On the other hand, Green infrastructure will have considerable social barriers in case that the interventions do not work properly (if the plants are dried, for example, or the noise barriers do not help reducing the noise).

Financial barriers and boundaries: Big water interventions such as the floodable park or the sustainable park have high financial barriers, as they are complex infrastructures. The green corridor, considering all its interventions such as the cycle lane, green paths, resting areas and arboreal interventions, have also limitations in the city centre, so the implementation costs will be higher than expected (for instance, planting a tree in a sidewalk compared with a park). The green infrastructures (vertical and horizontal gardens) have higher costs, compared with arboreal and plant interventions in parks and gardens. Some of the interventions will be more expensive than the cost expected during the planning initial phase.

3.2 Liverpool

Table 3-3: NBS/Barriers Table for Liverpool

NBS/Barriers	Political	Technical	Legal	Social	Financial
Urban Catchment Forestry	2	2	2	2	3
Wood Allotments	2	2	3	3	2
Pollinator verges & spaces	2	1	1	3	2
Pollinator walls/vertical	3	3	3	2	4
Pollinator roofs	3	3	3	2	4
Shade trees	2	2	2	2	3
Cooling trees	2	2	2	2	3
SuDS	3	3	2	3	3
Cycle Route Definition	2	2	2	1	2
Green Travel Routes	2	2	2	1	2
Pollution Filters	1	2	2	2	3
Carbon Capture	2	2	2	3	3
GI for Physical Activity	1	2	2	1	2
GI for Mental Health	1	2	2	1	2
Forest School	1	2	2	1	1
Forest Church	1	1	2	1	1
Green Art/engagement	2	2	2	2	3

GI for Education	1	2	2	1	3
Moving gardens	3	3	3	2	3
Floating gardens	3	3	3	3	4
BioApp community engagement	2	3	2	3	2
Road junction pedestrian improvements	2	3	3	1	4
Hard Drainage Pavements	3	2	2	2	4
Hard Drainage (Flood prevention)	2	3	2	2	4
Enhanced nutrient managing and releasing soils	2	2	2	3	4
City mentoring strategy (staff exchange)	2	3	1	2	2

Table 3-4: Explanation of Liverpool Scoring

1	Highly likely to proceed. No barriers. Politically easy and desirable. Technically easy. No legal issues. Socially acceptable. Low cost - offers savings
2	Will proceed with support. Few barriers. Senior officer/political approval needed. Few technical and legal issues. Some social education needed. Savings outweigh costs over time.
3	Senior support needed to progress. Several barriers. Practical challenges. Technically new/challenging in part. Social education needed. Legal concerns. Additional funding needed. Payback unclear or greater than 5 years
4	Unlikely to proceed usually or a longer-term option. Many barriers. Politically difficult. Legally challenging and new technical issues to address. Social and education benefits need to be explained. Funding unlikely Payback uncertain.
5	Very unlikely to proceed under business as usual conditions. Multiple barriers. Politically undesirable. Technically and legally challenging. Social benefits unclear. Funding problematic and unlikely.

3.2.1 Summary Barriers vs. NBS's Table and Evaluation

In Liverpool, the completion of the NBS barriers table has helped to highlight key areas of concern for future focus. In scoring the table some criteria were developed to aid consistency, with a level 5 score indicating an issue that would prove almost insurmountable. To ensure the Liverpool scheme remains deliverable scores higher than a 4 indicate schemes that are

unlikely to proceed. At this stage all schemes that would score higher than a 4 have already been eliminated from the Liverpool proposals so that we have a viable list of NBS proposals.

Politically the key potential barriers are associated with the introduction of pollinator walls, green roofs, floating and moving gardens. This is not unexpected as these are all relatively new, innovative and untried NBS solutions for the city. Although cautious, Councillors will naturally be keen to see these succeed. Another NBS that scored highly on the political barriers was hard drainage pavements. These are not new solutions but they are not something the city routinely considers and together with the novelty of the other NBS proposals local councillors will have concerns about the cost of their future maintenance and efficiency. This also extends to the SUDS which have had mixed success to date in the city with both good and bad examples of previous installations.

Technically many of the same NBS solutions also scored similarly. This is because green walls, roofs, SUDs, floating and moving gardens are mostly technically new to the city and there will be concerns about specifications and ongoing maintenance. Other areas of technical concern include the creation of a bio app which is still under consideration and the requirements and constraints that some of the road traffic junction improvements may create for the surrounding NBS proposals. City mentoring also scored similarly, mainly because until plans are further advanced it is not known what level of technical knowledge and understanding is required to effectively share with follower cities.

Legal issues are often a bit clearer. New initiatives such as wood allotments will require legal clarity on operations and there will need to be clear legal agreements for landlords and landowners that volunteer to have green walls, roofs floating gardens etc. – both to ensure clear liability and ongoing maintenance. Road junction improvements will similarly require legal permissions, planning consent etc. and could attract adverse public feedback.

Socio-cultural aspects of concern are most likely to be associated with NBS solutions such as wood allotments, pollinator verges, SUDs, carbon capture, floating gardens and nutrient releasing soils. Education on the value and benefits of some of these NBS may be required so that communities and stakeholders understand their purpose and appearance – for example, pollinator verges will need to be left to set seed before they can be cut which means that after the summer flowering there is likely to be a period of time when the areas looks un-kept. New initiatives such as nutrient releasing soils and the value of some NBS solutions will need to be clearly explained so they are fully understood and appreciated locally.

Financially there were a number of potential barriers that scored highly. Local Authorities are dealing with drastically reduced budgets and green space maintenance is a non-statutory requirement. There is a reluctance to take on any additional future maintenance and there will be some natural hesitation about future ongoing costs associated with unfamiliar nature-based solutions such as green walls and roofs. Local authorities will also have financial concerns about the cost benefit of nutrient releasing soils and may hesitate over the economic argument of digging up good existing hard surfaces to install features like hard drainage pavements.

3.3 Izmir

Table 3-5: NBS/Barriers Table for Izmir

NBS/Barriers	Political	Technical	Legal	Social	Financial
New green cycle lane and re-naturing existing bike lane sections	2	1	2	1	1
New Green Corridor	2	1	2	3	2
Grassed swales and Water retentions ponds around Bio-Boulevard	1	2	1	2	1
Smart Soil into Green Shady Structures	1	3	1	2	2
Planting Trees in new green corridor	1	4	2	1	1
Shade and cooling trees	1	4	2	1	1
Installation of natural pollinator modules	3	1	1	3	1
Installation of Parklets	3	2	3	3	1
Green fences/vertical (around Peynircioğlu River)	1	2	1	1	1
Installation of Fruit walls/vertical (around Peynircioğlu River)	1	1	1	3	1
Urban Carbon Sink (species to maximize carbon sequestriation around new green corridor)	1	4	2	1	1
Green Pavement (for re-naturing Peynircioğlu River)	1	1	1	3	1
Cool Pavement around NATURAL LIFE PARK car park	1	2	1	1	3
Green Covering Shelter (for NATURAL LIFE PARK car park)	1	2	2	2	3
Green Shady Structures (for NATURAL LIFE PARK car park)	1	1	1	1	1
Installation of Climate-smart Greenhouse	1	5	2	1	5
Community meeting facility for climate-smart urban farming	1	1	1	1	1
Market Stalls for Organic Urban Farming	1	1	3	1	1
Educational Path /Bio-boulevard	1	1	3	1	1
Engagement Portal	1	1	1	1	1
Municipality-enabled urban farming with Agricultural cooperatives (women)	1	1	3	1	1

Bio-blitz Event	1	1	1	1	1
Support to citizen project of NBS	1	1	1	3	1
City Mentoring Strategy (Staff Exchange)	3	1	1	1	1

3.3.1 Summary Barriers vs. NBS's Table and Evaluation

Table 3-6: Comments on NBS/Barriers Table for Izmir

NBS/Barriers	Comments
New green cycle lane and re-naturing existing bike lane sections	Establishment of the coordination for demo site between related units of municipality is necessary
New Green Corridor	It is necessary to act jointly with IZSU and other related institutions in design and tender stages.
Grassed swales and Water retentions ponds around Bio-Boulevard	Difficulties may arise in the technical implementation details because this NBS will be built for the first time.
Smart Soil into Green Shady Structures	Difficulties may arise in the technical implementation details because this NBS will be built for the first time. Cost may exceed expected value.
Planting Trees in new green corridor	Due to other applications mentioned in the green corridor, it may be difficult to allocate space in some areas.
Shade and cooling trees	Due to other applications mentioned in the green corridor, it may be difficult to allocate space in some areas.
Installation of natural pollinator modules	The widespread use of these modules in urban areas can create problems in the interaction of pollinator organisms with humans in dense urban areas.
Installation of Parklets	Citizen participation and demand are required, and if these can not be ensured, it may create a negative reaction in some places (the Residential zone).
Green fences/vertical (around Peynircioğlu River)	It is necessary to act jointly with IZSU and other related institutions in design and tender stages.
Installation of Fruit walls/vertical (around Peynircioğlu River)	It is necessary to act jointly with IZSU and other related institutions in design and tender stages. Furthermore, the desired results may not be obtained due to vandalism.
Urban Carbon Sink (species to maximize carbon sequestriation around new green corridor)	Due to other applications mentioned in the green corridor, it may be difficult to allocate space in some areas.
Green Pavement (for re-naturing Peynircioğlu River)	Due to surface coverage, it may be difficult for some urban groups (strollers, disabled people) to cross.
Cool Pavement around NATURAL LIFE PARK car park	Difficulties may arise in the technical implementation details because this NBS will be built for the first time. Cost may exceed expected value.
Green Covering Shelter (for NATURAL LIFE PARK car park)	The legitimate appropriateness of the areas to be selected poses risks to the people living in these areas (especially the residences), such as worry about the image and landscape, the cost of implementation can be high
Green Shady Structures (for NATURAL LIFE PARK car park)	The legitimate appropriateness of the areas to be selected poses risks to the people living in these areas (especially the residences), such as worry about the image and landscape, the cost of implementation can be high

Installation of Climate-smart Greenhouse	Because it will be implemented for the first time, it can create technical and financial difficulties. In addition, there may be risks in terms of creating a method in the technical specification
Community meeting facility for climate-smart urban farming	
Market Stalls for Organic Urban Farming	There may be operational problems
Educational Path /Bio-boulevard	If it can not be operated within the jurisdiction of the park, it may not be possible to perform the activities.
Engagement Portal	
Municipality-enabled urban farming with Agricultural cooperatives (women)	There may be operational problems
Bio-blitz Event	
Support to citizen project of NBS	Priority of provision of basic urban services can be perceived as priority.
City Mentoring Strategy (Staff Exchange)	There may be difficulties in the realization due to lack of staff and workload.

Izmir stands out among the lead cities with an above standard deviation from the European urban development pattern. This is both expected and problematic. The very rapid urban growth rates in Turkey and Izmir have created many difficulties for local government which has political, financial and legal battles to fight for even the provision of basic urban services. The outstanding issues stem from the super-intensive built environment leaving little freedom of action for the administration. This exhibits itself in the difficulties of creating green spaces, arboreal corridors and tree planting activity in the congested centre. Some anxiety appears based on the novelty of the NBS implementations such as pollinator modules, relatively unseen sights in the urban environment. Another important and high-ranking concern would seem to be procedural, which stems from the work practices in local government in Turkey, working in silos and problems of communication among city departments. Due to the very high land rent in the centre, proclaiming land for GI is very costly in Izmir which results in prohibitively high implementation costs for NBS.

3.4 Additional Table from Quy-Nhon City

Table 3-7: NBS/Barriers Table for Quy Nhon

NBS/Barriers	Political	Technical	Legal	Social	Financial
Recovering mangroves forest inside the Quy Nhon city.	5	2	2	3	4
Planting casurina on sand dunes in Nhon Hoi economic zone	4	1	1	2	3

Over recent years, the socio-economic activities of Quy Nhon have shown signs of prosperity. The objectives of urban development are closely related to the socio-economic development strategy of Quy Nhon city. To achieve this goal, Quy Nhon has been expanding its area by expanding the flooded areas in the lower Ha Thanh River and the Thi Nai Lagoon, which is heavily flooded. It is the main outlet for the Thi Nai lagoon and it is the place where many mangrove forests are concentrated, protecting the urban area inside the city. Strong dynamics occur every year due to climate change. In addition, the expansion of the city is through the merger of the communes of Nhon Hoi Economic Zone Phuong Mai Peninsula into Quy Nhon City to develop industry and seaports. This development threatens the loss of natural casuarina trees, which play the role of protecting sand, sand and sand in the sand and making it more severe, particularly in times of high winds. The economic development pressure is on the rise if Quy Nhon continues to develop its land bank in areas where such natural ecosystems are likely to increase the consequences of climate change. It can be seen that the political-economic barrier is an important barrier that seriously hinders the planting or rehabilitation of natural mangroves, casuarina and barriers. The highest other barriers to each NBS have been identified.

The second major barrier is the financial barrier, because implementing NBS solutions requires a great deal of cost, along with other planning and long-term implementations, especially Participation of many stakeholders in different areas, while local financial resources are limited.

Following the social barrier, this barrier will be underestimated if awareness, knowledge and understanding of leaders, staff and communities on solutions is enhanced through training, consultation public relations, propaganda, etc. Moreover, conflicts of interests and interests among local groups of people involved in the implementation of solutions. The co-management model is the solution proposed to address the social barrier. It is the local government's commitment to share the long-term benefits of the implementation solution.

Finally, legal and technical barriers. NBS is a new solution, the implementation and implementation of new solutions that barriers encounter is the lack of knowledge of technology, lack of regulations, standards and technical characteristics as a basis for evaluation and approval solutions. In addition, when implementing the new solution, there will be many embarrassing ways of organizing the implementation, which is one of the causes of delays during the implementation.

4 Success Stories – Failures

4.1 Liverpool

4.1.1 Political / Urban Planning

Success - URBAN GreenUP has senior political support/embed green corridor concept in local plan

The URBAN GreenUP project has attracted senior political support within the city council and thus helped to raise the profile of Nature Based Solutions. By linking Nature Based Solutions along a green corridor route the city has also been able to demonstrate its commitment to the green corridor concept outlined in the city's local plan. The 3 demonstration sites provide high profile sites to kick start the longer-term aspirational delivery of a network of green corridor routes with Nature Based Solutions that extends across the city.

Failure - Liverpool GI Strategy not embedded within local plan

In 2010 The Mersey Forest produced the Liverpool Green Infrastructure Strategy which was commissioned by Liverpool City Council in partnership with Liverpool Primary Care Trust (PCT) to improve public health through the planning of green infrastructure. The strategy presented a robust evidence base to support decision-making. Despite not being adopted the strategy remains a useful guide for city planners and has helped to define thinking on the development of the Local Plan.

4.1.2 Technical

Liverpool City Council has had varying experiences with the success of large-scale urban drainage systems. It is the perceived knowledge that the major differences to success come from both good initial design but also even more importantly the allocation and capitalisation of funding for good long-term maintenance.

Success – SUD at Estuary Business Park

Implemented approximately 15 years ago the business park was the first to implement open water network to balance and deal with surface water drainage, to provide an attractive location for investors and to reduce the development costs of installing more regular highways mains drainage system. Ten years late the business park is economically successful, but the water bodies are maintained by a private company with the costs paid for by service charges to the companies. The biodiverse habitats created for nothing are now species rich with natural fisheries and exceptional birdlife, including rare species at certain times. The waters are also a community asset with local fishing and picnicking allowed.

Failure – SUD at Stonebridge Cross Business Park

Designed approximately 10 years ago the business park followed the pattern of the Estuary Business Park above. This is a less economically buoyant area of Liverpool city and the business park has been much slower in its journey to be fully let and economically successful. The

water bodies here have been maintained on a lower budget by the public authority (Liverpool City Council). The waterbodies are now either overgrown with a monoculture of phragmites or quite empty with limited biodiversity.

It is not immediately clear whether there where actual design specification differences, installation cost differences or indeed what differences there currently are in management costs. Possibly even the water quality itself may be different, or the surrounding biodiversity pool of species may have been different pre-construction.

4.1.3 Legal/Organizational

Success - Friends of Parks groups

Liverpool has a number of local groups who are 'Friends of Parks' and work alongside city council officers to maintain, improve and animate park sites. These local groups provide an important link to local residents; often acting as local eyes and ears for the local authority. The members of the group provide both time and effort to assist in general park maintenance duties and many Friends of Parks groups regularly organise litter picks, bulb planting days, undertake simple maintenance tasks and organise/host various events and community fun days so that local residents can enjoy their parks and greenspaces. The groups have a wealth of local knowledge about the individual sites and constituted groups are often able to apply for external Government or Lottery funding which is denied to local authorities. Working together to an agreed development or improvement plan, Friends of Parks groups are able to both attract additional funding to improve parks and act as local custodians of the greenspace.

Failure – Understanding long –term liabilities of green infrastructure.

There could be said to be a failure to understand the nature of liabilities and the reticence of organisations to install green infrastructure without valuing the long-term benefits that they provide. This concern about long liabilities can actually lead to the destruction of green infrastructure in urban areas eg. large scale felling of street trees.

4.1.4 Social / Cultural Barriers

Success – Mab Lane Community Woodland.

The area that is now Mab Lane Community Woodland in Liverpool used to be two large fields that were so derelict and undesirable that most people kept away from them. Through a partnership of local people and organisations over 20,000 trees were planted on the site to create Mab Lane Community Woodland. In addition to the tree planting, measures were taken to prevent flooding, improve drainage, and enhance the landscape. The woodland, officially opened in June 2010, now has a network of native trees, wildflower meadows, a community orchard as well as seasonal wetland areas and footpaths.

The site was previously viewed in such a negative light that it was initially hard to convince residents that it could be transformed into a desirable place. There was a concerted effort to involve local people and events were organised to help engage people in its transformation.

Above all, the woodland has brought people together rather than drive them apart. The woodland has also had wider implications for the nearby communities; previously housing associations struggled to let nearby homes, whereas now there are waiting lists.

4.1.5 Financial Barriers

Success – Application and use of external funding.

During recent years of austerity, it has become increasingly important for the city to explore opportunities to attract external funding for green and open space maintenance and development. The city has been successful in using section 106 monies (funding put aside for greenspace improvement at the time of local development) and matching this with funding from other external sources such as competitive awards or funding available to community groups. By working together with partners and having an agreed shared vision the city has been able to continue to invest in capital improvements to many of its park sites.

Failure – Long term maintenance for green space

Despite the success in attracting section 106 monies and other funding streams for capital development it is much harder to secure funding to assist with ongoing maintenance costs. As parks are a discretionary service they do not automatically get funded for maintenance. In recent years during austerity and service budget cuts the parks maintenance budgets have been dramatically cut. A number of options for alternative and more sustainable maintenance have already been implemented but it is not yet possible to make parks financially fully self-sustaining.

4.2 Valladolid

4.2.1 Political / Urban Planning

Since 2014, the Valladolid City Council has built urban vegetable gardens distributed throughout the city as part of its Environment and Sustainability policies. To this end, The City Council has used abandoned urban plots, which gave an unsightly aspect to neighbourhoods.

Success - URBAN GreenUP has political support: The URBAN GreenUP project has attracted political support within the city council and it has settled the basis for the development of more Nature Based Solutions in the city.

Failure – There is not an integrated green infrastructure strategy. The project is helping to address the climate and environmental challenges identified in the Sustainable Integrated Urban Strategy (EDUSI INNOLID 2020). But there are not specific policies that regulate the implementation of Nature-Based solutions.

Failure – The initial selection of locations was not detailed enough. In the initial planning phase general locations were selected for the Nature Based Solutions in the city of Valladolid. After that initial process, there is need to increase the level of detail, in order to define the technical and economical aspects of the interventions. There have been identified some difficulties in the locations that were initially selected. So that, there have been necessary to

change some of those locations. This situation happens for instance in the vertical mobile gardens, as it is not easy to install NBS in the city centre because of narrow streets, concrete streets and sidewalks, underground networks systems for water and electricity, et

4.2.2 Technical

It was necessary a water connection, which was made for each user. In the same way the area was fenced and booth tools were placed to store the gardening and agricultural tools of common use.

There is urban orchard in different areas in outskirts of the city with 450 gardens for retirees, and 4 areas with around 50 plots/area for unemployed. In each area, there is space for a neighbourhood association to have a garden for educational and social purposes.

It is a requirement that the cultivation will be in an ecological way.

Success – We have adapted the green and blue infrastructure to the specific locations. In Valladolid there have been identified specific locations for the interventions, according to the availability of space, the location suitability, social and visual impact or proximity to the urban green corridor, among other criteria. The technical issues have been adapted to the needs of the city, but not the opposite. So that, there you have some practical examples:

- The green roof has been adapted to the El Campillo market's roof.
- The green shady structures have been adapted to the Plaza España canopies structural resistance.
- The Natural waste water treatment plant has been adapted to the suitable municipal plot in Contiendas Park, close to the waste water drainpipe.
- The electro-wetland has been adapted to the slope of the garden and it is close to a municipal waste water pipe.
- The floodable park has been adapted to the size of the municipal plot, that is small to cover the complete needs of this kind of intervention close to the Esgueva river.

Success – Urban garden bio-filter. The technical issues of this innovative intervention have been designed in laboratory, but the initial results obtained were successful. The green bio-filter is retaining the air pollution or car traffic.

Failure – Electro-wetland. This innovative intervention has been studied in an R&D laboratory. A prototype has been constructed and it is working properly. The electro-wetland prototype is producing energy while it cleans the water. But there have been found difficulties in adapting the prototype to the real location, using a waste water urban source, there might be problems with the pump, and the partners have worked to adapt the construction to a municipal garden.

4.2.3 Legal/Organizational

The City Council receives the garden application of citizens through civic centres. These applies are processed as soon as possible, provided there are free vegetable gardens. Users must commit to complying with rules of coexistence, respect, use and exploitation in an ecological way and they must renew their application and sign these commitments every year.

An external company of the city council is responsible for providing technical assistance to users always with the support of the Area of Environment and Sustainability of the municipality. This assistance is carried out once a week in winter when the activity is lower (from November to March) and from Monday to Friday during the rest of the year.

This orchard use is for self-consumption, where is forbidden the sale of products, but not its donation to social entities, such as the food bank.

Success – Comply with national regulations. Every Nature Based solution that will be implemented in Valladolid has been design complying with national regulations. That means national regulations such as the Water Law, Royal Decree Law for urban wastewater treatment, Royal Decree for water reuse or the Basic guideline for civil protection planning for flood risk. There are also regional regulations such as the Hydrological Plan or the Flood Risk Management Plan of the river Duero basin, and the Environmental Education Strategy in Castilla y León. Green infrastructure is complying with the Technical Building Code – CTE, a good example are the innovative green shady structures.

Success – Comply with local regulations. Likewise, every Nature Based solution that will be implemented in Valladolid has been design complying with local regulations. In the city we must comply with General Urban Planning Plan (PGOUVa). There are several local regulations such as parks and gardens, water supply and sanitation, public space, noise, public lightning. There are also urban plans, such as the Urban, Sustainable and Safe Mobility Plan for the City of Valladolid (PIMUSSVA); the Action Plan for Pollution Alert or the Municipal Environmental Education Program. There is also a specific municipal standard code that regulates the urban orchards, dependent on the Environment and Sustainability Department of the municipality.

Success – City Council Coordination. The URBAN GreenUP is a multidisciplinary project that is being worked up transversally among the different departments of the city council. There can be identified: Innovation, Environment, Urbanism, Urban Planning, Mobility, Parks and Gardens, Water management, Air quality, Security, among others.

4.2.4 Social / Cultural Barriers

Currently, only retired and unemployed people can be beneficiaries of urban orchards, so this circumstance generates discontent among other citizens and some social disputes.

Many of the beneficiaries have not initial knowledge. However, this knowledge is acquired thanks to the training given throughout the year, technical assistance and companionship.

There are many garden applications from wide diversity social classes, which generate a social and cultural space without barriers.

The associations that enjoy the community gardens organize many cultural and educational activities with schools, nurseries, NGOs, etc.

In some cases, there are coexistence issues, non-compliance with the rules and other problems, which require the municipality intervention in order to impose disciplinary measures that can imply the expulsion of the beneficiary from the program.

Success – Current urban orchards. Since 2014, the Valladolid City Council has built urban vegetable gardens distributed throughout the city as part of its Environment and Sustainability policies. To this end, The City Council has used abandoned urban plots, which gave an unsightly aspect to neighbourhoods. Currently, only retired and unemployed people can be beneficiaries of urban orchards. There are many garden applications from wide diversity social classes, which generate a social and cultural space without barriers. The associations that enjoy the community gardens organize many cultural and educational activities with schools, nurseries, NGOs, etc.

Failure – Urban garden live-stock. The city council find difficulties in implementing a henhouse with alive animals such as hens and cocks in an urban space. The neighbours are living close to the urban orchards and there might be disconformities. Despite the regulations that may apply are not totally clear.

4.2.5 Financial Barriers

The allocated budget is usually limited, it only allows the contracting of the technical assistance of the orchards, maintenance of common areas, payment of the water bill and occasionally common use tool; having the beneficiaries that buy plants, hose or irrigation system, maintenance of the common tool or symbolic rental of motorized plough.

Success – Green façade. The building where the green façade will be built is private. The budget that the European Commission provides for that intervention is not enough to cover the total surface of the façade. The private company owner of the building is co-financing the initial structural studies but also the maintenance costs, ensuring a high-quality intervention.

Success – Municipal co-financing. Valladolid City Council is financially supporting the implementation of the Nature Based solutions in the city.

Failure – insufficient budget for the extension and number of interventions. Some of the interventions have limited budget for designing, implementing, constructing or subcontracting. On the one hand, for instance, the floodable park budget is very limited to cover such a huge intervention. That means earth moving, engineering works, topography studies, hydrograph, hydraulics and soils initial characterization surveys. The area that can be covered with the allocated budget is small compared to the current risk minimization needs, for a significant return period. On the other hand, in Vac2 there were planned planting 1,000 trees, but there is not enough budget to reach that quantity.

4.3 Izmir

4.3.1 Political / Urban Planning

Failure and Success– Sub Demo B Site Relocation

The several layered jurisdictions present in Turkey, resulted in the change of plans related to the siting of sub-demo B which was originally situated in the Sasalı Nature Reserve. The Ministry of Urbanization and Environment had the final say in the site selection and the possible length of procedural deliberations were considered to risk the timely implementation

of the Project. It was thus deemed necessary to make a change to the present site for sub-demo B.

Failure and Success – Sub Demo A relocation

The original position of sub-demo A was also seen to be problematic. The car parking area situated around Egepark was seen to be heavily used for private use (most of the time illegally) and some important problems could arise from its selection as a sub-demo. The siting was transferred to its present positions at the Natural Life Park and the Vilayetler Evi car parks.

4.3.2 Technical

Success – İzmir Coastal Re-development

İzmir's perennial problem of seawater charge and flooding on the coastal strip has been successfully solved through the Izmir Coastal Development project, allowing for the possibility of connecting the totality of Izmir bay, cycle and pedestrian routes as well as solving the long-lasting drainage problematic.

Success – Meles Delta development

The Meles Delta is one of the most prominent of Izmir's urban waterways. The water in the riverbed is stagnant and also contained industrial waste water streams causing serious hygiene and putrid smell problems. The complete overhaul of the delta and stopping of industrial waste water charging has restored the waterway to its natural state and is used a recreational park at the moment.

4.3.3 Legal/Organizational

Success – İzmir Green Infrastructure Strategy

The preparatory work for Urban GreenUP, involved a serious stock taking vis a vis NBS solutions for the city of Izmir. Simultaneously with the start of the project, the Izmir Green Infrastructure -GI project was started with a series of public consultations. The Municipality kicked off the process by setting up the "GI Working Group" within the Municipality. A very wide participative process has been initiated with the active membership of universities, public institutions and NGOs. Over 150 experts have participated in this initiative that is ongoing.

Various strategies and programs to be developed within the process will try and establish as an imperative, a collaborative mechanism and process among the very large number of public and private institutions as well as design and realize innovative planning, design and management within the Municipality itself.

4.3.4 Social / Cultural Barriers

Success – The Transformation of the Buca Adatepe Construction and Demolition Dumping Site to the Neşet Ertaş Park

The "before" and "after" pictures taken of the area summarize the magnitude of the successful transformation to a park (Figure 4-1). The Municipality has re-developed ~ 18.250 m^2 of

dumping ground for demolition waste into ~12.400 m^2 of green area. Recreational and sports facilities have also been constructed.

Figure 4-1: The Transformation of the Buca Adatepe Construction and Demolition Dumping Site

Success – Riverside re-development around Peynircioğlu Creek to People's Park (Halk Park)

The up-river (essentially an artificial canal extension connected to the sea) length of Peynircioglu demo site totalling 100.000 m^2 has been re-developed into a green area.

The main purpose of the project was to create a public space which was isolated from **"Gated communities"** surrounding it. The pictures demonstrate that this has been successfully achieved (Figure 4-2). Green sloped surfaces from the canal to periphery of the site was realized. This redevelopment has also greatly increased the value of the interventions in Urban GreenUP.

The public's sense of insulation from the urban congestion and built environment around will be felt more as trees grow. The park also opens up and invites the "gated communities" around it to the serenity of a green park. Inside the park there are several locations such as "**Democracy Square"**, **"Community Armchair"** and also **"Free Speech Soapbox"** within the site where people can express themselves. The green pyramids provide informal use and also create a physical boundary with the city.

The park also supports the continuity of the bike lane. Proposed bike lane will reach the waterfront along with the green axis.

The main target is to increase plant species and biodiversity.

Figure 4-2: Riverside re-development around Peynircioğlu Creek to People's Park

4.4 Follower Cities

4.4.1 Ludwigsburg

- Success

For the renaturation of the river bank of the river Neckar in Ludwigsburg coordination processes between federal government (owner of the river) and the city (owner of the river bank) were necessary. In this project they worked closely and successful together.

- Failure

The City of Ludwigsburg wanted to buy mobile green rooms. They should be used for different events to sensitize the citizens for the topic of climate adaptation and of course make squares/places more attractive. But the municipal council rejects the project because of the costs. Now we have a different approach we'll try to rent these "mobile green rooms" this year.

4.4.2 Mantova

- Success

In Lombardy region, where Municipality of Mantova is localized, there is a new regulation about hydraulic management that all the municipalities must put in action before summer 2018. This will be a great action to face flash flooding in urban areas.

Mantova team think that a successful NBS in Italy could be the Bosco Verticale (Vertical Forest), a pair of residential towers in the Porta Nuova district of Milan.

4.4.3 Quy Nhon

- **Success**

Quy Nhon succeeds in the co-management model of mangroves in Thi Nai Lagoon.

From 2012 to 2015, the Rockefeller Foundation has funded Quy Nhon City to restore mangrove forests at Thi Nai Lagoon to limit the increase in damage caused by climate change

and the ongoing urbanization process. In the implementation process, the mangrove co-management model is established, which means that local communities are involved in the planting, care and protection of mangrove forests and benefit from the mangrove forest resources. Sustainable use of resources, sharing of long-term benefits for communities not involved in mangrove planting, care and protection, including community fishing, capture fisheries Seafood in the mangrove rehabilitation area. As a result, community participation in mangrove planting, care and protection is consistent with regulations that allow communities not to participate in the planting, care and protection of marine mangrove forests in new forest areas. Growing or manual harvesting should be avoided. Local authorities and communities involved in planting, tending and protection of mangroves participate in patrolling and settlement of conflicts arising, if any. Therefore, the care and protection of mangroves in Thi Nai Lagoon has been highly effective.

Quy Nhon successfully solicited donations from international organizations.

In the current difficult economic situation, local budget allocations for the response to climate change through the implementation of solutions is limited. Facing with that situation, Quy Nhon has called and mobilized international organizations and funded the implementation of natural rehabilitation solutions at Thi Nai Lagoon, SUDs, etc. Achieve initial results. For example, Rockefeller Foundation, AusAID, USAID and CRS, GIZ, etc.

4.4.4 Medellín

- **Success**

Urban Forestry and Landscaping Committee

Since 2011, the city has the Urban Forestry and Landscaping Committee, created by Municipal Decree 2119 of 2011, which is positioned and has achieved successful cases within the greening of the city with its technical concepts, as one of its functions is that of "Issuing a technical concept through the evaluation of landscape designs and proposed forestry treatments for different public works projects, before this is presented to the competent environmental authority, as an self-municipality control tool."

This committee is an advisory team for the Municipality of Medellín and its decentralized entities to guide the system of green public spaces. The concepts are realized by officials of the Planning, Environment and Physical Infrastructure Secretariats and they also work together with invited professionals such as advisors with experience in urban forestry. Have biweekly or extraordinary sessions in case they are necessary.

One of the many successful cases that were achieved with this committee, corresponds to the “Carrera Bolivar”, a well-known and traditional place in the center of the city adjacent to the Metro viaduct, whose urban renewal involved the felling and transplanting of numerous trees, the creation of gardens and the planting of new trees. Thanks to their technical concepts and the agreements between professionals and designers, there were adjusted conserve many of the existing trees and improve their conditions, as well as increase the effective green public space.

Urban Trees System

The Environment Secretariat developed the information system for the arboreal individuals of the city called Urban Tree System, this tool provides the municipality a technological tool, which contains the information of the trees located in the urban public space of the city.

In Decree 2119 of 2011, article 7 also established that entities once the work or intervention is completed must enter the information system. At the beginning there was a lot of non-compliance, but in recent years the entities have been committed and reporting on time in the system, in this way their value and importance of the system for the city has been recognized.

- **Failure**

In 2014, the Environment Secretariat had the initiative to create social network called SIAMED, designed as an application for citizens to report critical points in terms of attention to streams and solid waste issues, to report sowing, pruning or tree maintenance and adopting pets, among other functionalities. In addition, the user could have different options that allowed them to improve and contribute to a sustainable environment.

In a few days, the report of the sites overflowed the response capacity of the secretariat, since these entered as attention of compulsory response complaints and it was not being functional because it did not contain technical concepts that could be discarded from the beginning.

Although the idea was well received and could generate awareness among the citizens, the technology used was not adequate.

Based on this experience, we are currently adapting with the latest technologies to create a new version of the application, called “Siembra-Me”, this time the system will be able to indicate whether or not it is possible, if it is already reported or in process or if the site cannot be intervened by the secretariat, among other functions.

5 Conclusions

Urban renaturing consists of a whole inventory of interventions in the cityscape, designed to bring nature back to urban areas, increase climate resilience, enhance citizen welfare and improve public health. The historical development of any city, its present morphology, reflects a complex matrix of historical, technical, organizational, financial and cultural dimensions which are different from city to city, country to country. Despite the wide variety of paths taken by urban development, local governments face a battery of mostly similar barriers to renaturing, the scale and severity of which depend closely on the aforementioned paths. This report attempts to collate and categorize the barriers for each city, prioritize them and through an analysis of successful cases, point out to best practices among city administrations to overcome the various technical, legal, financial and political resistance to city renaturing which can then serve in the overall approach to building Renaturing Urban Plans.

Closely following global economic development, budget availability in cities for anything other than basic services provision, has altered, severely reduced, if not altogether eliminated, the situation changing from country to country, city to city. All lead and follower cities have mentioned budgetary constraints in their analysis often limiting the scope and depth of the projected implementations.

Especially, regarding novel interventions with few previous experiences to show and untested in the eyes of the public, local governments are naturally more sceptical about the potential negative political connotations. The difference between local election and renaturing planning success time spans, it is perhaps expected that local governments will target the most publicly attractive, less costly and fast return (both politically and financially) interventions. There is obvious imperative to better explain, both to city administrations and general public, the much wider impacts and returns from widespread renaturing in the urban environment. It has also been found that city administrations carry out rigorous eco-services valuations for renaturing interventions which are often dismissed.

From the treatise of all cities of the consortium, one important aspect stands out in relief, the importance of embedding renaturing plans in the overall planning processes of the city, making them part of the day to day strategic spatial planning operations. Although breaking up locked-in urban planning practice often requires top down interventions in the municipal hierarchies, the existence of a core strategy and dedicated human resource to this end creates the right impetus.