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D7.9: Report on exploitation strategy for public and private bodies

WP 7 , T 7.9

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Abstract

Based on the work of previous task under WP7, which identify and analyze the market opportunities for nature-based solutions (NBS), the deliverable 7.7 Exploitation strategy for public and private bodies aims to enhance NBS uptake in cities through potential exploitation pathways.

Task D1.1 provides a detailed description of 48 NBS that are developed and deployed in partner cities of the Urban GreenUP project. Under Urban GreenUP projects these NBSs are implemented in three partner cities (Liverpool, Izmir, Valladolid) through different approaches. In each implementing approach, public and private bodies play at different roles, experience distinguish interactions, consequently, they will face dissimilar challenges. To achieve the purpose of task 7.9, the deliverable takes a close look at the network actor in each implementing models by comparative analysis of case studies of demo sites by front-runner cities. The analysis examines how the co-creation networks are constituted for each NBS implementation typology, comprising: which relationships are existing, how key actors go and through what medium into the network of NBS implementation projects, and what challenges and barriers they might face throughout the implementation processes. Factors contributing to the governance arrangements during the implementation of NBS projects (as NBS tender, project management, political process) will also be considered through the case studies analysis.

A strategic management framework for the deployment of NBS projects in cities is also proposed based on the concept of a Sustainable balanced scorecard framework. Using the SBSC framework, Delphi consultation and AHP has been conducted with experts of the UrbanGreen UP project to identify critical success factor (CSFs) and success criteria facilitating the success of NBS implementation projects.

Finally, the comprehensive exploiting pathways of urban NBSs and strategic recommendations are proposed to support cities in exploiting NBSs.

The data in this package is collected from the report, exchange workshops, and surveys carried out with urban planners and municipalities of partner cities of the project who have experience with deploying of NBSs in their cities (Liverpool, Valladolid, and Izmir).



1. Introduction:

1.1 Purpose and target groups:

The work of WP7 Urban GreenUP project targets at the exploitation and market deployment of nature-based solutions (NBS). Based on the investigation of market opportunities for NBS in both European and Non-European cities from task 7.8, sub package 7.9 aims at proposing exploiting and deployment strategy of NBS on the market. In detail, this deliverable includes:

- The outcomes of desk research on relevant projects and publications on NBS market, stakeholder and their relationships in actor network for NBS, governance and business models of NBS.
- The analysis of case studies from demo sites by front-runner cities to learn how they address opportunities for successful NBS implementations.
- The analysis of strategic management framework for successful deployment of NBS projects in cities based on the concept of a Sustainable balanced scorecard framework with identification success criteria and critical success factor.
- The integrated exploiting pathways of urban NBS, strategic map and strategic recommendations to support NBS implementation project for cities or actors who wish to exploit NBS.

The main target groups of this deliverable are the partners of the Urban GreenUP project, front-runner and follower cities. The deliverable should also be available to NBS market stakeholders in other cities and their technical and business partners for further information on NBS market opportunities as well as the potential for new NBS market establishment and existing NBS market growth.

1.2 Contributions from other partners:

The table below explains the role of participant partners who contribute to the development of this report.

Partner	Contribution
RMI	<p>Research activities on NBS projects, NBS exploitation pathways in cities of the Urban GreenUP projects</p> <p>Devising conceptual framework and methodology review the research of D7.9</p> <p>Conducting workshops for discussion, surveys and interview for D 7.9</p> <p>Data collection and data analysis for D7.9</p> <p>Overall D7.9 coordination and writing</p>
UBO	<p>Definition of the deliverable structure</p> <p>Input on Stakeholders, Methodology, Survey questionnaire</p>



Front-runner cities	Coordination of survey distribution and interview planning Provision of secondary data for analysis
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Table 1.1: Contribution from project partners

1.3 Connection with other project activities:

Partner		Contribution
ACC	WP1	Definition of the Renaturing Urban Plan NBS typology and description
VAL	WP2	Implementation of NBS in city, stakeholder's engagement and participation, stakeholder network and values sharing for co-creation. Performances management system and strategic management. NBS exploitation pathways.
Front-runner cities		Coordination of survey distribution and interview planning Provision of secondary data for analysis

Table 1.2: Relation to other project activities



2. Overview of NBS market:

2.1 Nature Based solution:

Nature Based solutions (NBS) are defined by IUCN (2016) as “actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits¹”. However, with an aim at identifying the market opportunities and strategic exploitation for NBS, the report adapts a definition defines by Sowińska-Świerkosz and García, (2022) concluded that NBS are “interventions that: (1) are inspired and powered by nature; (2) address (societal) challenges or resolve problems; (3) provide multiple services/benefits, including biodiversity gain; and (4) are of high effectiveness and economic efficiency.” Within the past decade, there has been growing evidence on the capability of NBS in revamping some of the most pressing environmental and societal challenges environmental and societal challenges, such as emission reduction, climate adaptation and mitigation, air and water quality pollution, biodiversity loss, while also providing cost-effective solutions for public health, food security, and even social cohesion. As a result, many countries and international bodies are seeking ways to utilize NBS as one of the most promising tactics for achieving sustainable development goals (SDGs) (Albert et al., 2019; Voskamp et al., 2021).

The NBS are particularly valued and promoted in large cities, as they are compatible with urban context which is also disturbed by many existing environmental and social problems (Dumitru, Frantzeskaki and Collier, 2020; Burch et al., 2016; Tozer et al., 2020). In fact, the role of NBS is gradually become more vital in urban areas, as they provide important ecosystem services for within, around and influence the supply chain of the cities (UNEP, 2021), these uses of NBS in urban context at each level are described as below:

Within cities: NBSs offer natural shading and reduce urban heat island effects and cooling needs, manage run-off water, improve health and well-being by reducing air pollution, and offer recreational spaces.

Around cities: NBSs form part of city-region interlinkages related to watershed management, recreational spaces, wildfire management, reduction and capture of CO₂, sand and dust storm reduction measures.

Away from cities: NBSs can be applied to the procurement of goods and infrastructure as well as built environment decisions that influence urban supply chains.

In response to these trends, the Urban GreenUp project funded by EU has been carried out seeking Renaturing Urban plans to increase city sustainability through the implementation of innovative NBS. Within the scope of Urban GreenUp project, a catalogue of 48 NBSs has been developed and implemented in the urban context. These solutions are classified into 14 groups of interventions under 4

¹ <https://finance.earth/wp-content/uploads/2021/05/Finance-Earth-GPC-Market-Review-of-NbS-Report-May-2021.pdf>



main categories *re-naturing urbanization*, *singular green infrastructure*, *water* and *non-technical interventions* as shown in the table 2.1 below.

Re-naturing urbanization solutions	Singular green infrastructure	Water intervention	Non-technical
<p>Green Route</p> <p><i>At urban scale</i></p> <p>Cycle and pedestrian green route</p>	<p>Vertical GI</p> <p><i>At street & building scale</i></p> <p>Vertical mobile garden, Green noise barriers, Green fences, Hydroponic green façade, Green façade with climbing plants</p>	<p>Flood actions</p> <p><i>At urban scale</i></p> <p>Floodable Park, Urban catchment forestry, Hard drainage flood prevention, Channel renaturing</p>	<p>Supporting activity</p> <p>City Coaching</p> <p>Engagement</p> <p>Education activities</p>
<p>Arboreal interventions</p> <p><i>At urban scale</i></p> <p>Arboreal areas</p> <p><i>At urban & street scale</i></p> <p>Shade trees, cooling trees, Planting and renewal urban trees, Tree re-nature parking</p>	<p>Horizontal GI</p> <p><i>At urban scale</i></p> <p>Electro wetlands, Floating gardens</p> <p><i>At urban & building scale</i></p> <p>Green shady structures, Green roof, Green covering shelters</p>	<p>Water treatment</p> <p><i>At urban scale</i></p> <p>Green filter area, Natural wastewater treatment</p>	
<p>Carbon capture</p> <p><i>At urban scale</i></p> <p>Urban carbon sink</p>	<p>Pollinator</p> <p><i>At urban scale</i></p> <p>Pollinator's modules, Pollinator verges and spaces, Compacted pollinator's modules</p> <p><i>At street & building scale</i></p> <p>Pollinators roof, Pollinators walls/vertical</p>	<p>Green pavements</p> <p><i>At urban & street scale</i></p> <p>Hard drainage pavements, Green pavements – Green Parking Pavements, Cycle-pedestrian green paths, Cool pavement</p>	
<p>Resting areas</p>	<p>Smart soils</p>	<p>SUDs</p>	



<i>At urban & street scale</i> Green resting areas, Parklets	<i>At urban & street scale</i> Smart soil, Smart soil production in urban farming precinct, Enhanced nutrient managing and releasing soil	<i>At urban & street scale</i> SUDs Grassed swales and water retention ponds, SUDs for green bike lane/parking, Rain gardens	
	Urban farming <i>- At Urban and household scale</i> Small-scale urban livestock, Community composting, Urban orchards, Climate-smart Greenhouses		
	Pollutants Filter <i>- At urban & street scale</i> Urban garden Bio-Filter, Green Filter area		

Table 2.1: List of NBS by categories in Urban Green Up Project (Source: www.urbangreenup.eu)

2.2 NBS benefits:

NBS is an umbrella approach expecting to offer multiple ecosystem services simultaneously. While the value of NBS overall is intuitively apparent, currently the ability to provide reliable evidence is limited, which hampers efforts to select appropriate policy instruments and management approaches. The lack of empirical evidence on the outcomes and benefits of NBS adaptation in urban contexts has always been mentioned as a key barrier in persuading NBS replication (Chausson et al., 2020). Measurable outcomes of NBS is highly demanded in gaining wider public acceptance and engaging stakeholder participations (Anderson et al., 2021), which in turn consolidate long-term performance of NBS. Therefore, a performance assessment framework is important to NBS uptake, from planning to design and implementing.

Under the scope of Urban GreenUp project, an evaluation framework with more than 60 indicators was also recognized to assess multiple benefits generated by NBS at the urban level, and was adopted to evaluate the performance of NBS implemented in our partners cities. The framework was created by building on previous notable framework such as EKLIPSE, the European Green Capital Award, SDGs indicator framework, the Aichi Targets, the TEEB, the common international classification of ecosystem



services (CICES), and the MAES Urban. The indicators are grouped according to the type of services they provide to cities which include provisioning services, regulating services, cultural services and supporting services. Table x briefly describes the challenges the NBS addressed based on EKLIPSE framework mapped with type of indicators and the ecosystem services they provided.

CHALLENGES	TYPE OF INDICATORS	ECOSYSTEM SERVICE	Example NBS
CHALLENGE 1: Climate mitigation & adaptation	Carbon savings per unit area Carbon storage and sequestration in vegetation and soil	Regulation	Tree related actions; Carbon sink
	Temperature reduction	Regulation	Vertical & Horizontal Infrastructure; Tree related actions
		Regulation	
Energy and carbon savings from reduced building energy consumption	Regulation	NBS in buildings (green façade, green roof, green shady structures)	
CHALLENGE 2: Water Management	Physical indicators	Regulation	Tree related actions; SUDs; Natural Wastewater Treatment Plan; Rain Gardens; Floodable park; Green Parking pavements; Electro wetland
		Regulation	
		Regulation	
		Supporting	
		Regulation	
		Regulation	
		Regulation	
		Regulation	
	Chemical indicators	Regulation	Tree related actions; SUDs; Natural



	(water quality)	Provisioning	Wastewater Treatment Plan; Rain Gardens; Floodable park; Green Parking pavements; Electro wetland
	Economic indicators (benefits)	Regulation	Floodable park;
CHALLENGE 4: Green Space Management	Social indicators (benefits)	Cultural	Green cycle lane; Tree related actions; All NBS
		Cultural	
		Cultural	Non-technical actions;
	Environmental (biological)	Provisioning	Urban orchards;
		Cultural	Green cycle lane; Tree related actions; Vertical and horizontal interventions; Floodable park, NWTP
		Cultural	
		Supporting	
Supporting	Pollinator's modules		
Cultural	All NBS		
CHALLENGE 5: Air Quality	Environmental (chemical)	Regulation	Green cycle lane; Tree related actions; Smarts soils as substrate; Urban garden bio-filter; Vertical green interventions; Horizontal green interventions;
		Regulation	
	Economic	Supporting	All NBS (Monetary issues)
	Social (physiological)	Regulation	Urban garden bio-filter;
CHALLENGE 6: Urban Regeneration	Socio-cultural indicators	Cultural	All NBS (Global indicator)
		Regulation	All NBS (Energy issues)
CHALLENGE 7: Participatory Planning and Governance	Social indicators	Cultural	Non-technical actions;
		Cultural	



CHALLENGE 8: Social Justice and Social Cohesion	Social justice	Cultural	All NBS
	Social cohesion	Cultural	Non-technical actions;
CHALLENGE 9: Public Health and Well-being	Psychological indicators	Regulation	Noise barriers; Vertical & Horizontal green interventions
	Health indicators related to ecosystem service provision	Cultural	Green cycle lane; Vertical green interventions; Horizontal green interventions; Floodable park; NWTP
CHALLENGE 10: Potential of economic opportunities and green jobs	Economic	Supporting	Vertical & Horizontal interventions; Natural Wastewater Treatment Plant; Green filter area; Floodable park; Green parking pavements; Non-technical actions;
		Supporting	
		Supporting	
		Supporting	

Table 2.2: Evaluation Framework for cities Urban GreenUP project (Source: WP1)

2.3 NBS market:

Wild et al., 2020 made an initial approach to describe NBS market, which is made up of organizations that have a need for NBS (buyers) and those that supply NBS products and services to the market (suppliers).

From the demand side, the report on The Vital Role of Nature-Based Solutions in a Nature Positive Economy (McQuaid et al., 2022) identified key three areas where demand for NBS is expected. Firstly, policymakers, public managers and experts who recognized NBS potential benefits, for the urban environment, health and social wellbeing, economically and socially, as well as for the environment and ecology. Following in this vein, public actors such as city councils, municipalities, and policymakers may seek ways to implement NBS to address urban resilient needs (facing urgent issues as air or water pollution, heating, and social cohesion) or to accommodate urban development needs to improve the city's social and economic well-being (Raymond et al., 2017; Fastenrath et al, 2020; Bayulken et al, 2021; Sowińska-Świerkosz and García, 2021). NBSs are also demanded by private actors as business owners, entrepreneurs, and financiers who see their economic opportunities. In recent decades, there has been a growing interest from private entities for the use of NBS to achieve their desired business objectives such as increased cost-effectiveness, consistent profit growth, compliance with regulatory requirements, reputational and sustainable growth (European Commission, 2015; Trang, Lee and Han, 2019; Convertino, Vox and Schettini, 2021; Rosa da Conceição and Finlay, 2021; Meena et al., 2022). Firstly, owners of private properties such as hotels, parking lots, as well as shopping smalls/store owners who uses indoor landscaping and the outdoor surround environment to influence the attitude and



behavior of their customers and employees (Han and Hyun, 2019), can be direct buyers of some types of NBS (such as singular green infrastructures). Secondly, firms in the architecture or construction sector are also potential consumers of NBSs as an input to upgrade their end products. For instance, architecture firms and construction contractors buy NBSs (as green roofs, green facades, trees plants) from NBS providers to increase the sustainable and economic value of their infrastructure projects or buy NBSs such as smart soils as raw materials for the project. Finally, private actors can be indirect NBS buyers who are primarily involved in NBS implementation projects as funders or co-investors. The main driving force of private entities participating in such roles of NBS implementation projects is related with their corporate social responsibility. Finally, citizens and representatives of the "third sector" (non-profit organizations, community groups, and charities), who are typically end users, are also direct buyers of NBS when they see an opportunity to solve local issues, improve property values, living conditions, and participate in meaningful activities. An example of this is how green gentrification impacts property values, social exclusion, and displacement has been discussed (Scott et al., 2016; Tozer et al., 2020). Community-led urban re-nature projects are one source of third sector's NBS consumption (Egusquiza et al., 2021); another source comes from land owners as citizens or non-profit organizations (such as houses, universities, churches, etc.) who may voluntarily adopt a suitable NBSs to their properties (as a green roof and garden) under public support and take the responsible for maintaining these facilities. Citizens and NGOs can play an indirect role as donors for NBS projects.

On the supply side, regional, national and local government actors (as European Commission, public and municipal managers) are often relate to initiating roles in NBS implementation especially in large-scale interventions (Zingraff-Hamed et al., 2021; McQuaid et al., 2022). However, government actors might confront major barriers in delivering NBS (McQuaid et al., 2022). Firstly, a majority of works during NBS implementation are associated with engineering and technical requirements that necessitate a high level of expertise in planning, designing and managing, due to a shortage of qualified personnel, the capacity of the public sector to supply NBS may be limited. Secondly, existing framework of public procurement are often complicated and incompetent, restricting exposure to external suppliers (Kabisch, Stadler, et al., 2016; Davies and Laforteza, 2019; McQuaid et al., 2022). Finally, the inability to engage more citizens and local business in stewardship and co-creation for NBS might lead to undesired outcomes. While environmental outcomes of NBS overall is intuitively apparent, question has been raised on the influence of whether such approach effectively address societal problems such as inequalities, social cohesion (Tozer et al., 2020). The lack of consideration of differences and trade-offs between actors may potentially lead to conflicts and inversely influence the process of designing, implementing, and maintaining nature-based solutions in the long-term (see Giordano et al., 2017; Shrestha and Dhakal, 2019).

Recently, the roles of non-government and private actors are increasingly encouraged in decision making and operating of NBS. Kooijman et al (2021) conducted a study of non-governmental agents involved in the provision of NBS and proposed to classify these entities into two main categories with definitions:



“Nature-based enterprises: use nature as a core element of their product/service offering for the planning, delivery and/or stewardship of NBS and engage in economic activity.”

“Nature-based organisations: use nature as a core element of their product/service offering for the planning, delivery and/or stewardship of NBS but do not engage in economic activity.”

The third categories are “Nature-based products and services may be offered by enterprises or organisations where nature is not a core element of their product/service offering.”

Following the pioneer work by Kooijman et al (2021), McQuaid et al (2021) also identified eleven categories of economic activities in the NBS market and divided these into two major groups:

Direct use of nature	Indirect use of nature
<ol style="list-style-type: none"> 1. Ecosystem creation, restoration and management 2. NBS for green buildings 3. NBS for public and urban spaces 4. NBS for water management and treatment 5. Sustainable agriculture and food production 6. Sustainable forestry and biomaterials 7. Sustainable tourism and health and wellbeing 	<ol style="list-style-type: none"> 8. Advisory services 9. Education, research and innovation activities 10. Financial services 11. Smart technology monitoring and assessment of NBS

Table 2.3: Categories of economic activities in the NBS market

2.3 Implementation typologies for NBS projects:

The market approach pays more attention to individual actors, however, the network for NBS implementation and uptake in practice usually consist of numerous actors and complex multidimensional interactions. Many authors emphasize the importance of analyzing key stakeholders and innovative governance models (Kabisch, Stadler, et al., 2016; Frantzeskaki, 2019; Tozer et al., 2020; Zingraff-Hamed et al., 2020; Mahmoud and Morello, 2021), funding mechanism and business models when formulating strategic decisions or higher planning for uptaking NBS (Davies and Laforteza, 2019; Croeser et al., 2021; Sowińska-Świerkosz and García, 2021b). Egusquiza et al., (2021) conducted research that proposed a comprehensive framework for understanding how governance, financial, and business models are interconnected to facilitate the successful implementation urban nature-based solutions projects (NBS). The framework was adapted to analyses of 50 successful NBS case studies, and generalizing three overarching implementations approached for NBS which are: (1) State-centric approach; (2) Corporate-Centric Approach; (3) Community-Focused Approach; (4) Collaborative Ecosystem.

While different types of NBS implementations are studied with identification of key stakeholders and their different roles in each model, the formation of relationships and interactions between actors during the an on-going NBS implementation project remain complicated. Several researches discussed that establishment of co-creation and collaborative processes enabling NBS installation are often



organized by stakeholders themselves rather than strategic planning (Zingraff-Hamed et al., 2020, 2021; Mahmoud and Morello, 2021). The majority of NBS adaptation projects, including demonstration projects funded by the European Commission, are also carried out in an experimental or pilot manner to build the evidence and knowledge base needed to advance NBS development (Frantzeskaki, 2019). The Urban GreenUP projects within the Horizon2020 program also aimed at innovative NBS implementations in urban contexts by establishing NBS demonstrations in front-runner and follower cities. Innovative governance approach, business model, new approaches to stakeholder engagement, co-design and co-implement, lesson learned from practical experience are encouraged to future NBS uptake. Draw on the foundation of previous work and aligning with objectives of the projects, we built a framework to examine implementation typologies of NBS in urban context. Consequently, we collected data of case studies from Urban GreenUPs demos and applied the framework to analyze, the case studies also help to validate the framework. Finally, the report takes closer look at the actor-network of each NBS implementation typology to identify values and challenges of different stakeholders while participating in different roles in different types of implementation projects. The results suggest recommendations and strategic approaches facilitating future NBS implementation.

2.3.1 Governance for NBSs:

In the first step to build integrated implementation typologies for NBS, we first looked at the Governance models of NBSs. Rather than the traditional practices of conserving the intrinsic value of nature, the ecosystem services concept acknowledges humans as significant beneficiaries of nature (Primmer et al., 2015). This approach put more emphasize on the use value generated by nature itself to both mitigate environmental risks and solve societal problems (Loft, Mann and Hansjürgens, 2015). Recently, ecosystem services (ES) are increasingly provided in the urban context through the installation of NBS (La Notte and Zulian, 2021). NBSs are artifacts designed by humans, which are inspired and powered by nature, these solutions are potential to strengthen the ecological system and benefit human wellbeing (Sowińska-Świerkosz and García, 2022). There are four types of ES identified as major goals of urban NBS including provision, regulation, support, and culture service generating multiple social, economic, and environmental co-benefits for the urban environment and citizens (Francés et al., 2021; La Notte and Zulian, 2021).

Conventional perspective classified nature-related goods and services as “public good” market which often operated with government dominant (Zingraff-Hamed et al., 2020). In addition, prior natural interventions, such as biodiversity conservation or grey infrastructure (water-treatment plants, dams, seawalls, and etc.,) focused solely on environmental outcomes (monofunctional) which are less appealing to the communities or private actors. As a result, government and public sector are frequently referred as key actors in nature conservation and climate resilient actions. The concepts of ecosystem services and NBS solutions, on the other hand, emphasize achieving multiple human-centered outcomes, which necessitate stakeholder collaboration and collective decision-making (Paavola and Hubacek, 2013; Loft, Mann and Hansjürgens, 2015). There is growing evidence in the literature that NBS can perform more effectively when multiple stakeholders are involved suggestively in NBS



implementation (Van der Jagt et al., 2017; Gulsrud, Hertzog and Shears, 2018; Albert et al., 2019; Frantzeskaki, 2019; Tozer et al., 2020; Kiss et al., 2022).

Governance is fundamentally concerned with how the interactions and interdependencies of social and political actors are organized within a structured framework to make policy decisions (Martin et al., 2019). Traditionally, environment governance operated in a hierarchical framework that controls actions and outcomes through top-down decisions made by a political actor (Loft, Mann and Hansjürgens, 2015). However, such a centralized approach is yet to have a significant impact on solving natural problems (Primmer et al., 2015; Zingraff-Hamed et al., 2020). Changes in governance structure are necessary, particularly when new approaches such as ecosystem service and NBSs are widely adopted as promising strategies for addressing social and environmental challenges (Raymond, Frantzeskaki, et al., 2017; Zingraff-Hamed et al., 2021). Therefore, meaningful participation and an open governance structure are both critical to successful implementation of NBS. A significant research efforts to understand how new governance structures and collaborations can be formed throughout different stages of initiation, planning and design and implementation of NBS has received great deal of attention (Kabisch, Stadler, et al., 2016; Bisello et al., 2019; Zingraff-Hamed et al., 2021), and such practices are strongly encouraged by the EC (Sarabi et al., 2019). Lupp et al., (2021) groundbreaking work examines practices of NBS successful cases through the concept of “Living labs”, and finds key similarities which are: (1) A quadruple helix innovation network of private companies, public agencies, knowledge institution (academia), users, and other stakeholders; (2) intensive participation and involvement where actors are linked with each other and intertwine in all stages to develop solutions. These findings suggested that the concept “living lab” as illustrated in figure 2.1 is a potential approach for co-designing NBS.

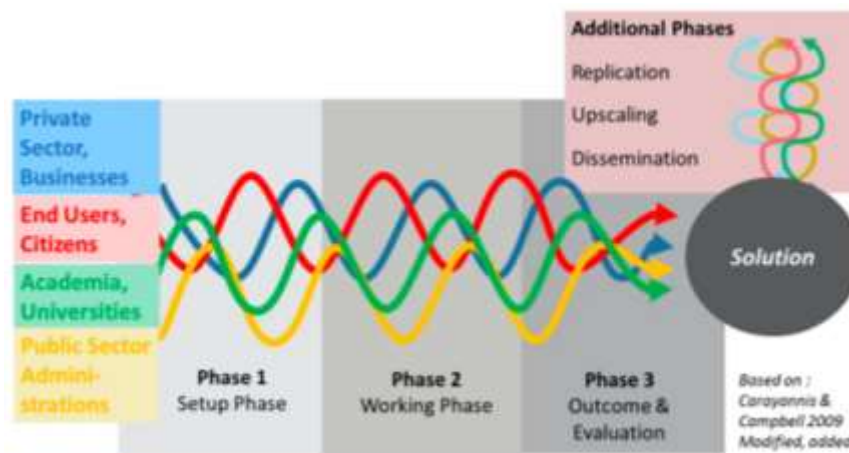


Figure 2.1: Stakeholders in a living lab approach (Source: Lupp et al.,2021)

The Living lab is, in fact, an practical example of “Co-creation” (Gulsrud, Hertzog and Shears, 2018; Bisello et al., 2019; Frantzeskaki, 2019). Co-creation is a term to describe “the practice of collaborative product or service development: where developers and stakeholders are working together” (Pater 2009; Prahalad and Ramaswamy 2004; Ramaswamy and Ozcan 2018). From both research and practice



perspectives, Co-creation is a potential strategy for dealing with the complexity and uncertainty that arises through NBS implementation. Co-creation efforts that combine different scientific disciplines, as well as active dialogue among stakeholders from policy to practice actors, are required to achieve NBS sustainability and resilience outcomes in urban areas (Kabisch et al., 2016; Frantzeskaki et al., 2020). While co-creation facilitates inclusive NBS design, NBS implementation requires collaborative governance (Frantzeskaki, 2019; Mahmoud and Morello, 2021). Table 2.4 provides synthesis of research findings from other projects and research works on innovative governance for NBS.

Projects/ Publications	NBS typology	Approaches	Findings
PHUSICOS projects - NBS in-depth case study analysis of the characteristics of successful governance models (Martin et al., 2019)	NBS for natural risk reduction (Isar River -flood protection, Wolong Nature Reserve-conserving Forest, Nocera Inferiore – landslide risk)	In-depth case study analysis: Absent of Market actors in all the cases.	Innovative governance approaches are: (1) “Polycentric governance” embracing new public administration arrangements that decentralize decision-making authority across multiple organizations and institutions (2) “NBS co-design” embedded in novel participation processes that eventually affect NBS (3) “Financial incentives” new financing approaches intrigued through consultation with stakeholders.
Clever Cities project - Co-creation Pathway for Urban NBSs: Testing a Shared-Governance Approach in Three Cities and Nine Action Labs (CAL)	Urban NBS in three cities – (1) Hamburg Green corridor with spots scaled interventions; (2) London water-body intervention in Thamesmead Lake; (3) Milan punctual interventions along a railway infrastructure and	Comparative analysis of these 3 cities and 9 CALs on key characterization for NBS implementation framework: (1) current urban-planning greening strategies in each context, (2) specific environmental and	Concept of the complete co-creation for NBS implementation that integrates the co-creation pathway (the operational structure) and the Urban Living Lab (the spatial medium) follow with inclusive shared-



<p>(Mahmoud and Morello, 2021)</p>	<p>green roofs and walls in the southern transect of the city.</p>	<p>societal challenges addressed, (3) different typologies and scales of NBS integration within urban morphologies, (4) specific governance process as response to co-design and co-implementation processes, and (5) availability of financial investment and main stakeholders.</p>	<p>governance process for upscaling NBS.</p>
<p>Connecting nature – Collaborative Governance for NBS solutions (Vandergert, Hölscher and McQuaid, 2019)</p>	<p>Investigate NBE – urban NBS</p>	<p>Using case studies and developed a five-step collaborative governance process of NBS</p>	<p>Proposed a five-step to develop a collaborative governance process for city authorities and actors: Make the case for NBS – Align NBS goals with wider goals of the city so you can build the case for delivering multiple benefits; Current status of location – Identify the current use ownership and management of where you want the NBS to be; Who are the required partners? – Identify all relevant partners and bring everyone together to co-create vision and goals for NBS; How will you work together? – Develop and agree a collaborative governance framework; What will you need to succeed? –</p>



			Conditions, skills, capacities, and reflexive learning to ensure ongoing success.
Governance models for nature-based solutions: Seventeen cases from Germany (Zingraff-Hamed et al., 2021)	NBS for flood risk management and mitigation in Germany	Hierarchical clustering procedure and a qualitative analysis of 17 case studies to identify governance models to NBS implementation	<p>Identification of four project types (also called as governance models) including: Type 1 – Cooperation and Initiatives; Type 2 – Co-design; Type 3 – Citizen power and Type 4 – Top Down</p> <p>These models are clustered through key features which are: (1) Framing and implementing organizational structures; (2) Project coordination; (3) Participation level; (4) Institutional setting; (5) Financing; (6) Property rights constellations; (7) Localization</p>
Conceptual and Operational Integration of Governance, Financing, and Business Models for Urban Nature-Based Solutions (Egusquiza et al., 2021)	Urban NBS projects	Proposed integrated implementation models (IM): Forming a WHAT (NBS project) – WHO (initiating actors) – HOW (IM) framework that structures the links between models of NBS implementation. Analyzing 50 case studies using the framework.	Identify four implementation models which are: (1) State-centric approach; (2) Corporate-centric approach; (3) Community-focused approach; (4) Collaborative ecosystem.
Collaborative	(1) Pollinator-friendly	Case studies from pilot	Adapted from Driessen et



<p>Governance Arrangements for Co-creation of NBS (Wilk, Säumel and Rizzi, 2021)</p>	<p>Food Forest in Dortmund through Non-governmental Actor-led Model; (2) “Farfalle in ToUr” Using a Non-governmental Actor-led Model in Turin; (3) Greening Unusual Spaces through Co-governance in London; (4) Co-management/Co-governance of Green Roofs and Walls in Milan; (5) Cocreating Multifunctional, Sustainably Productive and Inclusive Urban Landscapes through Self-governance in EdiCitNet;</p>	<p>demonstrators in Horizon 2020 projects (proGReg, CLEVER Cities, and EdiCitNet in Italy, Germany, the Netherlands, and the United Kingdom) -</p>	<p>al. (2012) based on a triangulation of central/local government (G), the private sector (P), and civil society (CS). Four such governance modes are classified along the spectrum:</p> <p>(1) A government actor-led model: public sector primarily responsible for NBS implementation, allowing for some stakeholder engagement (usually top-down); (2) Co-management, with the governmental actor carrying the main responsibility for NBS implementation, the private sector or civil society supporting the planning, management, and/or maintenance of NBS, often in a pre-determined role (contractual agreements, public-private partnership etc.); (3) Co-governance (interactive governance) with many different actors involved and equal roles of all network partners in formalized or nonformalized partnerships and participatory public-private governing arrangements; (4) Non-</p>
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			government actor-led model (self-governance); a bottom-up approach with private sector or civil society as lead actors and the supporting/responsive role of a public/state entity in participatory private-private governing arrangements.
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Table 2.4: Synthesis on key research findings on NBS governance

The NBS governance literature has focused on three aspects (1) stakeholder mapping, especially initiating actors to categorize types of NBS governance models (Zingraff-Hamed et al., 2020; Egusquiza et al., 2021); (2) identify the successful characteristics/enablers of the NBS governance (Dorst et al., 2019; Frantzeskaki, 2019; Martin et al., 2019; Fastenrath, Bush and Coenen, 2020; Frantzeskaki et al., 2020; Tozer et al., 2020); (3) propose a design roadmap for collaborative governance of NBS (Bisello et al., 2019; Vandergert, Holscher and McQuaid, 2019). Draw on developed concepts, we collect data from partner cities of Urban GreenUP project, and analyze to identify NBS implementing typologies. However, we argue that innovative collaboration can emerge as small practices at various stages during NBS implementation project (e.g., consortium before tendering, co-financing and co-construction) that need to explore further as lessons learned for future NBS strategic decisions. Therefore, the research takes further investigation on (1) multi-faceted relationships and interactions between actors within network of NBS implementation projects, (2) dynamic nature of relationships built in networks (ex: individuals can engage in various forms of collaboration, their values/interests to enroll in the network, challenges and conflicts arise throughout the project life cycle, (3) innovative influence strategies used by stakeholders to achieve their individual and overall project goals are examined in order to draw lessons learned for future planning.

2.3.2 Key actors and related actions to NBS:

The initial step for investigating NBS governance is to identify relevance stakeholders and their roles during NBS implementation. A study by Sarabi et al., (2019) identified across four levels including micro, meso (city-level), macro (regional, national or international) and transboundary level, actors of each level are described in table x.

The actors at the micro and meso levels are regarded as key stakeholders because they have direct enrollment in the networks that support uptake and implementation of NBS (Sarabi et al., 2019). While actors in micro-level are usually the target beneficiaries of NBS, they might participate in NBS implementation value chains with more than one role ranging from end-users to initiators. Community-led NBS projects are an example of this, in which the group of citizens are both project initiators and



beneficiaries (Frantzeskaki, 2019; Egusquiza et al., 2021; Zingraff-Hamed et al., 2021). Citizens and communities are also targeted audience of raising public awareness and acceptance policies (Anderson et al., 2021), thus, insights from micro level stakeholders are critical to gain context knowledge and experience to management actions (Sarabi et al., 2019).

Level	Actors
Micro-level	Community: NGOs/CSOs/interest groups, CBOs/neighborhood communities, Citizens, Research institutions/Academia, landowners. Market: Private sector/business owners, social enterprises, social entrepreneurs
Meso (City level)	Governments: Local government, Municipal departments, Water boards, Semi-government organisations/institutions
Macro-level	Regional/national government, actors work at regional bodies
Transboundary	Actors work surpass geographical and organizational boundaries to enhance the networks and relationships among NBS producers and users

Table 2.5: Stakeholder in NBS development (Source: Adapted from Sarabi et al., 2019; Egusquiza et al., 2021)

The actors at the micro and meso levels are regarded as key stakeholders because they have direct enrollment in the networks that support uptake and implementation of NBS (Sarabi et al., 2019). While actors in micro-level are usually the target beneficiaries of NBS, they might participate in NBS implementation value chains with more than one role ranging from end-users to initiators. Community-led NBS projects are an example of this, in which the group of citizens are both project initiators and beneficiaries (Frantzeskaki, 2019; Egusquiza et al., 2021; Zingraff-Hamed et al., 2021). Citizens and communities are also targeted audience of raising public awareness and acceptance policies (Anderson et al., 2021), thus, insights from micro level stakeholders are critical to gain context knowledge and experience to management actions (Sarabi et al., 2019).

The meso-level actors (city councils, municipal departments, local authorities) (also referred as “public actors” in NBS literature) has been identified as critical owing to their roles either as initiator or supporter of NBS implementation (Van der Jagt et al., 2017). Municipal authorities are often initiator of large-scale renaturing urban projects which require (1) high level of land availability/ownership and (2) more amount of funding (3) high-level of technical expertise. In fact, the big-scale renaturing urban projects can be more attracted to meso-actors rather than singular infrastructure intervention as they offer a high-public interest (Egusquiza et al., 2021) and become more cost-effective in the long-term when multiple benefits are taken into account (McQuaid et al., 2022). Local governments, on the other hand, serve as regulators and facilitators in terms of the legal framework, land availability, and financial funding for other initiators during the development of NBS projects (van der Jagt et al., 2017; Frantzeskaki, 2019; Egusquiza et al., 2021; Croci, Lucchitta and Penati, 2022). Finally, in regional/urban



contexts, local governments are frequently the primary actors in raising awareness and advocating for investment in NBS (McQuaid et al., 2022).

At macro-level, the support of national and regional policymakers is critical to the success of NBS implementation. They are responsible for planning and formulating strategies that facilitate NBS replications on a larger scale (Kabisch, Stadler, et al., 2016; Sarabi et al., 2019; Kumar et al., 2020). The European Commission (EC) has been a significant advocator at this level by including NBS in the Horizon (2020) research and innovation program and funding numerous projects with the goal of broadening the operationalization of ecosystem-based approaches across Europe and the world (European Commission, 2016). Finally, the successful diffusion of innovative concepts as NBS relies on transboundary actors who are central in building knowledge platforms and sharing networks (Sarabi et al., 2019). The transboundary actors can be academia, NGOs as R&D groups and also project officers.

The involvement of a broader range of stakeholders reflects how governance practices for NBS is changing from top-down to collaborative decision-making. As the role of government gradually shifted from leading to enabling or supporting for NBSs implementation, the involvement of other actors increased from being provided information, consulting, engaging, to partnering and empowering. Figure 2.2 shows the correlation of changes in the level of power and influence of the parties across different governance forms of NBS.

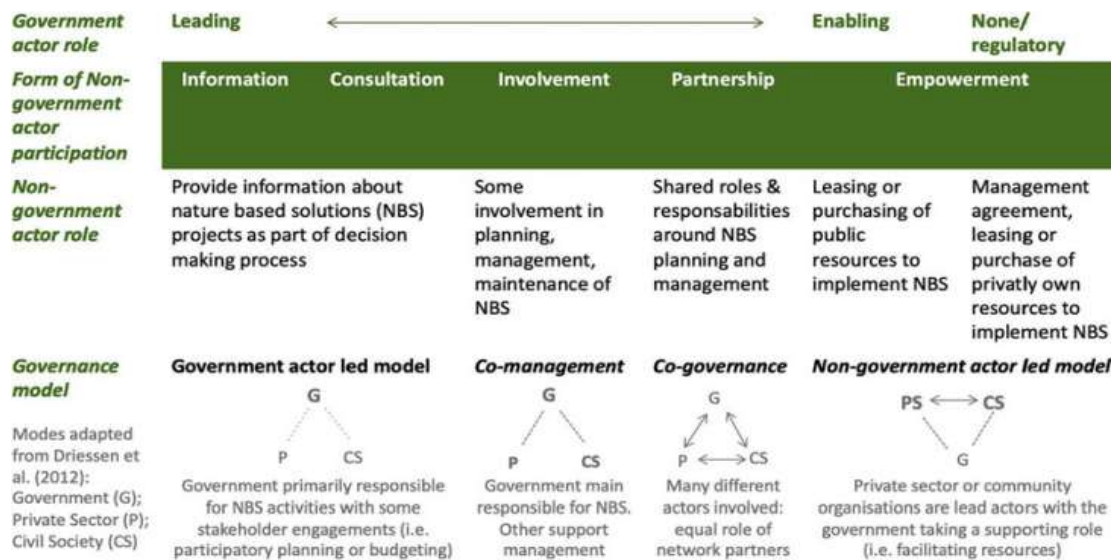


Figure 2.2: Government and Non-government roles in different governance models for NBS (Source: Wilk, Säumel and Rizzi, 2021)

2.3.2 Relationships and interactions between actors:

The review in the previous sections demonstrated that the implementation of NBS in cities can be carried out using a variety of models, with each stakeholder playing a distinguish role. For instance, initiator of NBS implementation can either be between public and private actors across different



implementing approaches. In this section, using framework and demonstration from Urban GreenUP project, the roles and relationship of stakeholders are investigated further.

NBS projects majorly resemble public infrastructure projects with a high level of engineering and innovation. Regardless of the initiator, implementing NBS requires finding professional providers the necessary services (such as consulting, design, and on-site construction), product (plants and materials) and community involvement. In some cases, the actors involved share responsibility through co-management practices. These relationships are formed in many different ways, through different forms of commitments to ensure the responsibilities and interests of each related party. Under the scope of Urban GreenUP project, Task 1.9 analyzes the method for implementing NBS in the cities is analyzed and illustrated in following diagram.

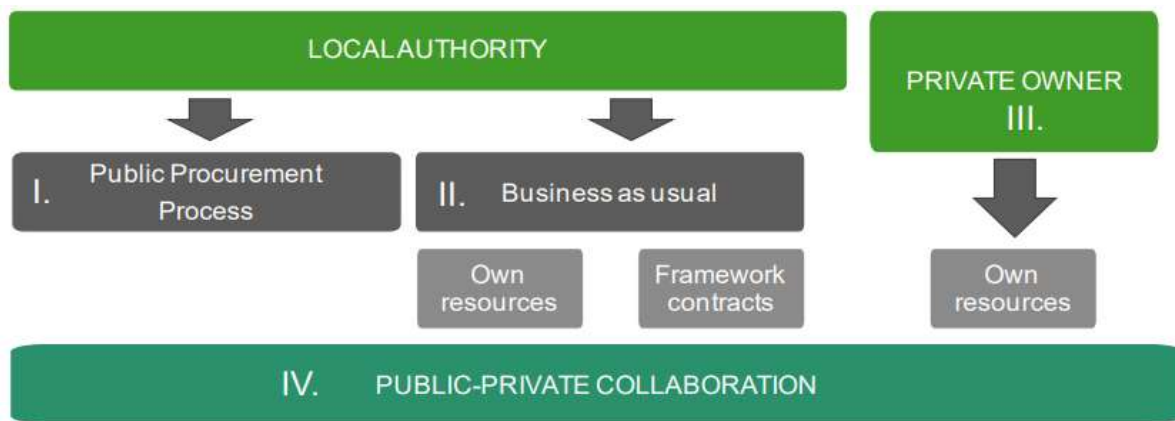


Figure 2.3: Methods for implementing NBS in the cities (Source: Urban GreenUP report WP1)

According to the framework there are three types of relationships which can be formed to facilitate the NBS implementation processes.

Public procurement (PPP): Public procurement is defined as “Government’s activity of purchasing the goods and services which is needs to carry out its function”. Through public procurement, public contracts are signed between public bodies and contractors to supply products and services, for instance, to execute construction works, designing solutions etc. There are three distinct categories of public contracts which are work contracts, supply contracts, service contracts. The tender process is used when procurement also includes the entire process from determining needs and specifications to accessing external markets to finding and assigning bids. In consideration of regulatory framework of each city, different types of public tendering processes have been recognized where (1) open procedure, (2) restricted procedure, (3) negotiated procedure are more popularly applied. Several other types of public contracts, such as (4) direct procurement and (5) minor contract are also utilized in some cases of NBS public tender. Because NBS implementation necessitates highly innovative and complex works, services, and products, strategies that foster innovation are employed in several projects such as innovation partnership, competitive dialogue to define technical specifications and complex contracts, or project competition to get access to qualified proposals for expertise as architect design, product development. While tendering is a complicated process requiring quotes and advertisement, public



procurement for NBS can also be conducted through the utilization of the city's regular in-house services or existing agreement framework. The process is known as Business as usual pathway.

Public procurement processes and contracts represent the relationships between public leader (in most case municipalities) and suppliers (private companies or NGO) in delivering NBS in cities. During the public procurement process, however, many emerging challenges have been disclosed by both public procurers and suppliers (Mačiulytė and Durieux, 2020). On the public procurer perspective, the gaps on knowledge, expertise and experience with the NBS is a major barrier for public procurers to prepare specification document, select, manage and evaluate supplier performance. Public institutions also have difficulty finding suppliers willing to bid on NBS projects and engaging the community in the decision-making process, consequently limiting the co-designing of NBS projects (Mačiulytė and Durieux, 2020). Finally, existing institutions and regulatory frameworks that are not specifically designed to support the NBS, as well as budgetary constraints, are contextual barriers that public officials face when incorporating PPP. On the supplier perspective, private companies and non-governmental organizations (NGOs) may not be familiar with PPP, which requires time and effort to prepare the bidding competition. The relationships between procurers and suppliers are thus strained because they must find a "common language" to ensure successful procurement process for NBS projects from preparation to execution stages.

(Civil) Works contract	Supply contract	Service contract
Implementation of a vertical garden, green wall, ecosystem island	- Purchase of trees and bushes	- Project drafting
Construction of SUDs schemes (drainage, wetlands)	- Instrumentation for monitoring	- Civil works management
Trees and pollinator’s planting	- Purchase of smart soil	- Planting trees
Installation of green parklets		- Soil permeability surveys
Installation of green parklets		- Maintenance services
Construction of a green car park covering shelter		- Engagement services
Construction of green corridor		

Table 2.6: Example contract types on implementing NBS. (Source: Task 1.9, WP1)

Public and private collaborations: stakeholder partnerships are widely encouraged during NBS implementation in innovative forms of co-management and co-management. Public private collaborations are usually carried out through signing a work agreement. A work-agreement is a legal document that often outlines how stakeholders want to collaborate, as well as their responsibilities and expectations. The agreement is mainly signed between the entities (municipalities, city councils, citizen,



NGOs and private actors) directly responsible for NBS implementation. NBS providers (those who provide products and services during the NBS process on the spot) are chosen based on the task agreement of the parties involved, which may also be done through public procurement or directly between non-governmental stakeholders and specific suppliers, under a sub-contract or using their own resources. The major challenge for this type of collaboration is to seek for interested stakeholders. A good example of an NBS public-private partnership is signing an agreement with the private owner of a building or parking area to install green infrastructure on their property and the agreement to commit co-management and maintenance of NBS. However, landowners usually have little or no incentive for provision of ecosystem services (ESs) (Driscoll & Crombie, 2001), meanwhile, the NBS installation process is often time consuming and can affect their existing business operations (as noise, safety issues, etc.). Other barriers to cooperation among stakeholders include a lack of experience and understanding of NBSs, as well as technical, financial, and legal resources to support this partnership.

Citizen/community engagement and other form of participation: citizens and the community, as discussed in the previous section, play an important role in NBS implementation because they are the end user and beneficiaries of NBS. Citizen participation, as defined by Kiss et al (2022) is the “involvement of individuals or communities in the planning, design, implementation and maintenance of projects and policies, such as NBS”. Citizen participation contributes to the success of NBS projects in two ways (1) meaningful citizen participation in the various stages of NBS implementation leading to higher social outcomes (such as social inclusion, social inclusion, equity, social acceptance and a sense of belonging (Frantzeskaki, 2019; Tozer et al., 2020; Anderson et al., 2021; Kiss et al., 2022), and (2) community bottom-up NBS initiatives enhancing social outcomes and environmental stewardship (Jerome, Mell and Shaw, 2017; Gulsrud, Hertzog and Shears, 2018; Tozer et al., 2020). The participation ladder developed by Arnstein (1969) has been adopted as a framework for categorizing typologies of citizen participation practices that emerged in NBS implementation projects (Puskás, Abunnasr and Naalbandian, 2021; Kiss et al., 2022). The ladder describes various participatory practices in urban planning, ranging from non-participation to token participation to citizen control. In the case of NBS, consultation, partnership and other practices of tokenistic participation have been discovered to be the most common approach across various NBS projects (Puskás, Abunnasr and Naalbandian, 2021; Kiss et al., 2022). Citizen participation is two-way the interaction between public actors and citizens/community. While studies commonly investigate the interaction from a single dimension – how public actors engage urban residents in NBS project, citizen-based influence on NBS project should also be considered (Wamsler et al., 2020). A significant challenge face by both stakeholder in citizens-municipalities relationships is to capture interests and enhance active participation from the others. As NBS is a relatively new and complex concept, the lack of understanding about NBS and its effectiveness also hinders the attraction of people to engage in these projects (Kiss et al., 2022). Furthermore, similar to NBS, citizen engagement is adaptive rather than pre-fixed approaches, some certain trade-offs and approaches to citizen engagement under particular institutional structures can jeopardize NBS social and environmental outcomes (Wamsler et al., 2020). On the other hand, community-based/bottom-up initiatives may find it difficult to obtain financial or regulatory support from local governments (Egusquiza et al., 2021).



2.3.4 Business Model for NBSs:

The final step to construct implementation typologies for NBS is identification of an appropriate business model. The concept of 'business model' was more popularized by for-profit organizations and focused on creating, delivering and capturing value economically (or financial performances). However, in line with growing concerns about sustainability and environment protection, development of new business models which also capture sustainable values, are gradually becoming more necessary. As NBS is a relatively innovation and is expected to create multiple benefits (including all sustainable outcomes as social, economic and environmental), conventional business models and finance mechanisms did not seem to fit with NBS projects. Along with the process of determining the governance model, the business model for NBS also requires specifications on a case-by-case basis (Egusquiza et al., 2021). Under the scope of Urban GreenUP project, WP7 T7.4 proposed the definition of the business model and guidelines to design a business model canvas for NBS projects. The canvas is illustrated in the figure below with 13 elements: **1. Project description** (list of NBSs, scale, objectives, duration, realization time, ownership); **2. Project activities** (key activities to deliver value); **3. Value proposition** (key values intended to create for stakeholders); **4. Stakeholders**; **5. Target users and beneficiaries**; **6. Resources** (description of resources necessary to deliver the project proposition and maintain it (time, expertise, working hours, etc.)); **7. Risks identification** (during implementation process); **8. Suitable financial instrument**; **9. Cost structure** (capital expenses and maintenance costs); **10. Possible revenues stream** (asset transfer, economic efficiencies as cost saving, payments/tariffs), **11. Ecosystem services provided** (supporting, regulating, provisioning and cultural); **12. Social benefits related to NBS** ; **13. Environmental benefits of NBS.**



NBS <i>project description (interventions planned, project scale, objectives, realisation time, duration, asset ownership)</i>	Activities <i>description of the key activities necessary to deliver your value proposition</i>	Value proposition <i>description of the value that the action intends to create for citizens/city-users/local government/other stakeholders and of the needs that the action aims to address and satisfy.</i>	Stakeholders engaged <i>list of the stakeholder involved in the project activities and their role</i>	Resources <i>description of the resources necessary to deliver your value proposition and to maintain it (time, expertise, working hours, etc.)</i>
			Target users	Risks
Financial instrument <i>on-budget/off budget innovative/traditional (see the attachment)</i>	Cost structure <i>capital expenses (€), and maintenance costs Capital expenses - are incurred to acquire fixed assets or add value to them in view of creating future benefits. The benefits derived from capital expenditure extend beyond the accounting period of the actual spend. The assets acquired in question might be tangible or intangible</i>		Revenue stream <i>identification (and quantification) of the revenue streams associated with the project implemented (asset transfer, economic efficiencies (cost savings), payments/tariffs for the use of the service, other)</i>	
Ecosystem services <i>provisioning regulating, cultural, supporting</i>	Social benefits <i>non-financial aspects of the business model that are beneficial for stakeholders and for the city (Diaz-Diaz et al., 2017), such as: job creation, business generation (e.g. activation of startups or innovative businesses), social inclusion)</i>		Environmental benefits <i>non-financial aspects of the business model that are beneficial for stakeholders and for the city (Diaz-Diaz et al., 2017) such as: energy/GHG emissions saved, resource efficiency, contribution to vulnerability reduction and resilience.</i>	

Figure 2.4: Urban GreenUP business model’s canvas (Source: Task 7.4, WP7)



3. Building the Implementation typologies – exploitation strategies for Public and Private actors:

3.1 Analytical framework:

Building and exchanging knowledge on general implementation frameworks that have been successfully used in pioneer cities is crucial for promoting NBS adoption and scaling in urban areas. The process of choosing the appropriate business and governance models that support the successful deployment of each NBS typology in each city context is necessary to establish such implementation frameworks. While the governance perspective focuses more on who and how decisions are made, the business model explains how actions are taken and values are created based on these decisions. However, a crucial component that defines both models is the "actors/stakeholders" of interactions within the NBS projects, as well as, the value they created and received. Because of this, governance and business models are intertwined, and each of their integrations results in a distinct implementation typology. A pioneer work of Egusquiza et al. (2021) has attempted to link types of governance model with business model and finance mechanisms and proposed four implementation approaches: State-centric approach; Corporate-Centric Approach; Community-Focused Approach; Collaborative Ecosystem. Built on this framework, we compile demo case studies from partner cities involved in Urban GreenUp projects and analyzed key characteristics to determine an integrated exploitation typology that most fits these cases. NBS, on the other hand, is a collection of innovative products and solutions that are frequently implemented as demonstrations or pilot projects in which willingness to learn and collaborate are encouraged (Frantzeskaki, 2019). Instead of an inflexible framework, collaborative governance that encourages new NBS co-creation and co-management practices and the development of NBS business models on a case-by-case basis is being prioritized. With an aim to build NBS exploitation strategies for public and private actors, besides identifying implementation typologies of NBS in the Urban GreenUp project, we take a further step in analyzing interactions between actors in each NBS implementation model, as well as, challenges arisen and lesson learned while they participated in each model.

Our analytical framework is proposed in Table YY, within the project the proposed strategies focus on the types of NBS in the project and the analytical framework starts from the NBS typologies.

NBS typologies: adopted in the case studies. In this report, we focus only on the 48 NBS typology which has been designed and implemented under Urban GreenUp project and challenges NBS addressed or benefits provided.

Governance Models:

1. Key Actors: Initiated actor and others stakeholder participation
2. Governance Network

Business Models:

1. Project description (list of NBSs, scale, objective, duration, realization time, asset ownership); and key Project activities (key activities necessary to deliver value);



2. Value proposition (the key values intended to create for stakeholders);
4. Stakeholders (list of stakeholders involved) – same as actors and some added stakeholders and Target users and beneficiaries
5. Resources (description of resources necessary to deliver the project proposition and maintain it (time, expertise, working hours, etc.);
6. Suitable financial instrument;
7. Cost structure (capital expenses and maintenance costs);
8. Possible revenues stream (asset transfer, economic efficiencies as cost saving, payments/tariffs),
9. Ecosystem services provided (supporting, regulating, provisioning and cultural) and Social benefits related to NBS and Environmental benefits of NBS.

Integrated implementation typology: Based on data from cases studies, the key actors, governance network and business model we identified 4 key implementation typologies for 48 urban NBS in the Urban GreenUP project. These models are also applicable for similar types of NBS when exploited in similar urban context.

Type 1: Renaturing urban projects

Type 2: Product development projects

Type 3: Adopt a green infrastructure

Type 4: Community initiatives/Community based project

Relationships during implementation and lesson learned:

3. Relationships: related form of governance model (ownership/ governance) => Generalized the implementation cases
4. Key challenges and conflicts of stakeholders during phases of NBS implementation

Recommendations: Innovative arrangements and strategy has been applied to overcome challenged => Outcomes, lesson learned and recommendations



3.2 Making the cases:

3.2.1 Valladolid:

City context: The Valladolid is a Spanish city of approximately 300,000 people, which is capital of the autonomous region of Castilla and Leon, Europe's largest region. The city has a continental Mediterranean climate and is located in a valley formed by the rivers Pisuerga and Esgueva. Valladolid is tourist attracted destination with many historic museums, palaces and churches. However, Valladolid are similar to other urbanization area facing multiple climate risks as heat island effect, poor air quality and flooding issues cause by the Esgueva River. In addition, while the city encourages the use of bicycles to improve the well-being of residents and reduce the impact of air pollution, cycling lane network in Valladolid was quite disconnect and extensive. A major objective of the City' Sustainable Urban Mobility Plan is to enhance connection of the present network. Therefore, Valladolid launched "Sustainable Urban Development Strategy" through URBAN GreenUp project to enhance connection between the city green areas. This plan not only tackles the environmental and social problems of the city but also aligns with the city existing urban planning objectives. Three sub-demo projects are selected for Valladolid Urban GreenUp plan facing different challenges and limited condition:

Sub-Demo A: Green Corridor. Actions to re-nature the concept of cycle lane in Valladolid.

Sub-Demo B: City Centre. Actions to re-nature areas with low availability of space for conventional green infrastructure.

Sub-Demo C: New models of re-naturing urban areas. It is divided into four main locations. C1. Football Stadium area (Parking). Actions to re-nature the concept of outdoor car parking; C2. Football Stadium area (Sustainable Park). Actions to create a sustainable park from different points of view but mainly from the use of water for irrigation; C3. Floodable Park area. Actions to create a floodable park in Valladolid; C4. Urban farming (Alameda Park). Urban farming and related actions.



Figure 3.1: Aerial view of the three Sub-Demo Areas of URBAN GreenUP in Valladolid (Source: WP2)



Type 1: Renature urbanization project - New Cycling pedestrian pathway in Valladolid Green Corridor

In this section, we focus on the case study of sub-demo A - Green Corridor in Valladolid with three relating actions comprising 1) New green cycle lane and re-naturing existing bike lanes; 2) Tree planting and 3) Natural pollinator modules.

Current pressing urban planning challenge: Extensive bike lane network but facing non-connection problem in which biking lanes are distributing unsystematically across three areas (West, East and San Cristóbal industrial) as demonstrated in the Figure 3.2.

Project description: The cycle lanes (new and renatured) is implementing to connect the city of Valladolid from East to West).

Project value: This green corridor will improve landscape connectivity between green areas while also providing critical ecosystem services to promote urban biodiversity and sustainable mobility.

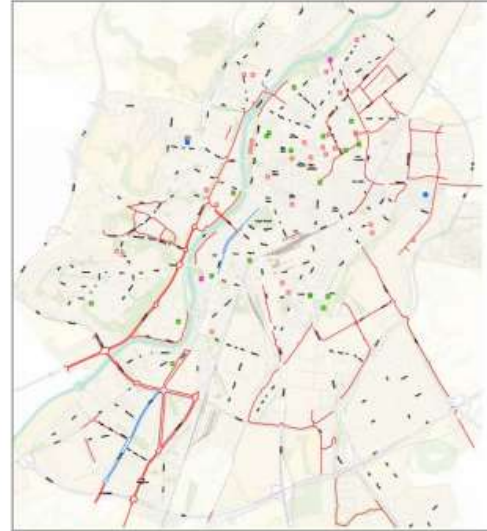


Figure 3.2: Current cycle lane in Valladolid (Source: Valladolid City Council, 2010)

NBS: Multiple NBSs are implemented in this project comprising 1) New green cycle lane (with 5 km new green cycle lane and 3 km re-naturing part of existing bike lane), three green resting area 100 m² each with tree shade, small pollinator modules, bike parking, resting structure), 1000 m² cycle pedestrian green path with green pavements and smart soils); 2) Natural pollinator's modules (as water fountain, housing for pollinators and birds). Among these NBS the New green cycle line is the core intervention.

Values/benefits: Based on the developed KPIs framework (established in EKLIPSE) expected addressing challenges are Climate mitigation and adaptations; Water management; Green spaces management; Air quality; Participatory planning and Governance; Public health and well-being and Potential of economic opportunities.

The new cycle line contributes to the promotion of the most efficient transport modes, the reduction of energy consumption, the improvement of the accessibility and security levels and the improvement of the quality of life of citizens. It will help to connect current existing cycle lanes with new cycle lanes, in order to increase connectivity, sustainable transport but also for biodiversity, using sustainable permeable materials which reduce the heat island effect. Along the green corridor three cycle-pedestrian green paths areas are installed, which are crossing points for coexistence, located in conflictive places.

This intervention includes green pavements in a special structure with filter properties. Those green pavements leave small gaps filled with smart soil and with specific creeping grass species with a short growing and minimum maintenance. These features will allow manage the water runoff and it could



serve in the cycle-pedestrian areas to reduce cycle speed in specific urban sections with many pedestrians.

This green corridor includes tree series, which provide shady places and improve the citizens' s well-being. Trees series will hold the connectivity among spaces and will contribute to preserve biodiversity. All actions related to vegetation will contribute to carbon sequestration. Green resting areas are green spaces projected for social passive recreation (resting, relaxation, observing nature, social contact). The development of green resting areas plays a central role in policies related to health, nature conservation and spatial planning.



Figure 3.3: Current new cycle lane in Valladolid thanks to URBAN GreenUP (Source: Valladolid City Council, 2022-2023)

Initiating actors: The leading actor and main coordinator for Green Corridor demo project is Valladolid City Council, a local government public entity from Spain. The City Council is responsible for most of the decisions related to this NBS implementation project.

Project scale and key activities: This is a large-scale project with significant execution addressing multiple environmental, economic and social challenges. The zoning areas are mostly public land which is a large area, the NBS is also selected based on the current development and urban planning priority of the City Councils (towards the Comprehensive Sustainable Urban Mobility Plan for the City of Valladolid (PIMUSSVA, 2015), with a specific section for reduce the use of motorized transports).

Other stakeholders: Valladolid city councils, Private (as suppliers of NBS related products and services as designing, writing technical document, execution), citizen as end-beneficiary.

Relationships during implementation phases:

- *Public procurement process:*

Local authority through public procurement processes and through business as usual activity. Type of contracts: Work contracts (construction tasks); Supply contracts (trees and bushes) and Service contracts (project drafting, civil works management, engagement activities).



Implementation of NBSs in this demonstration projects were actually launched simultaneously with other NBSs. While there is a design process and procurement plan for NBS, the city finally launched 36 administrative and tendering procedures. Most of these are minor and services contracts. For execution task, the city applied one the biggest work contract through open procedures, value of the contract is over €1 million (this contract combines construction of many NBS including green corridor). Calls are made to private companies to submit design bids, and after final design and technical project delivered, call for tenders for execution (works contract). The city also has an existing framework agreement which is applied for some purchases (trees, smart soil) and service (quality control & health & safety). The city also has an existing framework agreement that applies to certain purchases (trees, smart land) and services (quality control, health and safety). The framework provides an opportunity for the city to use local suppliers:

“The City Council encourages us to launch different lots. Why? Because if we make this big procurement into small pieces, small pieces. The procurement will be open to small enterprises and to small and local contractors. This is something that is quite important for our City Council, so in fact they did not prefer big. Big implementation, but small contracts just to be opened and open market to small contractors.” – Valladolid City Staff

“Through the framework, the City Council could buy the smart soil from local suppliers with a much simpler process” – Valladolid City Staff

PPP Group	Contracts	Types of Contracts	Process form
Green corridor	Project drafting/writing	Services	Minor contract
	Works management	Services	Minor contract
	Archaeological control	Services	Minor contract
	Construction works	Works	Open procurement
Purchases Trees and smart soils		Supply	Framework agreement

Table 3.2: Types of Contracts applied in Valladolid (Source: WP2)

- Citizen participation and co-creation activities:

Key co-creation activities in this includes processes to engage stakeholders during the project and dealing with community feedbacks and issues during NBS implementation. Types of citizen engagement activities: Information stand, informative session and collect opinion on decision for some NBS design, informative letters sent to neighborhood communities, Events, meetings, e-mail feedbacks, interviews and surveys.

Implementation typology: Based on data collection and analysis, the New Cycling pathway in Valladolid Green Corridor project illustrates a State-centered implementation approach, in which the government



(City government) plays a leading and coordinating role. Key implementation decisions are decided by the city council, key NBS interventions are selected based on the city's priority goals for sustainability and planning strategy, and the selected NBS are large-scale intervention and installed mainly on public land. The civic engagement activities are mainly at the tokenistic level where information provision is taken into account more than consulting activities. However, there are a number of Co-management practices emerged that enhance effectiveness of implementation processes of Green Corridor project. Council seeks assistance from private providers through service contracts for expertise task such as design and management. Furthermore, the agreement framework and small contract oriented expand local business participation in project implementation, creating many job opportunities and economic co-benefits. Academia/NGOs and research are important advisors to government actors in terms of gathering and transferring knowledge, as well as providing preliminary guidance on the implementation process. We identified this case as one of the examples of Renaturing Urban Project implementation typology.

Key financing mechanism: is co-financing which are both public funding from regional funding (EU) combines with municipal funding budget. The ownership of the NBS built in this project belongs to the City Council.

Cost Structure: approximately 485.000 euros which includes all the costs of the project administrative, execution of works and implementation of other actions.

Stakeholders		Lesson learned
Procurement		
<p>Public procurer: <i>Challenges:</i></p> <ul style="list-style-type: none"> - Possible lack of ordinances and local regulations related to NBS - Slow periods for public tendering and processing; possible delays (as missing tender documents or amendment, processing issue) - Existing framework focus mainly cost-effective rather than innovative/ sustainable criteria. - Responsibility for maintenance, unexpected issues in NBS maintenance 	<p>Supplier: <i>Challenges:</i></p> <ul style="list-style-type: none"> - Unfamiliar with administrative public procedures - Facing risks as the administrative procedures might take long time - Facing risks due to changing political decisions <p><i>Values:</i></p> <ul style="list-style-type: none"> - Test and develop their technology/products - Enhance public branding and CSR - Financial benefits: money value contracts, potential tax 	<ul style="list-style-type: none"> - Use instruments to improve the administrative procedures is highly demanded. - Apply cost-effective vs innovative to convince the existing political system (finance). - Have clear, detailed and well-defined contracts/ agreements - Use small contracts allow procurement opportunities to be open to small enterprises and local contractors. - Apply subcontracting allows the direction of works to be developed with personnel from the City Council. - Ensure well-defined technical projects (The city does not have



<p>planning</p> <ul style="list-style-type: none"> - Limited access to funding - Values: - Delivery of a large renaturing urban project that offers multiple co-benefits. - Overcome challenges due to lacks of expertise of NBS - Enhance cost-effective. 	<p>exemption</p>	<p>problem of lacking contractors, one of the reasons is because a lot of time and costs was initially spent on project drafting, consequently, technical instructions well-defined and easy to follow by contractors)</p>
Co-creation		
<p>Public staff: <i>Challenges:</i></p> <ul style="list-style-type: none"> - Most cases are inactive one-way interactions. - Low citizen participation - Co-creation requires time and resources <p><i>Values:</i></p> <ul style="list-style-type: none"> - Enhance public understanding and social acceptance of NBS - Enhance expected social outcomes and address social issues. 	<p>Citizen: <i>Challenges:</i></p> <ul style="list-style-type: none"> - Lack of knowledge about NBS - Lack of trust in institutions - Do not feel involved with the decision of the city <p><i>Values:</i></p> <ul style="list-style-type: none"> - Citizen are key users of NBS projects. - Co-creation helps citizen to gain more knowledge, awareness and acceptance on NBS. - Allow them to feel engage, to raise their opinions and gain more trust in the city decisions 	<ul style="list-style-type: none"> - Conduct more interactive and direct form of citizen participation during design and implementation - Strategic approaches to citizen - Promote more of educational activities - Support the formation of relevant association, NGOs - Plan to work with the citizen and involve them from the beginning/early stage of the project
Execution		
<p>Municipalities and contractors: <i>Challenges:</i></p> <ul style="list-style-type: none"> - Lacks expertise to manage innovative projects - Works stopped due to Covid-19. - Difficulties finding local skilled suppliers 	<p>Politician: <i>Challenges</i></p> <ul style="list-style-type: none"> - Argument on aesthetic of plan (seasonal effect: winter) - Changing opinions (required relocate) <p>Citizen: <i>Challenges:</i></p> <ul style="list-style-type: none"> - Dissatisfaction because their 	<ul style="list-style-type: none"> - Be aware of unexpected - Take into account: Public opinion in the face of a change is usually negative, but as time passed (3 months they realize the benefits and change their mind - Know how to anticipate and due with reactions - Communicate, work, involve with



<ul style="list-style-type: none"> - Planting period affect aesthetic of NBS. - Delays due to amendment – technical modifications - Availability of personal protection systems - Problem with supply of materials (plants). 	<p>property was influenced (25 requests and complaints were sent to the City councils)</p> <ul style="list-style-type: none"> - Arguments on plant aesthetic during winter - Low awareness as vandalism, stealing and breaking installation. - Anti-social behaviors as graffiti 	<p>politicians and all stakeholders from the beginning</p> <ul style="list-style-type: none"> -
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Table 3.3: Challenges, values across stakeholder interactions and lesson learned

Type 2: Product development – Electro wetland, Smart soil and SUDs

Current situation: Valladolid is also a densely populated urban area where a large amount of water is used and discharged through the city sewer systems. Other forms of wastewater include surface water run-off from car parks that can contain pollutants (as fuel, oil, etc) also enter the sewage systems and the wastewater is mainly treated at the Municipal Treatment Plant (EDAR of Valladolid) by means of a conventional strategy.

Project description: The Electro wetland (EW) is built and implemented in the city center. Aside from large grey solution as wastewater treatment plants to treat urban wastewater, which are often located in suburban areas, EW is considered as a natural wastewater treatment system. Electro wetland can be implemented in specific area, including those within cities.

Project value: The solution is expected to contribute to wastewater treatment efficiency and generate multiple co-benefits for urban residents. The system also generates electrical energy from the organic matter degradation which is stored and later used to monitor some of the parameters contributing to heat island effect.

Project scale and key activities: Despite the demo-scale, EW installation in the city center informs the populace about urban wastewater treatment technologies which helps to raise citizen understanding and awareness. However, one key challenge to EW implementation is that EW is a highly innovative and hybrid technology which previously has only been tested at laboratory level.

NBS typology: Electro wetlands (implication for other highly innovative NBS as SUDs, smart soils).

Multiple benefits/values: Based on the developed KPIs framework (established in EKLIPSE) expected addressing challenges are Climate mitigation and adaptations; Water management; Green spaces management; Air quality; Urban regeneration; Social justice and social cohesion (Education activity that enhance green intelligence awareness); Participatory planning and Governance; Public health and well-being and Potential of economic opportunities.

In details, the electro wetland consists of a natural wastewater treatment system that, in addition, generates electrical energy from the organic matter degradation. As a wastewater treatment, the EW



participates in the abatement of most wastewater pollutants such as organic matter. Although not initially integrated in the Valladolid solution, when fulfilling legal requirements treated wastewater may be used for irrigation purposes. Also, the EW will generate electricity, contributing to saving the energy use due to improved Green Infrastructure, and the garden improves biodiversity and clean the pollutants of the air.

Initiating actors: A research and development partner (in this case is LEITAT Technology Centre) and Valladolid City Council signed a collaboration agreement to address issues related to the implementation of the Electro-wetland (EW). This agreement serves as the legal framework for the Valladolid Electro-wetland project.

Other stakeholders: Valladolid city councils, private (as suppliers of NBS related product and services: designing, writing technical document, execution), citizen.

Relationships during implementation phases:

Electro wetland is an innovative nature-based solution in which the public lacks the experience to develop a demonstration for this solution from laboratory models/technical guidance. LEITAT is a Research Centre specialized in production technologies, this is a non-profit organization who is mainly responsible for implementation of EW. However, the EW demos are implemented majorly on public land, and the choice for locations are decided by city councils with LEITAT consultation.

- Public private collaboration: work agreement

The R&D partner (LEITAT) is more likely to be the initiating actor in this case. They submitted the project proposal to the City Council, both actors worked on and signed the agreement. The R&D partner is fully responsible for EW implementation from designing, built, operating, to monitoring this intervention. When the administrative procedure with Valladolid City is completed, the R&D partner is also in charge of selecting a company for Civil work contract. The Valladolid City Council did not launch a procurement procedure for the works contract because LEITAT used direct subcontract the task and finance the costs. This NBS implementation differs from traditional public tendering mechanisms. The public actor – Valladolid City Council in this case is co-promoter of the intervention, operation and maintenance tasks are carried out jointly between the two entities through an agreement.

- Citizen participation and Co-creations activities:

While there is no direct activity of citizen participation in decision making and execution stages of EW, the demonstration was implemented in green public area which is easily accessed by resident. There is also informative poster illustrating about EW, which served for educational and raising citizen awareness for wastewater treatment technology.

Implementation typology: Based on data collection and analysis, the Electro Wetland project demonstrates a Corporate-centered implementation approach, in which New Public Management governance with Public-Private-Partnership is found. The partnership in this case is between City Council and an NBS supply (R&D partner). As EW is an innovative solution and requires technical development with expertise monitoring, key implementation decisions are made by R&D partner. The intervention is



designed and implemented by LEITAT on public sites. The civic engagement activity is also at the tokenistic level where information is provided with aiming of raising citizens' awareness of wastewater treatment technology. Monitoring, managing, and maintenance duties are shared between partners based on their work agreement. We identified this case as one of the examples of Product Development implementation typology.

Key financing mechanism: is co-financing which are both public funding from regional funding (EU) combines with municipal funding budget. The ownership of the NBS built in this project still belongs to the City Council, in the future, the city seeks to transfer ownership of this NBS to an R&D or private partner.

Cost structure: Approximately 105.000 euros for implementation of this project.

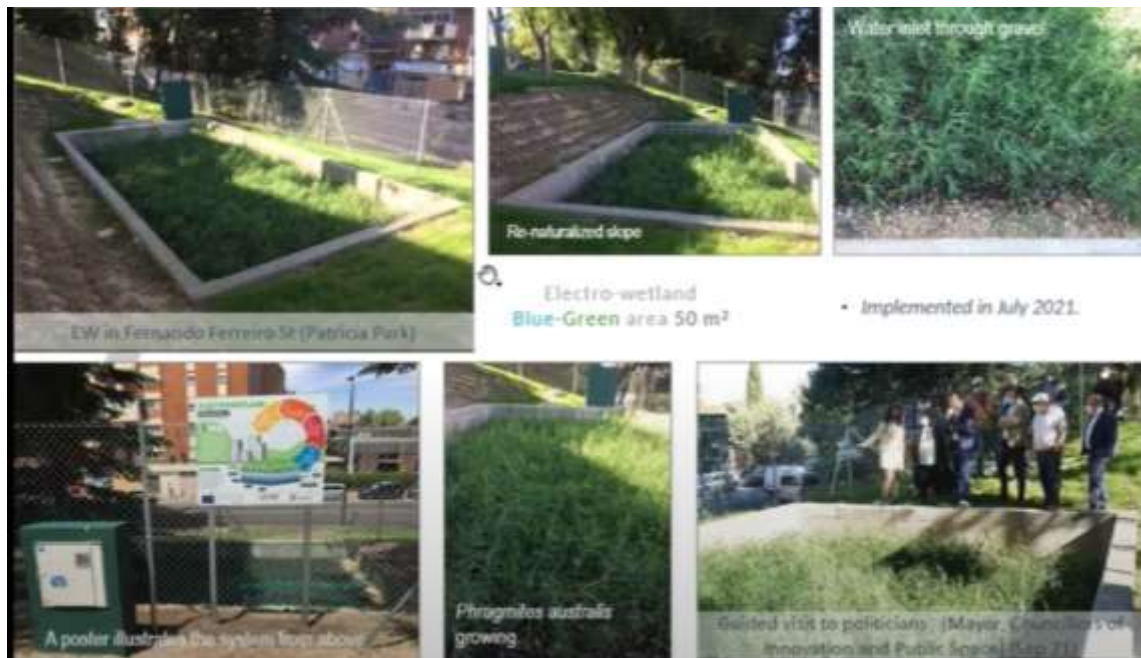


Figure 3.4: Electro-Wetland demonstration at Valladolid City

Work agreement		Lesson Learned
Research center (NGO): Challenges: Difficulty to find suitable demo site of EW due to many constraints of site Technical modifications (as the solution is still in developing phase) leading to switching site selection Slow and difficult administrative	Public Challenges: Relatively new and lack experience to NBS solutions Slow procurement procedures Difficulty to support in choosing good demo sites	It is very important to clearly defined and responsibilities of each stakeholder Good planning both before and after the execution Communication is important and stable



<p>procedure</p> <p>Available money is not enough to fund NBS installment</p> <p>Values:</p> <p>Have an opportunity to test and develop their product/technology in a bigger scale.</p> <p>Utilize public property for demos</p> <p>Demonstrated good results especially on water purifications</p> <p>Foster new applications and markets, future projects</p> <p>Agreement on maintenance for NBS.</p>	<p>Values:</p> <p>Good collaborating opportunities to learn and enhancing capacity from both side</p> <p>Good results/ expected benefits delivered</p> <p>Demos provide Co-benefits in Social justice and social cohesion (Education activity that enhance green intelligence awareness)</p>	<p>task force</p> <p>Instrument to improve administrative procedures (slow and inappropriate)</p> <p>Be aware and take into account operational and maintenance cost.</p> <p>Have in mind different scenarios and different alternatives to face risks.</p>
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Table 3.4: Challenges, values across stakeholder interactions and lesson learned

Type 3: Public and Private Collaboration - Green infrastructure in the city center

Current situation: Similar to other develop and urbanize cities, the downtown areas and some districts of Valladolid city are facing heat island effect, poor air quality and noise problems. Those issue pose impact on social and economic activity, as well as citizens' health and dramatically increases energy demand during the summer. However, the city center is characterized by low land availability with a high density of private buildings, or areas with used purposes (such as a school, church, market, hospital, parking, and so on...).

Project description: Valladolid City Councils launched a series of Green Infrastructure (GI) in their highly urbanized areas through the plan of Sub-demo B “City center – NBS to reduce heat island effect and improved air-quality”.

Project values: Different types of singular green infrastructures are installed to reduce maximum and average temperature, increase relative humidity and reduce air pollutants.

Project scale and key activities: In fact, the Sub-demo B plan includes both types of NBS implementations GI installed on both public and private properties which is at street or building-scale. However, the cases of GI implemented on public land shared similar characteristics as initiating actors, stakeholder roles, and relationships with a state-centric approach. In this section, we focus further on the cases where NBS is adopted on private property (or properties that are not entirely governed by the City councils).



NBS typology: Different types of singular green infrastructures (as vertical green interventions, horizontal green interventions, green noise barriers, ...). The case of implementing Green Facade El Corte Ingles is focused in our analysis.

Multiple benefits/values: Based on the developed KPIs framework (established in EKLIPSE) expected addressing challenges are Climate mitigation and adaptations; Green spaces management; Air quality; Urban regeneration; Participatory planning and Governance; Public health and well-being and Potential of economic opportunities.

In details, green facades can function as an acoustic solution to dampen the noise from outside and increase the sense of peace and quiet, and also can protect your walls from direct solar radiation providing thermal insulation. Buildings covered with green absorb less heat during the day and lose less heat at night helping to protect them from the frigid winter temperatures. When combined with high-quality insulation, a green facade can improve the energy efficiency and lower the heating and cooling loads. A green facade can also provide needed habitat for several urban creatures, including birds, butterflies, spiders, and other insects. They can also improve the citizen health through more direct contact with the natural world in the places we inhabit. The plants used by a green facade can improve the air quality around, because they have the ability to capture fine particulate matter released by cars, factories, and other common pollutants of urban air. Plants can even capture fine particulate matter such as metals like lead and cadmium and move them into the soil and out of the air that we breathe. Because plants cause evaporation and transpiration, they also play an important role in lowering the summer temperatures around the buildings we live in, thus, reducing the urban heat island effect.

Initiating actors: Public-private collaboration between Valladolid City Council and El Corte Ingles department stores. An agreement between the two entities was signed on May 2019, with the commitments agreed (co-responsibility).

Other stakeholders: Valladolid city councils, Private (as suppliers of NBS related product and services: designing, writing technical document, execution), citizen.

Relationships during implementation phases:

The green façade in Valladolid has been fully installed in a private building that belongs to El Corte Ingles department stores. El Corte Ingles is a private commercial building located in the center of Valladolid.

- *Public private collaboration: Work agreement*

In May 2019, the two entities signed an agreement outlining the commitments made (co-responsibility, co-financing). The construction work was divided into two sub-projects, the first for El Corte Ingles, who are in charge of the interior work and structural reinforcement of the building, El Corte Ingles co-designed, executed, and funded this task. The second sub-project, the construction of the vegetable garden, was completed through a public procurement process. The European Commission funded this portion through the URBAN GreenUP project, with Valladolid City Council contributing. Singular Green collaborated with El Corte Ingles architects on this second project. While each partner is in charge of a different part, the whole team have to coordinate consistently from beginning of design phase.



- *Public procurement:*

Type of contract: Work contract. Local authority signed work contract with a company for design and installation of the green façade through an open procurement. The El Corte Ingles signed contract with their architects.

- *Citizen participation:*

There is no direct activity of citizen participation in execution stages. However, the demonstration was implemented in a city-center building which attracted many residents and visitors. Consequently, the project is an effective marketing strategy both for the El Corte Ingles and public authority to enhance citizen accessibility and awareness for Green Infrastructure.

Implementation typology: The Green façade at El corte Ingles, based on data analysis resemble some characteristic of Collaborative Ecosystem implementation approach with Co-Governance/Collaborative governance model. In this case study, the roles and responsibilities on planning and managing NBS are shared between both private adopter (El Corte Ingles) and public actors (City Council). Specific responsibilities of each actor are defined through an agreement signed by both partners. Key implementation decisions such as the intervention and the design were selected based on consensus among stakeholders, and NBSs are installed on private property. Procurement process is applied for municipal to find NBS suppliers (NBS design and constructor), the awarded contractor is another private actor involved in this approach. In order to co-design and co-construct the Green Façade structure, a network of collaborators is established not only between key stakeholders but also between all relevant stakeholders (El Corte Ingles – the adopters, their architects, the municipality, and their contractors). We identified this case as one of the examples of Adopt a green infrastructure implementation typology.

Key financing mechanism: is co-financing which are both public funding from regional funding (EU) combines with municipal funding budget and funding also from private partner to facilitate construction work and future maintenance. The ownership of the NBS built in this project belongs private adopter.

Cost Structure: is approximately 270.000 euros for implementing this NBS demonstration.



Figure 3.5: Public-Private agreement for the Green Façade in Valladolid



Work agreement		Lesson learned
<p>Public:</p> <p><i>Challenges:</i></p> <p>Difficulty to find the buildings that are suitable to implement the green façade structure (most building is glass surface or have windows)</p> <p>Available money is not enough to fund NBS installment</p> <p><i>Values:</i></p> <p>Co-funding to support the NBS projects</p> <p>Utilize property of private partners</p> <p>Agreement on maintenance for NBS</p> <p>Good example model of Public-Private partnerships</p>	<p>Private adopter:</p> <p><i>Challenges:</i></p> <p>Relatively new to NBS solutions</p> <p>Need to re-construct inside of their property to be available to install NBS</p> <p><i>Values:</i></p> <p>Good opportunity to re-new the building look.</p> <p>Attract high traffic with tourist coming to see and take picture</p> <p>Enhancing their public branding and a good marketing strategy</p> <p>Energy saving for the building and green surrounding for customer and employee well-being</p>	<p>It is very important to clearly defined and responsibilities of each stakeholder</p> <p>Instrument to improve administrative procedures (slow and inappropriate)</p> <p>Be aware and take into account operational and maintenance cost.</p> <p>Have in mind different scenarios and different alternatives to face risks.</p>

Table 3.5: Challenges, values across stakeholder interactions and lesson learned

Type 4: Community based project – Urban Orchard Garden

Current situation: In Valladolid City, a network of urban orchards already exists in four different locations. These orchards are intended to produce organic fruits, vegetables, and flowers that are primarily cultivated and consumed by vulnerable populations (such as the unemployed, retired, disabled, and people with special needs). The Valladolid City Council is in charge of managing these public spaces, there are plots for both individual (single beneficiary) and community orchards (manage by associations or groups). The current orchards illustrated an effective community implementing approach for urban farming solutions in city context where multiple environmental and social co-benefits can be achieved. However, there are several needs to improve the current municipal orchards, support urban farming activities and strengthen the benefits generated by these urban orchards.

Project description: The Valladolid City Council launched a Sub-demo C "Urban farming" plan as part of the Urban GreenUP projects with the goal to develop already-existing community urban orchards.

Project value: A number of urban farming NBS are chosen to enhance facilities of the areas that offer opportunities for citizens to connect with nature, promote ecological and smart urban farming practices,



and enhance numerous co-benefits based on the needs that have been determined at each urban orchard.

Key activities and scale: The project launched in community gardens which is considered as community/urban scale. Under Urban GreenUp, the cities offer technical assistance and installing several green infrastructures in these orchards. Non-technical activities like public and educational activities are also carried out at this location.

NBS typology: the NBS which are selected for these areas are Urban orchards, Community composting facility, Small-scale urban livestock facility (henhouse), natural pollinator's modules, insect hotel, horticultural seedbed, and non-technical intervention as urban farming educational activities. Besides, other facilitators as irrigation system, rainwater storage, shady areas for resting and working, public bathroom are also implemented to upgrade the areas.

Multiple benefits/values: Based on the developed KPIs framework (established in EKLIPSE) expected addressing challenges are Climate mitigation and adaptations; Green spaces management; Air quality; Urban regeneration; Participatory planning and Governance; Public health and well-being and Potential of economic opportunities. In fact, the significant social and economic effects of urban orchard areas and other agricultural NBSs in cities are particularly noteworthy. It is also a model that exhibits high interactivity and connection with citizen and communities when compared to previous implementation models, especially because urban orchards in Valladolid are intended only for the unemployed or people with social needs. The associations that operate the community gardens are for example the Spanish Association Against Cancer, or the Neighborhood Association of Barrio España, one of the neighborhoods with the greatest socio-economic needs. There are significant opportunities to improve citizen physical and psychological health, generate economic outcomes through providing food and potential incomes for unemployed people. This intervention also raises awareness of environmental issues with people, as visits of scholars to the urban orchards are periodically organized.



Figure 3.6: Drop irrigation system and community composting in the municipal urban orchards of Valladolid



Initiating actors: While Municipalities (Government actors) are still leading actors who provide management set up, facilities supports and different sponsorship approaches, the key stakeholders who directly involve in cultivation activities and some NBS implementations are civil society (special groups of people) and NGO associations (Spanish Association Against Cancer, or the Neighborhood Association of Barrio España).

Other stakeholders: Valladolid city councils, Private (as suppliers of NBS related product and services), municipal technician, civil society, NGO groups, school and academia.

Relationships during implementation phases:

- Public support (technical support/sponsorships) and citizen adopter:

The municipality originally manage urban orchards in Valladolid by offering vegetable garden plots to vulnerable groups (unemployed, retired, neighbors' associations, disabled and special needs) who meet the requirements, rules of coexistence, and respect. Under Urban GreenUP, the cities offer assistance on installing drip irrigation systems and shady areas, horticultural seedbed, rainwater harvesting, community composting to support gardeners in these areas.

- For drip irrigation and individual composting, the orchard beneficiary only pays for the materials and received support from municipal technician for implementation.

- Other NBS including community composter, shady areas, public bath and rainwater are mainly implemented by City councils in the areas for public usages and educational activities.

In this case, the material, design and construction work of the community composting facilities are provided by NBS providers chosen by municipal through in-house contract or direct procurement depending on the final spent. In Valladolid front runner the purchase of the composting facilities was developed by a minor works contract of public procurement (the contract value is between 15.000 to 40.000 euros).

- Citizen Participation:

In this implementation model, where citizens are actively involved in urban farming activities, there is a high level of citizen participation. The Valladolid City Council additionally integrates a number of non-technical activities to strengthen social outcomes of their urban orchards such as annual urban orchards educative workshops for schools, or annual urban farming activities Open Day where the urban orchards is opened to all citizens to learn about how the municipal orchards work, included composting and urban farm management with chickens. Through interaction with various civil society groups, this model also promotes coexistence and multiculturalism (wide range of age and background). The Community Urban Orchards project, can be considered as a Society-Focused implementation model highlighting with citizen self-governance and empowerment approach. In this case study, municipal actors play an important role in supporting and facilitating, however, citizens are the stakeholders who directly involve in urban farming/food productions activities. Key implementation decisions such as the intervention and the design were advised and provided by government actors, the civil groups are key stakeholders in



production of their assigned gardens (within the urban orchards). This case is one of the examples of Community based project implementation typology.

Key financing mechanism is co-financing which are both public funding from regional funding (EU) combines with municipal funding budget. The ownership of the NBS built in this project still belongs to the City Council.

Cost Structure: is approximately 30.000 euros for implementing this NBS demonstration. The drop irrigation system for every urban orchard (only supply of materials) 10.000 euros + VAT per urban orchard (50 plots and 1 community orchard) and community composting facility 5.200 – 5.800 euros + VAT.

Agreement (with Gardeners)		Lesson learned
<p>Public:</p> <p><i>Challenges:</i></p> <p>Management of the orchards subcontracted to external assistance</p> <p>Cover the entire offer of orchards (a large-scale orchards with 200 plots of 50m2 each and 4 community orchards)</p> <p>Urban orchards occupy public space</p> <p><i>Values:</i></p> <p>Be able to deliver a NBS project that offers social and environmental service, especially, to vulnerable groups</p> <p>Enhance ecological awareness</p> <p>Mental health for citizens (users and visitors)</p>	<p>Gardener:</p> <p><i>Challenges:</i></p> <p>Perseverance and commitment in the use of the garden</p> <p>Small cost in tools and seeds (other input as fertilizer and water are free of charge)</p> <p><i>Values:</i></p> <p>Potential economic outcomes, with social and environmental service</p> <p>Ecological awareness</p> <p>Mental health for users and visitors</p>	<p>High occupancy of the municipal orchards offered (above 85%)</p> <p>High satisfaction of the gardeners</p> <p>Quality public service (technical advice, maintenance, infrastructure improvements)</p>
Procurement		
<p>Public:</p> <p><i>Challenges:</i></p>	<p>Suppliers:</p> <p><i>Challenges:</i></p>	<p>It is recommended to have a framework contract with approved suppliers.</p>



<p>The contract was quite simple for both supply and installation of work by minor contract.</p> <p><i>Values:</i></p> <p>Simple public minor contracts for local business</p> <p>Strengthen framework contract for approved suppliers facilitates contracting</p>	<p>(None as the tasks and material needed are simple)</p> <p><i>Values:</i></p> <p>Contracts for local business</p>	<p>The supply of public space to establish urban gardens is simple, as long as, there is free space available and there is sufficient citizen demand to use them.</p> <p>The installation that the orchards and community urban composter is simple but quite effective.</p>
Management		
<p>Public/NGO</p> <p><i>Challenges:</i></p> <p>Allocate human and financial resources (political decision)</p> <p>Outsource the external services</p> <p><i>Values:</i></p> <p>Subcontracting the external service alleviates the burden of municipal management</p>	<p>Gardener</p> <p><i>Challenges:</i></p> <p>Demonstrate high commitment to use the orchard (aware of planting, irrigation especially in the summer, requires daily attendance)</p> <p><i>Values:</i></p> <p>Free service for user (gardeners and visitors)</p>	<p>A municipal commitment is needed to offer municipal urban gardens and manage their maintenance.</p> <p>The service may have a small cost or be free to the user.</p>
Co-creation		
<p>Public staff:</p> <p><i>Challenges:</i></p> <p>Gardeners are having and raising their own definition the needs</p> <p><i>Values:</i></p> <p>Service and quality improvements specifically designed for gardeners</p> <p>The urban orchards offer access for visitors to green spaces with more interactive activities</p>	<p>Citizen:</p> <p><i>Challenges:</i></p> <p>A valid interlocutor is needed within the City Council, who attends to needs and answers.</p> <p><i>Values:</i></p> <p>The demands of the gardeners are resolved in a timely manner.</p>	<p>Meeting the needs and demands of gardeners means giving a service of the highest quality.</p> <p>Clear limits and rules of use need to be established (for example, who supplies the tools or plants)</p>



Table 3.6: Challenges, values across stakeholder interactions and lesson learned**3.2.2 Liverpool:**

The city of Liverpool has a lot of open spaces, including many beautiful parks and waterside areas built by the Victorians, but it also has a lot of abandoned buildings from the 20th century. These unfavorable environments can negatively affect people's health, well-being, security, quality of life and the city's image. There is a potential to re-naturing many of these sites by implementing different types of "nature-based solutions" to address both increasing environmental and social problems brought on by climate change. The key locations that will be transformed include those along the Baltic Corridor, within the city center's business and commercial district, and around the Jericho Lane and Otterspool neighborhoods. Trees will be planted, green walls—also referred to as vertical gardens—will be introduced, rain gardens and sustainable urban drainage systems will be established, and routes for pedestrians and cyclists entering and leaving the city will be improved. In collaboration with the Urban GreenUp project, Liverpool City Council diagnosed the city's current development and urbanization needs to select three suitable locations for multiple NBS deployments.

Sub-demo A: Baltic Corridor

Sub-demo B: Liverpool Business district development – NBS implemented in the City Center

Sub-demo C: Jericho Lane - Otterspool Corridor

Type 1: Renaturing urbanization project – Sustainable urban drainage initiative and water retention ponds along a green corridor route

There are two case studies of large-scale and integrated urban renature project which have been implementing in Liverpool which are the Baltic and Otterspool Green Corridor. The NBSs chosen for implementing are different for each site due to the various social, environmental, and urban planning issues present, but the re-naturing urban NBS groups and water interventions are key to these projects.

- The Baltic Corridor:

Current pressing urban planning challenge: The Baltic Corridor located in a southern area of Liverpool City Centre which connected with The Business Improvement District (BID demo B) through Bold Street. Following a period of inactivity brought on by the decline of seaports, this area rapidly became crowned again with emerging shops, businesses and hotels. Despite having a growing population, the area lacks both quantity and quality of green spaces because it was built on infrastructures of a former industrial zone. In addition, the city faces difficulties related to disputes between locals and business owners, poor perception, and a lack of active engagement among stakeholders toward significant development of the Baltic area with the region's relatively innovative and newly grown business culture. Finally, alongside with implementation of new walking and cycling routes, water management needs to be considered to avoid arising problems from surface water runoff and drainage systems.

Project description: A Baltic Green Corridor includes new walking and cycling routes combining with water interventions and several greening infrastructures are implemented in this area.



Project value: This Baltic green corridor will perform as a green connection between the emerging retail area on Bold Street with Wapping Dock and pass through number of distinct communities within this area. The urban drainage system alongside the green corridor contribute as a sustainable solution for water management for the area. This green connection is anticipated to integrate social areas between residences and commercial spaces, fostering interaction between locals and business owners and enhancing the Baltic region's functional flexibility.

NBS: Multiple NBSs are implemented in this project comprising 1) New pedestrian (1.25 km) and cycleway green route with shade trees, cooling tree shade and multiple green resting areas along the way; 2) Installation of singular green infrastructures including pollinator verges, pollinator walls and green screen; 3) Combination of water interventions as urban catchment forestry, SUDs raingarden, hard drainage pavements and floating gardens. Among these NBS the New green cycle line and the SUDs are the core interventions.

Multiple benefits/values: Based on the developed KPIs framework (established in EKLIPSE) expected addressing challenges are Climate mitigation and adaptations; Water management; Green spaces management; Air quality; Participatory planning and Governance; Public health and well-being and potential of economic opportunities. Especially, the new pedestrian and cycleway green route is the solution that both addresses the Baltic area's current urban planning challenge as well as pressing environmental, economic and social challenges.

Initiating actors: The Liverpool City Council is the main initiator and coordinator for the Green Corridor demonstration projects. The majority of the decisions pertaining to this NBS implementation project are made by the City Council, and these are large-scale projects with significant execution tasks addressing numerous environmental, economic, and social challenges. The majority of the implementation sites are relatively sizable zoning areas and majorly on public property; in fact, the Baltic Corridor is implemented in areas surrounding the city center with more land availability. The City Council's development and urban planning priorities, which emphasize supporting a livable environment for local residents and sustainable development to support the economic activities of local businesses, are also considered key criteria in the selection of the NBS.

Other stakeholders: relevant departments within Liverpool City Councils participate in support and approvals; Water organizations such as the Canal and River Trust own the dock waters, so the project needs to sign a legal agreement and pay a license fee; Other non-governmental stakeholders involved as NBS suppliers include private consultants to assist in the preparation of design specifications and on-site delivery, the Canal and River Trust design saltwater island and participate in the procurement process, and private construction companies to provide works. Academia partners such as undergraduate and postgraduate students or citizen who carried out several research studies and science investigations relevant to the projects. Finally, local civic and community groups are involved such as the neighborhood community and councilors, who are also end users of the NBSs.

Project scale and key activities: This is a large-scale project carried out at the urban level that requires multiple construction activities on relatively large areas in the Baltic Triangle, Liverpool City. Key



activities of the project are (1) implementation of pedestrian and cycle green routes with shade trees, cooling trees, and green resting areas along the way; (2) installation of several singular green infrastructures; and (3) installation of several water interventions as urban catchment forestry, rain gardens in the corridor linking between Tradewind and Madison Squares, and hard drainage pavement to form a drainage system for the area. Multiple co-creations, citizen participation activities, and non-technical activities are also carried out during different stages of implementation projects.

- The Otterspool/Jericho Corridor:

Current pressing urban planning challenge: The Otterspool is a suburban site is already regarded as a green space with a rich biodiversity, but it has drainage and connectivity problems, as well as some concerns about the local air quality. The three main parks in the city, Princes Park, Sefton Park, and Otterspool Promenade, are all close by. However, Otterspool's drainage system was regarded as being quite old at the time of diagnosis assessments. Princes Park is also dealing with neighborhood drainage issues while Sefton Park has overflow issues. In addition, these spaces were unconnected which limit citizen access to open green-blue sites.

Project description: A Jericho Lane – Otterspool green corridor with cycling pedestrian pathway and a blue corridor with a sustainable urban drainage system (SUD) were proposed at Otterspool. Apart from previous solutions, the project focused on designing and testing a natural drainage system with “open waters”.

Project value: This Otterspool/Jericho lane will perform as a Sustainable Urban Drainage system that simultaneously address water quality and water drainage issues from Princes Park through Sefton Park to Otterspool Promenade. This SUD system is constructed as a blue corridor within a green connection between three sites. This blue-green corridor connection provide a distinct approach to urban water management and is expected to provide public access to the open water site and enhance biodiversity and connectivity of these green areas.

NBS: Multiple NBSs are implemented in this project comprising 1) New pedestrian (1.25 km) and cycleway green route with urban carbon sink; 2) Installation of singular green infrastructures including pollinator verges, pollinator walls and vertical GIs; 3) Installation of water interventions as underground sustainable urban drainages (SUDs). Among these NBS the Sustainable Urban Drainage is the core intervention.

Multiple benefits/values: Based on the developed KPIs framework (established in EKLIPSE) expected addressing challenges are Water management; Green spaces management; Climate mitigation and adaptations; Air quality; Participatory planning and Governance; Public health and well-being and potential of economic opportunities. In particular, the core solution of this project, sustainable urban drainage system (SUD), is proposed to solve current water management issues of Jericho/Otterspool area's as well as to contribute to other pressing environmental, economic and social challenges.

Initiating actors: The Liverpool City Council is the initiator and the Council project officers are main facilitators of all the works for Jericho/Otterspool demonstrations. The majority of the decisions pertaining to this NBS implementation project are made by the City Council, and these are large-scale



projects with significant execution tasks addressing urban planning issues as well as numerous environmental, economic, and social challenges. The implementation sites are relatively large zoning areas and land ownership is all public realm. In addition, as major construction work is underway at three parks in the city, Princes Park, Sefton Park and Otterspool Promenade, agreements have been signed between the city council and the parks. about the project. The project team is also in charge of communication with the community and local groups/residents. Finally, ecological surveys and drainage information, as well as obtaining approval from the water supply organization and for reservoir engineer, are required to be collected by project staff prior to work. The City Council's development and urban planning priorities, which emphasize on building a Sustainable Drainage system for this area are also considered as key criteria for selection of the NBS.

Other stakeholders: relevant departments within Liverpool City Councils participate in support and approvals; the city council owns the freshwater park lake (part of the SUD) and requires approval from an authorized local government; other non-governmental stakeholders involved as NBS suppliers include private consultants to assist in the preparation of design specifications and on-site delivery, and private construction companies who participate in the procurement process and provide works. Finally, local civic and community groups are involved such as the Friends of the Park Group, the Park cafe operator, the Park user/visitor groups, the neighborhood community and councilors, who are also end users of the park.

Project scale and key activities: The project is carried out at a large-urban scale with relatively large construction sites across three key green areas in Jericho/Otterspool in Liverpool City. Key activities of the project are (1) implementation of pedestrian and cycle green routes, and road junction improvements that link the three parks together, (2) installation of green infrastructures such as pollinator verges and spaces, pollinators walls, green screens, and utilization smart soils (mainly biochar) to manage soil nutrient and carbon sequestration, (3) creation of urban carbon sink through planting a tree and aquatic vegetation, (4) implement two SUDs for the area, the first one is an open water area linked with a waterway at the northern entrance to Otterspool Park to increase water storage capacity, and the second SUD is installed at a location to south of railway where there are usually flooding issues. Multiple co-creations, citizen participation activities, and non-technical activities are also carried out during different stages of implementation projects.

Relationships during implementation phases of both projects:

- Public procurement and Tendering process:

The public procurement and tender of NBS in Liverpool City are divided into multiple approach. Local authority through business-as-usual activity (in-house procurement through local authority services, providers, contractors, and agreements for low-value works), the use of in-house service can maximize the economies and ensure works delivered comply with relevant regulations. The second strategy involves local authorities making purchases through open procurement procedures without input from external landowners. NBS are novel interventions, some of which need to be designed and tailored to fit specific sites. For the implementation projects, the open tender mechanism to find "design and build"



providers is essential. Liverpool City Council groups procurement items by themes to increase economies of scale.

Inhouse provider	Works to be procured
Liverpool Streetscene Services Limited (LSSL)	<ul style="list-style-type: none"> - Tree planting into soft ground within the land ownership of registered housing providers. - Hydro-seeding (pollinator planting) the slipway to Wapping Dock in conjunction with the Canal and Rivers Trust. - Pollinator planting on verges.
Highways/Liverpool Streetscene Service Limited (LSSL)	<ul style="list-style-type: none"> - Installation of dropped kerbs, route way resurfacing and repair and associated accessibility or highway crossing works. - Planting of shade/cooling/urban catchment trees into soft ground in parks/open spaces or highways pavements and hard landscapes.

Table 3.7: Example of In-house providers in Liverpool City

Procurement theme	Works to be procured
Water	-Raingarden with semi permeable pavement
Trees	-Trees in containers
Green infrastructures	-Green screens
Combine package	-Way marking, art (engaging community), and bio app

Table 3.8: Example of procurement themes provider in Liverpool City

Type of contracts: Work contracts; Supply contracts and Service contracts through Open procedure, restricted and direct procurement.

The in-house procurement approach was first considered for NBS and NBS components that can be supplied using available in-house services of the City Council for example tree planting and street construction. This approach brought both administrative and economic efficiency as there are existing framework, low contract value and the contractors had experience with the Council projects. However, the works progress might take longer time than expected as they might have other prioritizes request from the City Council. Competitive open bidding is implemented for some particular NBS innovations such as Sustainable Urban Drainage System (SUD). As these are relatively innovative interventions and high-value contracts, Liverpool Municipal staff have decided to follow Council's procurement procedures. This process allows consultants to be appointed to provide support with defining



specifications and technical information and preparing tender documents requiring expertise as assessments on risks and safety issues at the construction site. The competitive tender is open for any contracts to apply. Initially, applications are assessed mainly based on finance and risk criteria to choose suitable contractors, in the second stage, the potential applicants are evaluated based on cost and quality weighting (30% for cost and 70% for quality). Due to the fact that NBSs are all relatively novel and complex, the quality criteria are emphasized more through 3-5 questions following the evaluation to reduce risks of failure. Applicants are assessed by panel members who make their judgments using moderated scores. Finally, the JCT minor contracts documents are used to appoint successful contractors. However, NBS is not a pre-fixed intervention in which special components or materials are demanded, the project team also utilizes the direct exemption approach. For instance, the design of trees in containers includes technical requirements such as anti-graffiti and scratch resistance, self-irrigation, making use of recycled material, and complying with highways road safety or the rain garden which is very difficult to call and assess qualified contract. The project team, therefore, needs to take the direct exemptions procurement approach, where the project team directly approach companies and supplier to follow their order. In fact, the team launched open procurement for these contracts twice but they did not succeed and decided to build a consortium of companies to solve the problem. Nevertheless, there are multiple risks that might arise in the second approach especially limited legal, procurement, and financial support because it goes against the City procurement regulations.

In addition, project officers will also need to contact utility companies for records, adjacent land owners for access to support the project.

- Citizen participation and Co-creation activities:

The municipal team investigates all possibilities for co-creation and civic engagement. Numerous interactive sessions with a variety of stakeholders are held prior to implementation, including visits to universities, churches, and faith centers, organizations and landowners, registered suppliers, interested parties in local area; open consultation days for forest activities; as well as talks and seminars with NGO and community groups (friends of groups for parks, neighbors, university groups etc.). In fact, the on-site delay caused by Covid during execution gives more time for co-creation activities. The landscape architect actively solicited input from communities and local organizations regarding their preferences for plant and flower species as well as color schemes. In order to determine the route and desired lines, she also observed walking patterns and communicated with the neighborhood. Additionally, there are on-sites activities like free seed and plant giveaways, opportunities for planting bulbs, public tours of construction sites, signs about the progress of the work being done on the sites, and Twitter posting.

In order to increase the effect of raising awareness, Liverpool municipal staff also launched a number of events and promotions, including Pop up Forest, Clean Air Day, and Year of the Environment. Additionally, there are competitions, Bio-app activities, competitions and consultation sessions with nearby universities. Collaborations are formed with the involvement of various stakeholders such as Council staff, ward members and local politicians, religious groups, and academia. However, during the Covid epidemic, there were fewer interactive activities. The project also involves academic partners such



as undergraduate and graduate students or citizens who have carried out a number of related scientific research and investigations.

Implementation models: Based on data collection and analysis, both of the Green Corridors in Liverpool, highlight with the building of new walking and cycling routes and Sustainable Urban Drainage projects illustrates the State-centered implementation approach, in which the government (City Council and Municipal staff) plays a leading and coordinating role. Key implementation decisions and key implementation activities are made by the municipal project teams and City Council. The NBS interventions are selected based on the city's priority objectives on sustainability and planning strategy. In this approach, NBSs are large-scale interventions and are installed mainly on large areas of public land. However, there are a number of Co-management practices which has been applied in this implementation plan to enhance project performance. For instance, the municipalities seek external stakeholders (NGOs, private) to consult on the design, technical, and management parts of the projects, and a flexible procurement approach was adopted to overcome the challenge of finding suppliers for highly innovative components of the interventions. In fact, the project demonstrates a wide range of citizen engagement and co-creation efforts at many different levels instead of just at the tokenistic level, in which activities at the level of consultation, cooperation and co-deciding are experienced especially with local residents. Academia/NGOs and research are important advisors to government agencies in terms of knowledge acquisition and transfer, as well as providing preliminary guidance on the implementation process. We identified this case as the examples of Renaturing Urban Projects implementation typology.

Key financing mechanism: is co-financing which are both public funding from regional funding (EU) combines with municipal funding budget. The ownership of the NBS built in this project belongs to the City Council.

Stakeholders		Lesson learned
Procurement		
<p>Public procurer:</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • Deliver within budget • NBS was not a priority (especially during Covid there were delays) • Staff reluctant to engage in NBS projects as it meant more work and unfamiliar area • Addressing enquiries around ongoing maintenance 	<p>Supplier:</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • Unfamiliar with administrative public procedures • Facing risks as the administrative procedures might take long time • Facing risks due to changing political decisions • Lacks eligible requirements and abilities to apply and 	<ul style="list-style-type: none"> - Conduct soft marketing testing to gauge the level of expertise and interest from contractors. - Expert support on technical issues and procurement was helpful to articulate requirements and be an informed client - Ensure effective communication (Procurement questions and requirements)



<ul style="list-style-type: none"> • Addressing inquiries about why some parts of the city were not benefiting • No general fund for daily tasks and quick purchases/services • Political changes and differences of opinions • Lacks experience and knowledge for assessments (to consider potential risks and critical considerations) • Delays due to multiple issues • Not enough capacity to support (existing legal, procurement support) • Limit funding available <p><i>Values:</i></p> <ul style="list-style-type: none"> • Obtain best competitive quote • Overcome challenges due to lacks of expertise of NBS • Enhance cost-effective. 	<p>compete for tendering contracts.</p> <p><i>Values:</i></p> <ul style="list-style-type: none"> • Test and develop their technology/products; gain more experience on relevant fields • Enhance public branding and corporate social response (CSR), building their business profile • Financial benefits: money value contracts, potential tax exemption • Deliver a good job within budget 	<p>need to be clear, ask contractors for clarification on information provided</p> <ul style="list-style-type: none"> - Plan well, allow more time for the unexpected (changing in relate regulations) - Be aware that most company do not have both design and deliver skills - Be aware of problem might arising from partners /contractors - Establish clear budget and ask finance team support on monitoring spending - Be flexible and seeking different ways to get the final results - Accept and allow that there will be unexpected issues
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Co-creation

<p>Public staff:</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • NBS is novel and complicate which is difficult for enhance participation • The Covid pandemic limits interactive forms of citizen participation <p><i>Values:</i></p> <ul style="list-style-type: none"> • Enhance public understanding and social acceptance of NBS • Enhance citizen perception and awareness toward 	<p>Citizen:</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • Lack of understanding about NBS to believe in NBS longer term impacts for the society • Not willing to participate in co-creation activity or to engage in NBS projects. <p><i>Values:</i></p> <ul style="list-style-type: none"> • Citizen are usually main user and key beneficiaries of NBS projects, who are benefited from environment, social and 	<ul style="list-style-type: none"> - More interactive and direct form of citizen participation should be conduct during design and implementation - Strategic approaches to citizen - Seeking more consultation and involvement with the community can create opportunities to find addition funding available and engage new partners - Ensuring information is shared as works develop
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<p>environmental and social issues</p> <ul style="list-style-type: none"> • Provide opportunities to connect different stakeholder groups • Enhance expected social outcomes and address social issues. 	<p>economic outcomes of NBS.</p>	
During on-site execution		
<p>Municipalities and contractors:</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • Keep updating/ensure sufficient communication to all interested parties • Being flexible to accommodate unknown issues on site • Delays due to lockdown periods, approvals • Staff turnover and raising costs issues as the project can take up to more than a year (staff sickness, even loss of good contractors due to Covid) • Unavailability of contractors due to demand • Problem with supply of materials (plants) • Problem with unexpected on-site technical issues (Ex: Keeping the site fenced off and safe, dealing with old tip areas and unmapped waterways) • Lacks expertise to manage innovative projects <p><i>Values:</i></p> <ul style="list-style-type: none"> • Deliver the project and install NBSs which is expected to 	<p>Politician:</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • Changing opinions • Convince them of the value of the disruption as a long-term benefit to the sites - Values: • Expected outcomes and impacts deliver by the project • Positive project's outcomes, especially environmental improvements are well received by local voters <p>Citizen:</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • Dissatisfaction and complaints (for floating island and pollinator site which loss open spaces for dogs) • Limited access to public spaces during execution (for example: part of the parks was fenced off from access for several months during works) • Protection action (as fencing) kept the site safe to the public <p><i>Values:</i></p>	<ul style="list-style-type: none"> - Agree a timetable of works on site with key milestones delivery dates (an indicative timescales for works on signs can be helpful) - Weather may dictate the speed or order for delivery of some works - Agree qualification/experience of staff on site - A short disruption led to many on-site improvements - Have regular meetings, minute them and share actions with dates - Regular updates and communications to all parties, when people are informed there are usually less complaints - Regular visits and take photos - Check for correct planting, preparations or substitutions with dates - Check that contractor has ordered specialist materials, has necessary approvals and permissions - Agree payment installments post delivery - Seeking consultant help on management (especially where



<p>address multiple environmental, economic and social issues</p> <ul style="list-style-type: none"> • Building up the knowledge and experience with innovative and sustainable projects 	<ul style="list-style-type: none"> • Expected environmental, social and economic impacts of NBS • Rediscover and access to greener areas in the cities (as parks, heritage sites, ...) 	<p>there is dispute)</p> <ul style="list-style-type: none"> - Different communities have different opinions and needs
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Table 3.9: Challenges, values across stakeholder interactions and lesson learned

Type 2: Product development – Wapping Dock Floating Island (Saltwater)

Current pressing urban planning challenge: The Baltic Corridor is located in the Southern part of Liverpool City, as previously mentioned, where several recently constructed shopping streets have low greening coverage. At one end of this corridor is Wapping Dock, a dock on the River Mersey and a part of the Port of Liverpool. This is a densely urban area that is dominated by blue spaces and the saltwater port, which interferes with the creation of normal green environments such as growing urban forestry or green areas. However, from another perspective, this area has a lot of traffic and a large-open seaport space, which offers spaces and opportunities to install NBS and ensures easy access for residents.

Project description: The floating island garden is designed and installed in a corner of the Wapping Dock as a part marked one end of the Baltic Corridor. The floating island's proximity to the slipway makes it easier to monitor biodiversity and conduct maintenance and irrigation tasks without interfering with waterway traffic or encroaching on the open area of the water body.

Project value: The floating island is considered a highly innovative solution and particularly appropriate compared to other greenspace solutions as it is able to introduce a greenspace on the blue space (especially on saltwater). This initiative not only adds more green space to the dock area, but it also encourages biodiversity by allowing pollinating plants to grow incorporating with pollinator planting on the dock slipway. In addition, the floating island has social effects of drawing attention to and increasing understanding of the Baltic Green Corridor and Nature-Based Solutions. There are opportunities for ancillary vegetation to act as a food source for aquatic and avian species as well as a filter for pollutants and habitats for water-based biodiversity. As the island are situated in the location with high foot traffic and an attractive amenity offer, it is expected to have economic advantages such as boosting property values, promoting tourism, and increasing spending.

NBS typology: Floating islands (implication for other highly innovative NBS as SUDs, electro wetland, smart soils).

Multiple benefits/values: Based on the developed KPIs framework (established in EKLIPSE) the floating island expected to deliver environmental benefits as climate mitigation and adaptation (carbon saving by stored in vegetation, reduce heatwave risk), Water management (pollutant filter and monitor run-off coefficient in relation to precipitation quantities); social benefits as green spaces management and urban regeneration (connectivity to existing GI, diversity of NBS, land use and functionality);



participatory planning and governance (citizen perceptions, awareness, engagement); public health and well-being and potential of economic opportunities.



Figure 3.7: The saltwater floating island in Liverpool

Project scale and key activities: While the total surface area of the floating island is around 63m² the solution is designated to be implemented in a relatively large blue area (as rivers, lakes) which is classified at urban or city level. The floating island is made from recyclable/non-toxic materials, the bottom is a coral structure, and the top is covered in a variety of salt-tolerant plants. Different parts of the floating island are prepared before being assembled in docks and towed to the determined location. Thereafter, monitoring, irrigation and maintenance activities are required to ensure the condition and operation of this NBS. The installation of floating islands in a high-traffic area of the city helps to inform and draw the attention of residents and tourists to the Baltic Corridor and NBS projects.

Project key outcomes/benefits: Improved interaction between people with nature, enhance environment quality, enhance green spaces in the dock area, new habitat provision, attract wildlife, increase biodiversity, strengthen fish stocks, encourage investment, act as route marker, promote climate change work in city.

Initiating actors: The Liverpool City Council is the initiative actor in this project. However, the Canal and River Trust owned the dock waters, and the city signed a legal agreement and a license fee was paid to implement the island on dock waters. Most of the key decisions are made in consultation with both parties and the technical consultant group, but the municipal project officers played key roles in engaging stakeholders, liaising with community groups and water users, oversee procurement, delivery, and payment of works.

Other stakeholders: Departments of Liverpool City Council cooperate with project staffs and provide needed approvals, Canal and River Trust as a non-government entity who owned the dock water, local



technical college as academic consultant for development of the solution design, construction companies as NBS suppliers and deliver the works on site, community and citizen groups who were engaged in the project activities and also target user/final beneficiary of the floating island.

Relationships during implementation phases:

The idea of a floating island is innovative, and it calls for participation from technical entities (like academic institutions or research centers) in order to conduct research and develop the island's design. The project received support in designing a floating island from students at a local technical college and their ideas helped to inform the final design for tender. The Liverpool Life Sciences College is keen to use this real-life opportunity to challenge the students to design an island concept that meets the needs of the project. The group with success project idea is appointed for consultation roles for the project, they assisted in the design specification for tender, participated in the assessment of the procurement process, and supported on-site delivery. The floating islands are intended to be installed in the water/blue area such as river, lake, docks area and in urban context, the major of water area is owned by public or nonprofit organizations. In this case of Liverpool Council City, there are two demos of floating ecosystems: Saltwater floating ecosystem in the city docks and freshwater floating ecosystem in a park lake. In the first case, the city council need to sign a works agreement and paid a license with Canal and River Trust in order to host the saltwater island on the dock water. In the second instance, the floating island is created for a freshwater lake in a city-run park on public property, in which an approval from local authority is required. These collaborations are analyzed further in the following section.

- Public private collaboration: work agreement with external

The Liverpool City Council and municipal project staffs are the initiating actor and the central coordinator of the project. While the municipal staff had primary responsibility for island implementation, their stakes emphasize coordinating or co-governing roles. In order to facilitate the NBS to be installed, there are different types of relationships that were formed with other stakeholders. As mentioned, a work agreement was signed between the City Council and the Canal and River Trust, a non-governmental organization that is responsible for a large area of canals, rivers, docks, and reservoirs in England. Under the agreement, the city had to pay the organization a license fee was paid to host dock waters. In addition, the city's project officers seek the waters owner's consent on the saltwater island design, and they also participate in the procurement process as members of the review panel.

- Competitive tender:

In conjunction with the Canal and River Trust, the municipal project team launched a competitive procurement process to select an external company for these work contracts. Technical proficiency and experience are essential criteria for tender selection, with evaluation weighting set at 70% for quality and 30% for cost due to the innovative nature of this type of NBS and the opportunity to develop such a solution. The project team worked with the Canal and River Trust and the consultant groups to develop design specifications, as well as prepare a value guide for the works to ensure that submitted proposal are appropriate and affordable. While many companies were interested, only one submission from an experienced company that addressed the requirements with a slightly higher value was accepted and



appointed for the project. This NBS implementation is different from traditional public tender mechanisms as providing a floating garden on the dock area (third party waters) is seen as a new challenge for the city, therefore the public actor – Liverpool City Council, in this case, is the co-governor actor. In fact, on-site deliveries are overseen by an externally appointed contractor, who is also involved in assisting with the design and technical preparation from the outset of the project. The city intends to seek cooperative support for the maintenance of the floating island for 2-years from the Canal and River Trust or funding from local businesses.

- Citizen participation and Co-creations activities:

In terms of co-creation, the City Council held a community consultation meeting where a resident did not support the project proposal. Other community initiatives to increase citizen involvement in planting and launching were purposefully planned but unable to proceed due to the pandemic. While there were not any significant citizen activities execution stages of the floating island, the demonstration was located in a high foot traffic area that is easily accessed by residents and tourists.

Implementation typology: Based on data collection and analysis, the floating island project demonstrates a Corporate-centered implementation approach, in which New Public Management governance with Public-Private-Partnership is found. The partnership in this case is between government (City Council), an external property owner (docks water owner), technical consultants and NBS supply (R&D partner). As floating islands are considered a relatively innovative solution and are still in the product development stage, the city government, NGOs (property owners) and technical advisory groups work together to participate in key implementation decisions. During implementation, responsibilities are also more clearly distributed as the city's project team acts as a coordinator between the parties while the construction supervision role is assigned to a technical partner. The civic engagement activity is also at the tokenistic level but to a high degree where citizen consultations are collected. In addition, the location of the docks is decided with the aim of raising citizens' awareness of the NBS solution. We identified this case as one of the examples of Product Development implementation typology.

Key financing mechanism is co-financing which are both public funding from regional funding (EU) combines with municipal funding budget. The ownership of the NBS built in this project still belongs to the City Council, in the future, the City Council expects to transfer the floating island to the Canal and River Trust and seek funding from local businesses to share duties on maintenance.

Procurement/Work agreement		Lesson Learned
<p>Public procurer:</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • Difficulty to find suitably qualified contractors • Slow and difficult 	<p>NBS Suppliers:</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • Relatively new and lack experience to NBS solutions (to be deliver the first-pioneering 	<ul style="list-style-type: none"> - Clear specification and consultant support were required to ensure the project was successful - together with an element of trust - For Procurer: Specifying the



<p>administrative procedure to work with</p> <ul style="list-style-type: none"> • Staff changes at partnering organization (at local college and Canal and River Trust) • Extra costs on license and due to Covid-19 delay • Exit strategy and funding for maintenance <p><i>Values:</i></p> <ul style="list-style-type: none"> • Good collaborating opportunities to learn and enhancing capacity from both side 	<p>prototype saltwater island)</p> <p><i>Values:</i></p> <ul style="list-style-type: none"> • Have an opportunity to trial a new innovative approach, to design and develop their product. • Utilize public property for demos • Demonstrated good results especially gaining attraction on demos • Contract agreement on maintenance service for NBS • Foster new applications and markets, future projects 	<p>criteria carefully with consultant’s support to ensure you get a robust and environmentally friendly build</p> <ul style="list-style-type: none"> - For Supplier: Allow access to a small contingency fund to accommodate unknown costs in pioneering works. Anchorage points could have been reduced, but were initially over engineered for safety - It is very important to clearly defined and responsibilities of each stakeholder - Good planning both before and after the execution - Communication is important and stable task force - Instrument to improve administrative procedures (slow and inappropriate) - Be aware and take into account operational and maintenance cost - Have in mind different scenarios and different alternatives to face risks
<p>Co-creation/Citizen engagement activities</p>		
<p>Public staff:</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • Deliver an unknown and risky project without prior experience (especially on co-creation) • Lockdown problems resulting in failure to carry out community engagement activities <p><i>Values:</i></p>	<p>Citizen:</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • One resident was opposed to the island in the docks <p><i>Values:</i></p> <ul style="list-style-type: none"> • Many dock water users embraced the added value, benefits and interest of the 	<ul style="list-style-type: none"> - Not everyone will always support a project. We discussed the plans with the resident opposing the works and agreed an initial 2 years trial and kept them informed throughout - For Public Staff: Good communication between all partners and stakeholders is essential on ‘new’ projects like



<ul style="list-style-type: none"> • Learning and experience and delivery of something exciting and innovative that results in climate change discussions • Having a good chance to discuss and consult with the residents • The project is more well received to citizen 	<p>saltwater island</p>	<p>this</p> <ul style="list-style-type: none"> - For Citizen: Allow a 2 yeas initial period for the island in the docks to see if any predicted problems materialized
<p>During on-site execution</p>		
<p>Municipalities/Project officers:</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • Technical issues, for example, to ensure that the island did not attract nuisance birds or people wanting to swim out to it <p>NBS suppliers:</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • Technical modification to ensure function of the NBS such as to find plants tolerant of very high salinity and design ways that the island could store rainwater to irrigate some species <p>Politician:</p> <p><i>Challenges:</i></p> <p>To get acceptance of a new installation in a historic area</p> <p><i>Values:</i></p> <ul style="list-style-type: none"> • The project was well received, with some good results/ expected benefits delivered • Good external media promotion and subsequent enquiries (from Seattle, Romania, Australia) • Demos provide Co-benefits in raising attraction and awareness • Building experience and capacity working on such an innovative project • Positive support from an environment project that is well-received by citizens, attracted to tourists and having impact as increased animation in a quiet part of the city <p>Citizen:</p>		<ul style="list-style-type: none"> - For municipalities: The choice of experienced contractors is important, especially, for new projects to minimize risk - For contractors: Good specification is essential as is the need for flexibility to adapt designs and plans to local environments - For politician: Diversity choice of NBS can be helpful, not all environmental improvements take place on land. These can help to improve water quality and provide habitat - For Citizen: It is important to keep citizen informed and note that the island growth will be slow to start and that in winter months many species may die back



<p><i>Challenges:</i></p> <ul style="list-style-type: none"> • Disruption on site but this was minimized to half a day as the saltwater and freshwater islands were assembled quickly and floated into place <p><i>Values:</i></p> <ul style="list-style-type: none"> • The islands increased biodiversity and interest in the areas (attracted birds and wildlife which can be observed from the water's edge) 	
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Table 3.10: Challenges, values across stakeholder interactions and lesson learned

Type 3: Public and Private Collaboration – Green Wall in Parr Street

Current pressing urban planning challenge: Located in the Liverpool city center area is the business communities or Business Improvement Districts (BID). In this city, there are currently three BIDs include (1) Retail & Leisure BID (formerly City Central BID) representing over 670 businesses across the retail and leisure heart of Liverpool city center attracting the footfall of over 60 million people a year, (2) Culture & Commerce BID (formerly Commercial District BID) representing more than 450 businesses across the Commercial District, Waterfront and St George's Quarter and (3) Accommodation BID representing 88 of Liverpool's hotels and serviced apartments. The city center, on the other hand, is one of the parts of the city with the least access to green space and with the least room for green development because of the high building density. Both public entities and the BID's local private business recognize the need for green development in the city center to lessen the effects of climate change impacts as flood risk, improve air quality, enhance biodiversity, enhance resident well-being and visitor experience, and finally guarantee sustainable economic growth for the region.

Project description: Liverpool City Councils launched a series of Green Infrastructure (GI) in the BIDs demo areas in the city center through the plan of "Sub-demo B: Liverpool Business district development – NBS implemented in the City Center" and some Green Infrastructure is also implemented in "Sub-demo A: Baltic Corridor".

Project values: In order to increase green coverage in high foot-traffic areas, different types of singular green infrastructures (GI- NBS) are installed mainly on different types of infrastructures in the city center where the land for green spaces is limited. This will address climate change issues and improve the social and economic development of the area.

Project scale and key activities: The larger Sub-demo plan for BID areas of the City of Liverpool is also an urban-scale project. However, in this case, we focused on the implementation model for Green Infrastructure (GI), which is primarily installed for unit of property scale (as buildings, houses). Key solutions implemented are (1) Green wall on the Parr Street Car Park, (2) Suspended green wall on St John's Center building, (3) Pollinator roofs at the Royal Court Theatre, (4) mobile garden at Royal Court. These are cases where NBS is adopted on external non-government property input.



NBS typology: Different types of singular green infrastructures (as pollinator green wall, pollinator green roof and mobile garden). The analysis will focus on the case of Green Wall on Parr Street Car Park and Green Wall on St John's Center building.

Multiple benefits/values: Based on the developed KPIs framework (established in EKLIPSE) expected addressing challenges are Climate mitigation and adaptations; Green spaces management; Air quality; Urban regeneration; Participatory planning and Governance; Public health and well-being and Potential of economic opportunities.

Initiating actors: Green infrastructure is developed specifically for private buildings and properties but ultimately it benefits the public. The deployment model for this type of NBS is typically characterized by Public and Private Collaboration settings. The Green Wall (Sub-demo A) was led by the Liverpool City Council in an agreement with the Car Park owner, while the Suspended Green Wall (Sub-demo B) was led by Community Forest Trust in an agreement with St John's Center.

Other stakeholders: Departments of the Liverpool City Council for approval, other private companies participated in procurement and become suppliers of NBS (designing, writing technical document, construction), citizen and tourist as end-users.

Relationships during implementation phases:

- *Public private collaboration: Landowner/Developer agreement*

In this type of partnership, initially, an agreement is required between Liverpool City Council and the owner of the property (land or building) to define the responsibilities of each party. Although the public actor is often the initiator, private buildings or land owners need to be involved in the design, construction, installation, and setup phases of these NBSs. Ultimately, these actors are the owners responsible for the long-term maintenance of the NBS. On the Urban GreenUp project, the Liverpool project team worked with a variety of land owners from large businesses such as St Johns Shopping Centre, Registered Housing Providers to other types of owners like universities, churches, and some smaller businesses. Successful landowner acquisition cases are also NBS's example for other businesses in the city. Key factors to be considered when working on an agreement with a landowner are a shared vision of meeting the project requirements and pleasing the landowner, and the design and modification of the NBS to suit the site, site plans and construction information are well prepared, availability of land owners or their employees to make decisions, business changes on issues such as land ownership, impact on NBS planning site.

- *Open Competitive Procurement:*

Type of procurement: The green walls in both demos were procured from open competitive processes with a number of submissions. The procurement for the green wall in Parr Street Car Park was led by the City Council officers and the procurement for the green wall in St John's Center building was led by the Community Forest Trust officers, however, decisions are jointly made with the land owners, especially, on the final design and appointed contractors. In both cases, the legal contracts to clarify future responsibilities and risks were required. The evaluation weighting for the green wall is also set at



70% for quality and 30% for cost, which is available in the advertisement for the tender call with a guideline cost value to ensure affordable proposals.

- For the green wall in Parr Street Car Park, an open-day site visit was initially held for interested contractors, after which several approaches were outlined by contractors. However, many contractors failed to meet the Local Government procurement process which was complicated and unfamiliar to them. Therefore, the checklist of questions for contractors and the process itself were made simpler. The main difficulty in the tender process is that most submitted prices are higher than the budget, and even the preferred bidder's cost is also very close to the maximum range, leaving very little funding for any additional Green Infrastructures (GIs). After the contractor was appointed, another issue arose when an unsatisfied contractor claimed that the chosen proposal did not adhere to current fire regulations. To address this problem, project officers had to work with an independent and experienced third party to carry out specialized fire calculations for the green wall system. Additionally, a Liverpool City Council Building control approval was sought to guarantee that the intended wall complied with recently developed best practices. In accordance with city council procurement policies, unsuccessful contractors were informed with given feedback and scoring on their submissions.

- The Green Wall at St John's Center was tendered and awarded by Cheshire West & Chester Council. The selected bidder also went through a procurement process similar to the previous case, and was evaluated by three independent assessors, with the consent of the mall owner.

The city has signed legal contracts and agreements to ensure maintenance responsibilities with contractors and owners. The agreement also to ensure that the building owner would maintain the green wall in longer term and permit access for ongoing research.

- *Citizen participation:*

There is no direct activity of co-creation with citizen or citizen participation in execution stages. However, the green walls were implemented in city-center buildings which attracted many residents and visitors. Consequently, the project is an effective marketing strategy both for the building owners and public authority to enhance citizen accessibility and awareness for Green Infrastructure.

Implementation typology: The Green Wall at Parr Street and the St John shopping center projects, based on data analysis resemble some characteristic of Collaborative Ecosystem implementation approach with Co-Governance/Collaborative governance model. In this case study, the roles and responsibilities on planning and managing NBS are shared between both private adopter and public actors. Specific responsibilities of each actor are defined through an agreement signed by both partners. Key implementation decisions such as the intervention and the design were selected based on consensus among stakeholders, and NBSs are installed on private property. Procurement process is applied for municipal to find NBS suppliers (NBS design, risk assessments and constructors), the awarded contractor is another private actor involved in this approach. In order to co-design and co-construct the Green Wall, a network of collaborators is established not only between key stakeholders but also between all relevant stakeholders (the adopters, public officers and their contractors). We identified this case as one of the examples of Adopt a green infrastructure implementation typology.



Key financing mechanism is co-financing which are both public funding from regional funding (EU) combines with municipal funding budget and funding also from private partner to facilitate construction work and future maintenance. The ownership of the NBS built in this project belongs private adopter.

Stakeholders		Lesson learned
Procurement:		
<p>Public: City Council</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • Relatively new to work on procurement process for an NBS that locate on third party buildings • Coordination to ensure stakeholder consent • Limited funding budget <p><i>Values:</i></p> <ul style="list-style-type: none"> • Strengthen experience on procurement with multiple stakeholders to facilitate future projects 	<p>Private: NBS contractors</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • To deliver an innovative solution with a constraint budget • Technical challenges (deliver a green wall in a shady street with low natural sunlight) <p><i>Values:</i></p> <ul style="list-style-type: none"> • Creative design, with structure and monthly changing interest. Interactive and focus on evergreen planting. 	<ul style="list-style-type: none"> - Keep updated with (safety) regulations related to the project - Adopt applications is helpful (as remotely water the green wall) to support maintenance or avoid risks - For public procurer: ensure effective communication and keep stakeholders informed; improved and flexible administrative procedures to support contractor; - For contractors: notice the ability to use eco-friendly methods to deal with any plant diseases rather than chemical approaches
Agreement:		
<p>Public: City Council</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • Ensure the wall meets the demands of the project and the building owner <p><i>Values:</i></p> <ul style="list-style-type: none"> • Co-funding to support the NBS projects • Utilize property of private partners with agreement on maintenance for NBS 	<p>Private adopter:</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • Relatively new to NBS solutions • Being affected during execution process as the NBS being carried out on their property <p><i>Values:</i></p> <ul style="list-style-type: none"> • Good opportunity to re-new the building look. 	<ul style="list-style-type: none"> - It is very important to clearly defined risks and responsibilities of each stakeholder - develop a legal template - Have in mind different scenarios and different alternatives to face risks. - For public procurer: maintenance contract should be prepared early and passed to the building owner as the work to maintain is specialized; Be flexible on solution (the type of



<ul style="list-style-type: none"> • Provide an interactive wall, with changing planting on a small urban street 	<ul style="list-style-type: none"> • Attract additional customers and increase revenue/value of building • Promotes business and demonstrates commitment to climate change 	<p>wall and choice of plant)</p> <p>- For property owner: The ability to shadow the contractor for daily maintenance and irrigation can sometimes help reduce maintenance visits and costs</p>
On-site execution		
<p><i>Challenges:</i></p> <p>Municipalities:</p> <p>Ensure continued access and reduce noise on site during the build period</p> <p>Avoids complaints and loss of revenue for businesses</p> <p>Politician:</p> <p>Getting public acceptance to an expensive city solution</p> <p>NBS contractors:</p> <p>Technical and resource challenges for on-site execution (to store plants and materials and access to water and electricity)</p> <p><i>General Values:</i></p> <p>High profile and showcase of NBS, funded by external sources and maintained privately but with public access and benefits</p> <p>Building experience and capacity working on such an innovative project with multiple innovative types of collaboration</p> <p>Citizen:</p> <p><i>Challenges:</i></p> <p>Understanding the specialist nature of the planting and the value of the wall</p> <p><i>Values:</i></p> <p>Expectations of improved biodiversity, plant colour, visual lift to the area, improved air quality and cooling. Good for social and mental wellbeing and helping to form an attractive active travel route</p>		<p>For Public Officers:</p> <p>Keep on-site delivery to a condensed period of time (Covid break led to fence off part completed works for several weeks);</p> <p>Be prepared for unexpected on-site issues</p> <p>For Contractors: Good plan on time for project deliver avoid busy time of the city</p> <p>For Politician: Good opportunity to do a visual demonstration (Green wall) to raise awareness about climate change and biodiversity, and to engage private sector in partnership with the city on NBS.</p>



Table 3.11: Challenges, values across stakeholder interactions and lesson learned**Type 4: Community centric – Urban Orchard Liverpool**

Current situation: There are several green spaces and parks with open access to citizen across Liverpool City. However, the city sees an opportunity to grow beyond current public parks by promoting biodiversity and activities for residents.

Project description: The Liverpool City Council integrates multiple small urban orchards into existing parks and green spaces as part of the Urban GreenUP projects with the goal to enhance biodiversity and to diversify activities for the parks.

Project value: A number of small orchards are planted in parks and open green spaces to provide multiple benefits to the park, one of which is enhance the connection between citizen with nature and promote urban farming practices.

Key activities and scale: The cities procured different types of fruit trees and planted into small urban orchards in chosen areas.

NBS typology: the key NBS are Urban orchards, Community composting facility, Small-scale urban livestock facility (henhouse), natural pollinator’s modules, insect hotel, horticultural seedbed, and non-technical intervention as urban farming educational activities. Besides, other facilitators as irrigation system, rainwater storage, shady areas for resting and working, public bathroom are also implemented to upgrade the areas.

3.2.3 Izmir:

Izmir is the third largest city by population in Turkey situated on the western coast of Anatolia. The region experiences a Mediterranean climate with a hot, lengthy summer and relatively mild winter each year. Izmir is one of the oldest cities on Mediterranean coast that offer a wide range of historical sites and cultural diversity. Service, manufacturing, and agricultural sectors significantly contribute to the city's modern, dynamic economy, which is rapidly expanding. Nevertheless, Izmir is currently threatened by air pollution, climate change, coastal risk, heat island effect, water management and green space management issues due to its dense population and rapid urbanization. Within the framework of the Urban Greenup project, Izmir Metropolitan Municipality has carried out a number of interventions in the three critical areas of the city with the primary objective of building a more resilient and livable city. The urbanization process in Izmir has resulted in highly fragile nature sites and a variety of environmental issues faced by each site. The NBS is therefore chosen in accordance with each zoning character and problems as follows:

Sub-demo A: Abatement of heat island effect in urban-nature continuum. Action to reduce heat island effect in city center with low land availability - Karşıyaka Metropolitan District.

Sub-demo B: Climate-smart Urban Farming with smart soil production, biofuel production unit and climate-smart greenhouses – Sasalı Natural Life Park

Sub-demo C: New green corridor including renaturing Peynircioglu Stream and Bio-Boulevard





Figure 3.8: Location of Demo Sites in Karşıyaka and Cigli Metropolitan District.

Type 1: Renature urbanization project - Peynircioğlu Stream and Urban Green Corridor

In this section, we focus on the case study of sub demo C - Peynircioğlu Stream and Urban Green Corridor which is a 10 km long green corridor is implemented with a set of Re-naturing urbanization solution in 1) Cycle and pedestrian route; 2) Tree planting and 3) Natural pollinator modules.

Current pressing urban planning challenge: There are an existing cycle routes surrounding Izmir bay with public bike sharing system, which links between Izmir coastal areas to sensitive nature protection areas. The current route, however, lacks connectivity due to some disruptions and provides insufficient greening access to residents.

Project description: A Green Corridor - Peynircioğlu Stream Corridor including a sustainable transportation system (new and renatured cycle lane new and renatured) and some greening sections (as the Bio-Boulevard) are implemented in this area.

Project value: From Sasali Natural Life Park in Cigli District to the confluence of the Peynircioglu River and coastal promenade in Karsiyaka District, this green corridor will offer more environmentally friendly and sustainable connectivity throughout the entire area. It connects the rural-urban continuum and serves as a kind of continuous link between two districts. The NBS was planned with the corridor to serve as an urban planning solution while simultaneously supplying vital ecosystem services to support urban biodiversity and citizen well-being.





Figure 3.9: Routes of new and existing cycling lanes in Izmir

NBS: Multiple NBSs are implemented in this project comprising 1) Cycle and pedestrian route in new Green Corridor (with 5.5 km new green cycle lane) with 4800 cool and shade trees planting and urban carbon sink; 2) Culvert works and green pavements for Peynircioglu stream and 3) Vertical green GI (fences and fruit walls) and 4) non-technical activities in Industrial Heritage Route.

Multiple benefits/values: Based on the developed KPIs framework (established in EKLIPSE) expected addressing challenges are Climate mitigation and adaptations; Water management; Green spaces management; Air quality; Participatory planning and Governance; Public health and well-being and Potential of economic opportunities.

Initiating actors: the Izmir Metropolitan Municipality, who represents the local government in Izmir, is the project's principal organizer and main actor. Most of the decisions pertaining to this NBS implementation project are made by the City Council (City mayor and other departments). This is a large-scale project with significant administrative task and construction works that addressing multiple environmental, economic and social challenges. The zoning areas are mostly public land and accounted for a large area, the sites and NBSs are selected based on the current needs of the area and key urban planning direction of the City Council, most decisions required approval by the City Mayor.

Other stakeholders: associated department across Izmir city councils participate in support and approval for the project. The academic partners of the project Izmir High Tech University, Landscape Department of Ege University and Soil department of the same university were also involved within the design, technical documentation and monitoring of the results of the NBSs. The relevant partners were selected during the proposal stage according to the needs of the planned interventions and details had



been studied together. Private partners as suppliers of NBS related product and services (designing, writing technical document, execution), citizen as final beneficiary.

Project scale and key activities: This is a regenerative urban planning project implemented at an urban scale requires construction activities over a large area starting at Sasalı Natural Life Park in Çiğli District and merging into Peynircioğlu Stream and coastal promenade in the Karşıyaka District. These main activities of the project involved (1) implementation of new bicycle and pedestrian green routes into the existing bike lane to form a comprehensive sustainable green route that links the two districts together, (2) planting cool and shady trees along the green corridors and the stream to maximize level of carbon sequestration, air pollutants and heat reduction, and perform as habitat for insects and bird and stormwater interceptors, (3) planting fast growing and large canopy trees around Peynircioğlu Stream to create Urban Carbon Sink for carbon sequestration, (4) Culvert works comprised approximately 1km length of Peynircioğlu Stream riverside to turn current artificial and impermeable riverbank infrastructure into a re-nature riverbank with green pavements next to green fences and fruit walls at the edges of the riverbank, (5) concrete walls of riverbank is replaced by terra mesh walls – an environmental beneficial option that is also very simple to build, (6) installation of green fences and walls alongside of the stream to provide more access to green areas, (7) installation of 10000 sqm of green pavement as surface along the riverbank which is also contribute to urban heat reduction, (8) installation of green resting and industrial heritage green route. Multiple co-creations, citizen participation activities, and non-technical activities are also carried out during different stages of implementation projects.

Relationships during implementation phases:

- *Public procurement process:*

Local authority through open public procurement processes, restricted and negotiated procedure, direct procurement

Type of contracts: Work contracts

Due to the political context and legal framework, multiple of NBS implementations are combined into one single tender contract for bidding (contract of more than €20,000 need to go for open tender, contracts with similar work area are often questioned by financial staff), therefore the municipal staffs launch 7 combined contracts namely Penynircioğlu Econologic Corridor, Izmir Agriculture Development center; Parklets; Green Roof (Car Park area); Biochar Production Facility project; Waste Mud Project; Industrial Heritage Route project. Implementation of NBSs in this demonstration projects were actually launched simultaneously with other NBSs.

The estimated cost of the tender is usually studied before the tendering process. Tenderers with required documents bid prices are evaluated by the tender commission. The tenders shall be examined for their conformity with the qualification criteria determining the capacity of the tenderers to perform the contract, as well as with the conditions set forth in the tender documents and whether an arithmetical error exists in unit price charts. After requesting an explanation, the bidders with the extremely lowest bids with insufficient explanations are also eliminated.



The contract was awarded to the tenderer who submitted the economically most advantageous tender also taken into account qualitative factors such as operation and maintenance costs, cost-effectiveness, productivity, quality and technical merit. Then, the successful tenderer was notified to sign the contract by issuing a performance bond within ten days following the date of notification.

- Co-creation/Citizen engagement:

The co-creation and stakeholder engagement activities in Izmir project was quite success at the beginning of the project, especially during the design phases. Activities at collaborating and co-decided participation level as interactive workshops, demo designs for NBS as parklets and pollinators are organized with some good results. However, participation effort did not progress effectively during implementations with several meetings with citizen representatives and feedbacks and complaints from the community. The municipalities mainly communicate with the person who representing the neighborhoods and they managed to talk with the citizens. The budget for stakeholder engagement was not planned well at the beginning, the city requested for more granting but did not success. Some engagement activities are delays while waiting for approval.

Implementation typology: Based on data collection and analysis, the Green Corridor project in Izmir illustrates a State-centered implementation approach, in which the government (City Mayor and City department) plays a leading and coordinating role. The city council decides key implementation decisions, key NBS interventions are selected based on the city's priority goals for sustainability and planning strategy. The project is a large-scale re-naturing project where NBSs are installed mainly on public land. The civic engagement activities in the design stage demonstrated a higher level of participation with interactive workshops and meetings. However, during implementation due to the Covid pandemic and budget constraints, citizen engagement activities turned back to a tokenistic level where information provided is taken into account more than consulting activities. However, there are a number of Co-management practices emerged that enhance the effectiveness of the implementation processes of the Green Corridor project. For instance, the municipality seeks consultation from academia/universities through service contracts on tasks requiring expertise such as product development and performance management, and evaluation of construction works. While the combined work contract reduces the number of administrative tasks and paperwork for the public staff, it limits contractors' ability to apply for project tenders. Academia/NGOs and research are also important advisors to government actors in gathering and transferring knowledge and providing preliminary guidance on the implementation process. We identified this case as one of the examples of Renaturing Urban Project implementation typology.

Key financing mechanism is co-financing which are both public funding from regional funding (EU) combines with municipal funding budget. The ownership of the NBS built in this project belongs to the City Council.

Stakeholders	Lesson learned
Procurement	



<p>Public procurer:</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • Different kind of works in single tender was a challenge to find contractors • Insufficient expertise and personnel to prepare technical document/manage progress • Exchange rate fluctuations affected the costs of contractors affecting work progress • Lacks of contractors with sufficient competence (at first no experience contractors for biochar) • Slow periods for public tendering and processing; possible delays (as missing tender documents or amendment, processing issue) • Existing framework focus mainly cost-effective rather than innovative/sustainable criteria. • Frequent change of top management at the Municipality affected procurement, especially non-technical activities • Limited access to funding <p><i>Values:</i></p> <ul style="list-style-type: none"> • High participation as this was a tender regarding a grant • Co-creation experience with action require innovation most R&D parts are covered by contractors but got consultation from academia (professors). • Less paperwork due to combine contracts. 	<p>Supplier:</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • Unfamiliar with administrative public procedures • Facing risks due to changing political decisions • Facing risks of insufficient technical competence since these are relatively novel and innovative interventions. <p><i>Values:</i></p> <ul style="list-style-type: none"> • Big value contract granted by European • Opportunities to develop new technology/ products • Enhance experiences and building capacity/ competencies • Enhance public branding and CSR • The Municipalities dissemination plans of the Green Infrastructures is a good opportunity, especially for those worked in Urban GreenUp. 	<ul style="list-style-type: none"> - Learn the budget management along with the manufacturing process - Coordination with different units/department within the municipality is important during procurement. - Consider safety guidelines and regulations which might affect surrounding neighbor of project sites - Ensure to follow the drawn technical project, be aware of difficulties experienced - Project tender and construction processes are not independent and must be considered coordinately - Citizen engagement activities needed to be introduced as early as possible in procurement process to get more support.
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Co-creation



<p>Public staff:</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • Unexpected amendment, unplanned budget request for stakeholder engagement but did not get approved. • Participation for the following phases were limit mainly because of Covid-19 <p><i>Values:</i></p> <ul style="list-style-type: none"> • Enhance public understanding and social acceptance of NBS • Enhance expected social outcomes and address social issues. • Learned to have a more holistic approach while planning implementations 	<p>Citizen:</p> <p><i>Challenges:</i></p> <ul style="list-style-type: none"> • Not able to participated due to Covid-19 • Local people opposed to some manufacturing processes and practice <p><i>Values:</i></p> <ul style="list-style-type: none"> • Citizen are key users of NBS projects. • Co-creation helps citizen to gain more knowledge, awareness and acceptance on NBS. • Allow them to feel engage, to raise their opinions and gain more trust in the city decisions 	<ul style="list-style-type: none"> - Conduct more interactive and direct form of citizen participation during design and implementation - Strategic approaches to citizen - Citizen engagement activities needed to be introduced as early as possible to get more support. - Citizen acceptance increase if they are more involved in the projects.
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Execution

<p>Municipalities and contractors:</p> <p><i>Challenges:</i></p> <p>Risks due to changing political context (lead to changing decision of sites, designs etc.)</p> <p>Approval and permission procedures, paperwork and managerial issues took longer than expected</p> <p>Deficiencies in the regulation (for sewage sludge took longer time to get permission use)</p> <p>Lacks expertise to manage innovative projects</p> <p>Longer time to seek for consultation from professions/academic</p> <p>Failure/Dysfunctionalities of some implementation due lack of technical knowledge</p> <p>Covid-19 causes difficulties in providing materials and plants, especially imported plants</p>	<ul style="list-style-type: none"> - Coordination with different units/department within the municipality is important during both maintenance and implementation stages. - Ensuring project management by including surrounding neighbor on-sites in the project process - Acquiring knowledge on vegetative manufacture and maintenance processes especially in vegetative landscape projects. - Have regular meetings, minute them and share
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<p>Some unexpected technical difficulties (energy support, unqualified materials, aesthetical and growth ability of plants)</p> <p>Responsibility and errors in maintenance planning</p> <p><i>Values:</i></p> <p>Successfully deliver the project with multiple NBS installed and offers multiple co-benefit, ecosystem services</p> <p>Building up the knowledge and experience with innovative and sustainable projects</p> <p>Politicians:</p> <p><i>Challenges:</i></p> <p>Inconsistent perspective (as new Mayor and management team in 2019 having different opinions required relocate sites, changing designs)</p> <p><i>Values:</i></p> <p>Show support to positive environmental projects with environmental improvements that are well received by local voters</p> <p>Citizen:</p> <p><i>Challenges:</i></p> <p>Lack of understanding and awareness of NBS led to citizen complaints</p> <p><i>Values:</i></p> <p>Final beneficiaries of ecosystem services and multiple benefits delivered by the NBS project</p> <p>Raising self-awareness and contribute to environmental actions.</p>	<p>actions with dates</p> <p>- Regular updates and communications to all parties, when people are informed there are usually less complaints</p>
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Table 3.12: Challenges, values across stakeholder interactions and lesson learned



<p>For Public entities (Governmental or Municipal actors)</p> <p>1.City diagnosis and assessment - Most pressing environmental and societal challenges - Key challenges/problems of the city urban planning strategies - Key goals/objectives of the city development strategies</p> <p>2. City capacity assessment - Political and legal support and available finance support - Existing regulations and policy support - Access to technical, expertise skill, and land availability and other resources - Motivation to innovation and risk tolerance</p>	<p>3.Choose NBS and implementation zoning</p> <p>Type 1: Urban areas with relatively large land availability (streets, routes, public sites, industrial, historical sites for renaturing) NBS: Large scale renaturing urbanization NBS and water intervention, integrated with suitable Green Infrastructures</p>	<p>4. Exploitation pathway with stakeholders</p> <p>Urban Renaturing Urbanization projects Initiator: Public authority - a municipal centric approach but seeks co-management with non-state stakeholders NBS suppliers: private entities, NGO, academia who can support NBS implementation from consulting to delivering mainly through public procurement process Citizen participations: variety approaches from informing to co-deciding opportunities</p>
	<p>Type 2: Public area (some with high citizen accessibility) NBS: Particularly technical and innovative NBS (ex: electro wetland, floating garden, smart soil production)</p>	<p>Product Development Initiator: Public authority and NBS developer through agreement or contract - a corporate centric approach where government provide the support for an entity (company, R&D non-profit organization) to implement NBS through co-management, in most case shared or public ownership. NBS suppliers: private or non-profits entities who able to develop innovative NBS, public entities can launch partnership through public procurement or work agreement Citizen participations: mostly at informing level as these are novel NBS which should be place at public area with educational purposes to enhance knowledge and awareness</p>
	<p>Type 3: City center with more building and private property NBS: Green infrastructure (GI) and some types of water intervention</p>	<p>Adopt a Green Infrastructure Initiator: Public Private Partnerships with external land owner (NBS adopter) under a work agreement - a collaborative approach where both partners are joining to co-governance NBS with external ownerships NBS suppliers: private companies (landscape, green solutions, etc.,) who can support NBS implementation from consults to delivery, mainly through public procurement process Citizen participations: Citizen can be landowner who adopt GI or end-beneficiary engage mostly at tokenistic level.</p>
	<p>Type 4: Community and public area for resident and community NBS: Urban farming, community gardens, community NBS initiatives, NBS related-activities, non-technical solutions</p>	<p>Community projects Initiator: public entities can be initiator to develop social areas with high support for citizen participation or communities/citizen grassroot initiatives for their local area – a community centric approach with empowerment/non-government led governance, these are implemented on community’s public area NBS suppliers: private or non-profits entities who able to consults and deliver NBS relate component through public procurement or contract, citizen also directly involve in NBS deliver (ex. Farming or cultivating activities) Citizen participations: participation at level from informing to empowering level, citizen can also get direct economic benefits while joining these activities</p>



For Private Entities	NBS Typology	Exploitation pathway
<p>Private, NGOs as NBS suppliers</p>	<p>Type 1 - NBS: Large scale renaturing urbanization NBS and water intervention, integrated with suitable Green Infrastructures</p> <p>Type 2 - NBS: Highly technical and innovative NBS (ex: electro wetland, floating garden, smart soil production)</p> <p>Products and service: related to NBS delivery</p> <ul style="list-style-type: none"> - Design renaturing - urbanizing solutions - Supplying related materials - Design and produce innovative components related to NBS - Construction service – Construction works - Consultancy - Advisory services - Education, research and innovation activities - Financial services - Smart technology monitoring and assessment of NBS - Maintenance services in long-term 	<p>NBS suppliers exploited renature-urbanize NBS, highly innovative NBS (in early testing phase) in the following potential ways:</p> <ul style="list-style-type: none"> - Participating in Large-scale renature urbanization projects which is initiated by Municipality/Government can be a potential opportunity for NBS suppliers for exploiting NBS market - For highly innovative NBS which previously has only been tested at laboratory level or in early development stages. R&D entities (private, institutions, academia as universities) can seek relevant government funding and support (legal and resources as sites for NBS implementations), or direct response to municipal procurement call for suppliers to develop their products and scale up their productions. <p>Benefits:</p> <ul style="list-style-type: none"> Get high-value contracts and sell their products/services Effective market strategy to test and develop their technology/solutions/products Enhance capacity, knowledge and experience in implementing NBS Opportunities for demonstrating their product/ solutions Enhance public branding and CSR Potential finance incentives Networking opportunities – to join the NBS network Incentives from related regulations and policies for green and sustainable business Get addition services contracts (as long-term monitoring, maintenance and future opportunities)
	<p>Type 3 - NBS: Green infrastructure (GI) and small-scale water intervention for building and private property</p> <p>Products and service: related to NBS delivery</p> <p>Type 4 – NBS: Urban gardens, urban farming, urban orchards and non-technical projects</p> <ul style="list-style-type: none"> - Design green infrastructure – NBS (greening, landscape) solutions at unit scales to be implemented in non-public properties - Supplying related materials - Design and produce innovative components 	<p>NBS suppliers exploited the green infrastructure for building and NBS solutions for landowners (private, non-public) in the following potential pathways:</p> <ul style="list-style-type: none"> - Participate in procurement that public authorities recruit through their collaboration with public land owners (PPP work agreement). - Participate in procurement that public authorities recruit through their community projects. - Direct contracts with building and landowners to provide products/services by demand. - Provide services as input for building, housing construction and architect business or collaborated to co-supply <p>Benefits:</p> <ul style="list-style-type: none"> Get high-value contracts and sell their products/services



	<p>related to NBS</p> <ul style="list-style-type: none"> - Construction service – Construction works - Consultancy - Advisory services - Smart technology monitoring and assessment of NBS - Maintenance services in long-term 	<p>Effective market strategy develops their technology/solutions/products Enhance capacity, knowledge and experience in implementing NBS Opportunities for demonstrating their product/ solutions Enhance capacity, knowledge and experience in implementing NBS Enhance public branding and CSR Networking opportunities – to join the NBS network Incentives from related regulations and policies for green and sustainable business Get addition services contracts (as long-term monitoring, maintenance and future opportunities) Potentially gain competitive advantage in term of price in collaboration with other companies</p>
<p>Private, communities, citizen, NGOs as NBS volunteer adopter, supporter (funding), leading actors</p>	<p>Type 1 - NBS: Large scale renaturing urbanization NBS and water intervention, integrated with suitable Green Infrastructures Type 2 - NBS: Highly technical and innovative NBS (ex: electro wetland, floating garden, smart soil production) Key roles: Can join as funders/co-funders, volunteer participants in co-creations and participation, self-awareness, perception to support NBS uptake and maintenance Type 3 - NBS: Green infrastructure (GI) and small-scale water intervention for building and private property Type 4 – NBS: Urban gardens, urban farming, urban orchards and non-technical projects Key roles: partners with public authority with shared responsible in NBS implementation (co-governance, co-financing), or be initiator of NBS implementation projects (or grass-root communities initiatives for NBS uptake)</p>	<p>Other non-government actors as private, communities and citizen, NGO who volunteer to join and support NBS uptake can exploit NBS through following pathways:</p> <ul style="list-style-type: none"> - They can support and participate government NBS implementing projects as funders and co-funders, volunteer participants in co-creations and participation activities, enhance self-awareness, perception, sense of cohesion to help the community develop sustainably, provide assistance in preservation of NBS in public areas to support NBS maintenance. <p>Benefits: End-users, key beneficiaries of all environmental, social and economic outcomes of NBSs (NBS expected outcomes measured by Eklipse framework) Key beneficiaries of the City’s urban planning and sustainable development strategy as NBS is a part to achieve the strategy</p> <ul style="list-style-type: none"> - They can also be partners to implementing NBS in their properties, take the responsibility to NBS implementation and maintenance, or leading a NBS implementing projects for the communities. <p>Benefits: End-users, key beneficiaries of all environmental, social and economic outcomes of NBSs (NBS expected outcomes measured by Eklipse framework) Economic benefits (ex: selling urban farming products, increasing house/land price, ..) Enhance public branding and CSR Potential finance incentives</p>

Table 3.13: Strategic exploitation pathway



3.5 Investigating critical success factor (CSFs) and strategic management frameworks for Nature-based Solution implementation project:

In previous section, we investigate NBS potential exploitation pathway through consideration of NBS implementation actor networks. In fact, the NBS are often launched as an integrated large project that combined several exploitation pathways. However, NBS project are complicated compared to traditional environmental actions. Implementing and managing such NBS project is challenging since they require unconventional knowledge and skills (Toxopeus and Polzin, 2021), while numerous issues might arise if no an overarching strategy in place to manage such projects. In order to monitor such innovative projects, it is crucial to present a strategic management framework with a list of recognized success criteria and critical success factors. This framework will serve as a guide for future deployment of NBS programs in other cities.

Although success criteria can be developed for a variety of purposes, the focus has been on NBS performances outcomes rather than management of NBS implementation at project specified level. These previous performance assessment framework targets monitoring final outcomes or lagged indicators of NBS rather than leading indicators to monitor NBS projects through a project lifecycle which can be more supportive to enhance NBS expected outcomes.

In order to address these problems: (1) identified critical leading indicators and (2) propose an overarching management framework that supports the successful deployment of NBS projects, we propose a Sustainable Balanced Score Card (SBSC) for NBS projects. Under the framework of SBSC, we also identified critical success criteria and success factors of NBS projects. A combining process of Delphi and AHP techniques with a group of experts allows us to identify and weighting the criteria and factors proposed under the SBSC application framework.

This research aims to: (1) identify success criteria and success factors for SBSC for NBS implementation projects, (2) validate and evaluate the relative importance of criteria and factors of the SBSC model, (3) propose the SBSC strategic management framework for deployment of NBS project, (4) prioritize success criteria. We take a multi-criteria decision-making approach combining Delphi and analytic hierarchical procedure (AHP). Two rounds of Delphi consultations are used to achieve the first two objectives, and an AHP method is used to accomplish the latter two objectives.

3.5.1 Project strategic management framework - Sustainable Balance Scorecard (SBSC):

According to the Process Performance Framework (Kagioglou, Cooper and Aouad, 2001), a strategy is considered as an input to a performance management system which is identified by a number of organizational goals/objectives. These goals/objectives can be achieved through effective activities related to strategy implementation and deliver performance results for the organization and its stakeholders. In turn, performance measurements serve to validate the strategy and provide outputs that contribute to the development of the new strategy. Similar mechanism is discussed in the strategic management model proposed by Hunger and Wheelen, (2012).

There have been multiple strategic models that are adopted and continuously developed over last few decades. The logical framework analysis (Baccarini, 1997) and Theory of Change (Stein and Valters,



2015) was mostly use as practical tools for planning and defining success of the project in nonprofit sector. A variety of performance measurement frameworks have been such as the Performance Measurement Matrix (Keegan et al., 1989), Strategic Measurement Analysis and Reporting Technique with a pyramid structure of performance (Lynch and Cross, 1989), the Results and Determinants Matrix (Fitzgerald et al., 1991), the Balanced Scorecard (BSC) (Kaplan and Norton, 1992), the Performance Prism (Kennerley and Neely, 2002). Among these models, The Balanced Scorecard (BSC), first developed in the 1990s, offered managers a relatively more overarching approach with comprehensive set of performance measures (Kaplan and Norton, 1992). Multiple perspectives including quantitative and non-quantitative, financial and non-financial, allowed “balanced” performance management across the spectrum of an organization's operations (Banabakova and Georgiev, 2018). However, the original BSC is no longer sufficient, as growing sustainability concerns require organizations to incorporate sustainability into their strategic planning. Organizations pursue social and environmental goals not only as an obligation to their stakeholders but also an opportunity to attract more customers, employees and investors (Ellemers and Chopova, 2021). Consequently, calls have been made to incorporate sustainability goals into performance measurement systems in diverse organizations (Nikolaou and Tsalis, 2013; Stanitsas, Kirytopoulos and Leopoulos, 2021) and projects (Saad, Nazzal and Darras, 2019).

In innovating the original BSC to offer social and environmental sustainability dimensions two distinct approaches have been taken: (1) Integrating sustainability criteria into the original dimensions (financial, customer, internal processes, learning and growth) e.g. (Al-Zwyalif, 2017); Möller and Schaltegger, 2005); and (2) adding additional sustainability dimensions, e.g. (Figge et al., 2002; Hubbard., 2009). Modified BSCs have been applied to green practices in the semi-conductor industry (Hsu et al. (2011), managing natural disasters (Moe et al., 2007), sustainable development Chai (2009), participatory planning (Fürst et al. 2014), green transport strategies (Stoš et al., 2015) general greening initiatives Al-Zwyalif (2017) and to construction projects (Tennant and Langford, 2008; Maya, 2016; Huynh et al., 2020; Gunduz and Al-Naimi, 2022; Kagioglou et al, 2001; Yang et al. (2010); in Malaysia (Chan and Hiap, 2012), and Vietnam (Luu et al. (2008)) (Tennant and Langford, 2008; Maya, 2016; Huynh et al., 2020; Gunduz and Al-Naimi, 2022).

The recent trend of forming separated and temporary teams to work on a project that focuses on addressing novel ideas or tasks has significantly increased in different types of organization (Bakker, 2010). Large organizations often undertake multiple projects, and it is important to ensure that the organization's strategic goals are translated into project success. NBS is also innovative in nature, and NBS implementation, particularly in an urban context, is a social innovation process with a complex network of stakeholders. Consequently, NBS implementation is carried out in the form of projects. The gaps in knowledge of managing NBS implementing a project is a growing concerns as NBS gains popularity. In addition to environmental transformation, NBS projects are expected to deliver social outcomes including improved quality of life, increased citizen preservation awareness, and new governance mechanisms to confront climate change. A key concern is that NBS are novel, and implemented in different social and geographic contexts. Multiple and diverse technical and managerial knowledge gaps create uncertainties (Sarabi *et al.*, 2019). For example, during NBS construction, in



addition to the technical challenges, project managers must maintain public support despite demolition waste (Wang et al., 2019), dust, noise and safety concerns (Vuorinen and Martinsuo, 2019). “Success” must therefore be assessed according to multiple perspectives and criteria. While multiple NBS performance evaluation frameworks have been developed (e.g. the widely adopted EKPLISE framework (REF)), these focus on outputs rather than management indicators, especially at the project level.

This study realizes the need to develop a practical and comprehensive performance management framework for NBS implementation projects and environmental-infrastructure projects in general. In response to this gap, we apply SBSC as a systematic and inclusive approach to support successful project management and implementation of such projects. The SBSCs are chosen as the framework for three reasons: (1) SBSC allows integrating sustainable perspectives which are key targets of NBS projects, (2) SBSC is applicable at project level and (3) this is a comprehensive framework that has received widespread validation and acceptance from a solid body of literature. We also investigate and validate a list of success criteria and propose the relevant success factors to achieve these success criteria of NBS projects. The proposed SBSC framework includes five perspectives:

- Finance perspective: In the original BSC for business proposed by Kaplan and Norton (1992), the finance perspective responds to the question “To succeed financially, how should we appear to shareholders?”. However, when applications of the BSC are extended for various types of organizations including nonprofit, public, governmental, the financial objectives and measurements of each type of organization can be determined differently.
- Operation perspective: The internal process perspective in the BSC for business strategy responds to the question “what process must we excel at?” , which takes into account the efficiency of each internal business process. Similarly, the proposed SBSC’s operation perspective examines the performance of the operation processes during the implementation of NBS projects.
- Sustainability perspective: The main objective of the customer perspective is to enhance customer satisfaction. The performance indicators from a customer perspective provide insights for businesses to enhance their services. Since the urban NBS and NBS projects aim at providing ecological services which offer economic, social, and environmental benefits to society. Consequently, in the proposed SBSC framework for the NBS project, the customer perspective is substituted by the sustainability perspective which evaluates the environmental, social, and economic outcomes of the NBS project.
- Stakeholder perspective: In addition to the original BSC framework, stakeholder perspectives on the project are considered in the SBSC for NBS implementation projects. This viewpoint is critical in assessing the satisfaction of various stakeholders. The assessment of stakeholder perspectives may also suggest practices for increasing acceptance and stakeholder engagement in the NBS project.
- Learning and Growth perspective: To achieve our vision, how will we sustain our ability to change and improve?”



3.5.2 Research Methodology:

Based on the literature on BSC by Kaplan and Norton, (1992), the study attempts to propose a Sustainable Balance Score Card framework (SBSC) as a strategic management tool that enhances the successful implementation of NBS projects within urban contexts. In this paper, an integrated process between the Delphi technique and the Analytical Hierarchical process (AHP) is employed and depicted as shown in Figure 3.10. The research process consists of four main phases, the methods and results of each step are discussed in detail in the following section.

Phase I: Literature Review and Discussion workshops

Step 1: NBS project overview and proposed list of success criteria and success factors

- Project success criteria:

In the attempt to construct a performance management system, it is critical to address performance measures that reflect the strategic goals. This indicator system not only promotes the achievement of expected results towards the organization's strategy, but also is a tool to support the strategy continuous development. Under the scope of a project, Artto et al. (2008) defined a strategy of a project as a “direction in a project that contributes to the success of the project in its environment”. Determining and evaluating the success of a project therefore plays a critical role in development of a project management framework. Project success, on the other hand, is a multifaceted and difficult to define concept (Todorović et al., 2015). The majority of literature reviews examine project success using multiple constructs as efficiency and effectiveness management (Ika, 2009) and explicate project success using criteria of project success (Artto et al., 2008). There have been some arguments differentiate between criteria of project success (success criteria) and project management success (success factors) (De Wit, 1988; Prabhakar, 2008; Osei-Kyei et al., 2017). While success criteria are measurements of the project expected outcomes (Chan, Scott and Lam, 2002), success factors (or critical success factors) are the driven forces which is incorporated to management system that directly or indirectly lead to achieve the successful project outcomes (Rockart J., 1982). However, project success and project management success are both critical to the success of any project (Wang et al., 2022). Researches on project success criteria and success factors contribute to the development of both theoretical and practical models by reflecting state-of-the-art updating novel practices in strategic planning and project management (Yun et al., 2011).

One of the most noticeable initial approach to measure project success is the Barnes' Iron Triangle which includes three basic criteria: costs, amount of time, and performance (quality) (Todorović et al., 2015; Albert et al, 2017; Huynh et al., 2020). Although Barnes did not publish his work as scientific, the triangle has become the foundation for the development of project management field and various approaches to measuring project success (Howsawi et al., 2014). These three dimensions of project criteria have been controversial due to the concentration on organizational perspective while neglecting motivations of other stakeholders on project success (Aaltonen, 2011; Mir and Pinnington, 2014), and different stakeholders are proved to have discordant perspectives on project success (Chan and Chan, 2004). In response to the criticisms, the project management research has been continuously developed



and put forward the need to add multidimensional perspectives into measuring project success and performance.



PHASE I: WORKSHOPS and LITERATURE REVIEW

Step 1: NBS project overview and proposed list of success criteria and success factors

1. Literature review of Success criteria and Success factors
2. Collect qualitative data from two virtual sharing session of NBS projects
3. Collect qualitative data from demo sites project reports

Outcome: Proposing the SBSC hierarchy structure, list of success criteria and success factors

PHASE II: DELPHI PROCESS

Step 2: First round Delphi

4. A panel of 10 experts was selects to the first round of Delphi process
5. Questionnaires sent anonymously to the experts with open questions asking: (1) Experts comment of the SBSC framework, success criteria and success factors that the authors have given and (1) additional comments/suggestions for the framework.

Outcome: The SBSC hierarchy and success criteria and success factors was reshaped follow expert's opinion.

Step 3: Second round Delphi

6. Selecting an expand panel of experts (to 30 expert) who has experienced with NBS implementation project
7. Create questionnaire with two parts includes Likert rating (1-5) and open questions.
8. Sent out the questionnaires and collecting survey data
9. Calculate Mean score and Content Validity Ratio (CVR) for quantitative data, analysing qualitative comments from open questions and finalized the SBSC framework.

Outcome: Final SBSC framework with a list of Success Criteria and related Success factors

PHASE III: ANALYTIC HIERARCHICAL PROCESS

7. Design the AHP survey using
8. Data collection: Distribute the AHP survey (pairwise matrix) to NBS experts, project staff, and municipal staff to perform judgment ranking on importance and pairwise comparison.
9. Using AHP tool to construct a pairwise comparison ranking matrix for success criteria
10. Calculating consistency ratio (CR) and perform AHP analyses to rank critical success criteria and measure global weights of Success factors and Success Criteria.

PHASE IV: PROPOSING STRATEGY USING SBSC

Step 4: Discussion with project runners to verify the proposed SBSC and strategy

11. Proposing strategy map using SBSC framework to enhance the success of NBS projects
12. Verified whether the proposed strategy map is applicable to NBS projects

Figure 3.10: The research flow



During the 1980s, numerous important project criteria was introduced in response to these critics as functionality, management, technical requirements and satisfaction of multiple stakeholders (investors, contractors, project teams and customers) (De Wit, 1988). The multi-dimensional paradigm of assessing project success has continued to develop and with regards to the sustainable development goals where the economic, environmental, and social aspects in term of the "triple bottom lines" has been increasingly suggested in a number of studies as additional performance evaluation criteria (Singhet al., 2012; Gianniet al., 2017; Cantele and Zardini, 2018; Nawaz and Koç, 2018).

The nature-based solutions play a critical part of urban renaturing effort in the green economy to increase the sustainability and well-being of cities. Within the scope of Urban GreenUp project, a catalogue of nature-based solutions has been developed and implemented in the urban context including re-naturing urbanization, singular green infrastructure, water and non-technical interventions (www.urbangreenup.eu). The NBS implementation projects are characterized with construction of green/blue infrastructure and installation of living environment elements (as plants, pollinators and water) (Croeser et al., 2021). Consequently, performance criteria of the construction industry and performance criteria of NBS effectiveness is also taken into account during the criteria selection process to propose strategic management framework of NBS implementation projects. In the field of construction management, a prominent model for evaluating success was created by Chan and Chan (2004). The model combined a number of key performance indicators (KPIs) of construction projects into nine success dimensions, including time, cost, value and profit, health and safety, environmental performance, quality, functionality, expectation and satisfaction of users, and participant satisfaction. Wang et al., (2022) carried out a systematic review using descriptive analysis approach on the success criteria and critical success factors (CSFs) for mega infrastructure construction projects (MICPs) across 20 countries and proposed a conceptual framework of success criteria. The framework identified 20 principal success criteria for MICPs and classified these into five dominant categories including project efficiency, stakeholder's satisfaction, organizational strategic goals, innovation and development in construction industry and impact on society (figure x).

Nevertheless, the central point of undertaking NBS implementation projects is to deliver the nature-based solutions that fulfill its expected performances. To develop a strategic management framework for these projects, it is necessary to consider the perspective of evaluating NBS effectiveness. In fact, research efforts to address concerns and provide evidences on the effectiveness of NBS in urban context has increasingly been encouraged by the European Commission (European Commission, 2015) (Sowińska-Świerkosz and García, 2021a). One of the early attempts to assess the benefits of NBS was the set of indicators proposed by Kabisch et al. (2016) considers four key aspects including integrated environmental performance, health and well-being, transferability and monitoring and citizen's involvement. Raymond et al. (2017) expanded on the work and developed the ECLIPSE framework, which provides comprehensive and systematic guidance for evaluating and implementing urban NBS. The framework investigates both the direct costs and benefits of NBS obtained from ecosystem services, as well as the indirect costs and co-benefits of interactions between different aspects, using the consideration of ten key societal challenges faced by cities (Raymond et al., 2017).

To enhance further NBSs uptaking, the International Union for Conservation of Nature (ICUN, 2020) constructed the global standards for NBS actions based on examining best practices regarding societal



challenges, biodiversity, ecosystem integration, economic viability, management capability, and trade-offs between the benefits provided by an NBS. As the opportunities for implementing urban NBS are facilitating internationally, researches on evaluating NBSs effectiveness are continuously carried out and contributing to the literature works. Sowińska-Świerkosz and García, (2021) recently completed systematic review updating new knowledge related to NBS performance assessment and suggested 7 aspects including (1) stakeholders' participation, (2) policy and management capability, (3) economic efficiency, (4) analysis of synergies and trade-offs, (5) adaptation to local conditions, (6) adequate spatial scale and (7) performance in the long term.



Figure 3.11: Success Criteria for MICPs

- Strategic management and project success factors:

The literature review suggested that project success is achieved by the “success factor” which is defined by (Daniel, 1961) as an informative source for shaping strategies, making decisions, and measuring results for project management. In 1979, Rockart expanded the concept using the term “critical success factors” that referred to “areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization” (Rockart, 1979). Rather than being oriented towards the achievement of a goal or purpose, Rockart study displays that senior leaders have a direct tendency to address “what is necessary to succeed” and suggests a framework as pathway to determine “critical success factor” for an organization which at final is aiming to achieving their goals. In both of the models proposed by Rockart (1979) and Wheelen et al (2016), the process of strategizing a project accompany with the identification of success factors (or critical success factor). The investigation of “critical success factors” is also intended to subsequently establish a framework with multiple criteria for evaluating project performance and project success (Rockart, 1979; Shahu, Pundir and Ganapathy, 2012; Huynh et



al., 2020). The project objectives are transformed into activities, budgets, procedures through implementation phase. While the phase is executed after strategy formulation, it generates project performance with actual results. Therefore, implementation plays a critical role in strategic management and deficient implementing are often accused for plenty of strategic failure (Wheelen and Hunger, 2016). Transparent values and objectives to be achieved is necessary for project leaders/managers to monitor project implementation. The success criteria should also be apparent to enable project evaluation (Wheelen, Thomas L., Hunger, 2016).

As this study is a part of a large project which focuses on the development, application, and replication of renaturing urban plans in a number of partner cities to mitigate the effects of climate change, improve air quality and water management, as well as to increase the sustainability of cities through innovative nature-based solutions. With the aim to propose a sufficient and updated list of success criteria and success factors, in the first phase, we carried out a systematic review of existing published articles, reports, and documentations of previous nature-based solution research and action projects combined with the currently available reports in the project that related to our research question “What are the success criteria and success factor for urban NBS project?” The evaluation frameworks that have been widely applied to the NBS project was synthesized, analyzed and compared in terms of application goals, structure, content of criteria and the methods of identification and validation. In addition, a review of different management framework applied in identical areas as environmental and ecological construction projects was also carried out (Orencio and Fujii, 2013; Ameen and Mourshed, 2019a; Huynh et al., 2020). As SBSC is developed in the context of Urban GreenUP project, the latest and pragmatic knowledge and experience from periodic meetings are also utilized in the selection of criteria and factors. A list of over 20 criteria and 60 factors that will serve as the basis for the Sustainable Balance Score Card (SBSC), a useful management tool for implementing NBS projects in urban areas, are proposed to build the initial questionnaires for the first round Delphi.

Phase II: Delphi Process

The Delphi Method:

The Delphi method is a reflexive that uses anonymous and iterative round of surveys with a controlled opinion feedback system to gather novel ideas and generate verifiable agreement from group of respondents (usually experts) (Mukherjee et al., 2015; Dalkey and Helmer, 1963). This approach can be used to accomplish a variety of objectives, especially to reach a consensus viewpoint or making a consensus decision that is contributed from separated individual perspectives rather than group discussion (Lemieux and Scott, 2011; Fallah and Ocampo, 2021), and to ascertain a multi-criteria framework through participants with both academic and non-academic experience (Hsu et al., 2011; Orencio and Fujii, 2013; Fallah and Ocampo, 2021).

Due to its flexible process that enables the collection of opinions from a diverse group with complex professional and socioeconomic characteristics (Fallah and Ocampo, 2021), the Delphi technique can facilitate a knowledge exchange platform and enhance the participative decision-making of multiple stakeholders (for example academic, business, government and non-government groups) (Gagliardi et al., 2008; Grime and Wright, 2016; Grace et al., 2021). Nevertheless, depended on the objectives and questions of the research, the choice of respondents should be explored in depth. The anonymous



component of Delphi method, as opposed to direct connection, promotes greater comfort and involvement while experts express their viewpoints (De Lange et al., 2010). This approach may thereby address the drawbacks and shortcomings of other group-based opinion mining and decision-making techniques, including influence bias brought on by groupthink pressures, the halo effect, egocentrism, and the dominance effect (Hsu and Sandford, 2007; Mukherjee et al., 2015; Grime and Wright, 2016). Another opposing argument has been raised on the anonymous mechanism is that it can lead to accountability and compliance issues. However, the iterative Delphi procedure, which involves asking the same panel of experts the same questions repeatedly over the course of multiple rounds until a consensus is reached, can lessen this risk. It is also advised to have an in-person or reflective discussion where experts can share their thoughts and comments on the results of previous anonymous rounds (Konu, 2015; Taylor, 2020). While the iterative process acknowledges the contribution of comments and opinions of expert groups and ensures the credibility of final consensus results, it can be time-consuming and costly (Rabbani et al., 2014). With remarkable and multifunctional characteristic, the Delphi method has been expanded into various forms and is widely used in many diverse spheres, such as government (Rayens and Hahn, 2000; Kattirtzi and Winskel, 2020; Li, Taihagh and Tan, 2022), health (Powell, 2003; Akins, Tolson and Cole, 2005; Tamminen et al., 2022), education (Hung et al., 2008), environment, manufacturing and business (Hsu et al., 2011; Dohale et al., 2021; Qureshi et al., 2022). In environment related fields, the Delphi technique is mainly applied for problems identification, knowledge gathering and exchanging, participatory decision making, developing framework and model to support assessment and/or decision making. Mukherjee et al (2015) has detailed four different applications of the Delphi technique in ecology and biological conservation researches including decision Delphi, scenario Delphi, argument Delphi and policy Delphi.

Nature-based solutions (NbS) are considered to be capable of resolving the issues brought on by climate change in a beneficial and sustainable manner. However, knowledge of their advantages and deployment is restricted due to their novelty and complexity and Delphi is an effective method for resolving these issues. Initially, Grace et al., (2021) designed a Delphi process to explore the essential knowledge needs for implementing and uptaking NBS in Mediterranean contexts. The author also emphasized the need of implementation knowledge in the analysis of NBS utilization. Nesshöver et al (2017) has proposed Delphi as a methodology for participatory evaluation that gathers the opinions of various stakeholders on the effectiveness of putting nature-based solutions into practice. The Delphi technique is used for performance management and assessment in addition to governance goals. In the fields of urban planning and ecotourism management, respectively, Ameen et al (2019) and Fallah et al, (2021) used the Delphi method to provide indicators that contribute to the sustainability assessment framework. Due to the potential to help discover issues, solutions, and challenges that are economically significant, the Delphi method has also been utilized in management studies with various purposes. For instance, developing implementation model for a new initiative (Nguyen, Tucek and Pham, 2022; Qureshi et al., 2022), generating concepts for new products and services (Konu, 2015), making decision on systems (Dohale et al., 2021). In this study, we use a Delphi process with two rounds to design a framework of criteria for managing projects to provide nature-based solutions or environmental related construction project as describe in the following section.



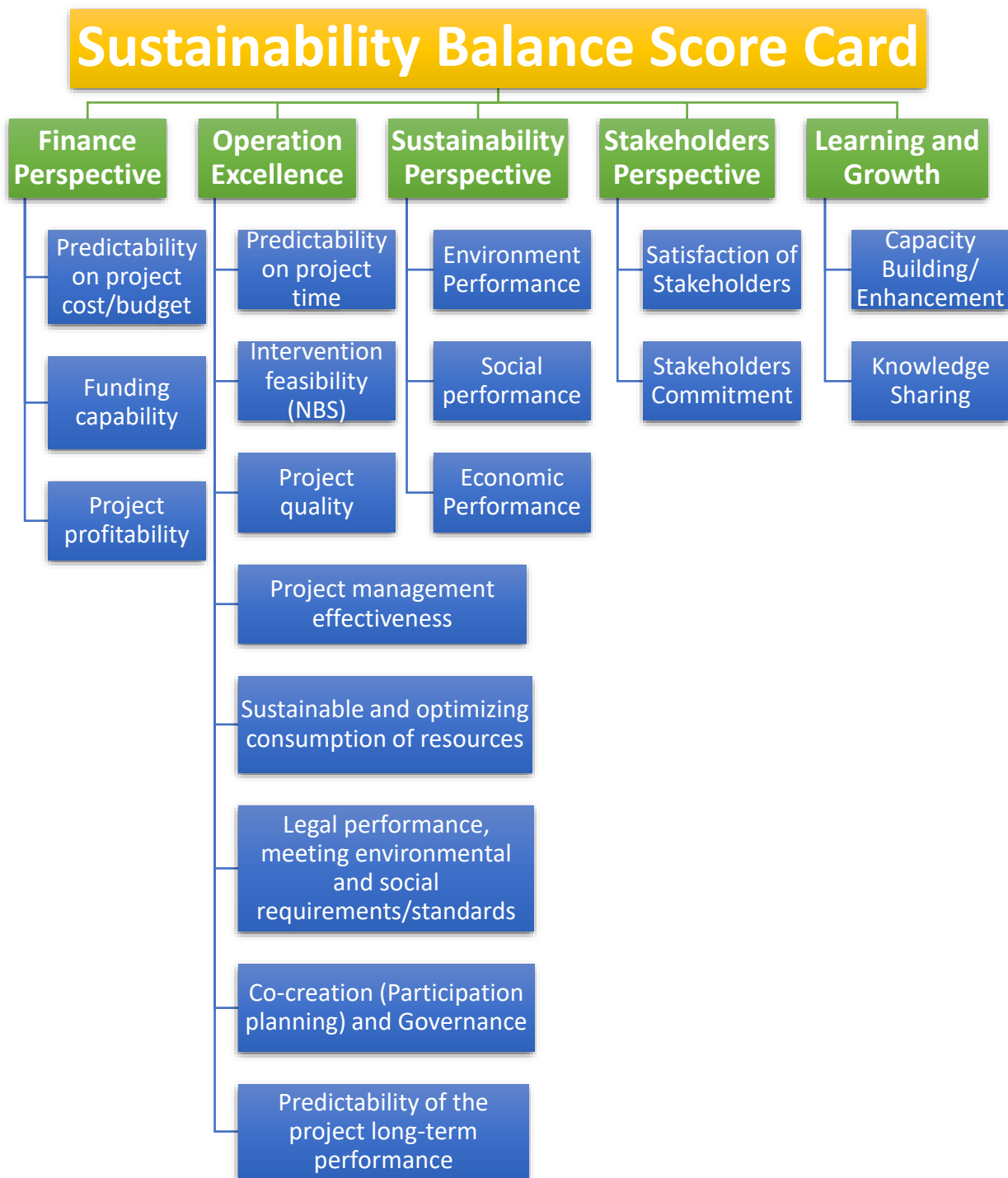


Figure 3.12: The SBSC hierarchical framework for NBS project



The Delphi design process:**Step 2: Conducting first round Delphi**

Since the list includes criteria and factors was also reviewed from the project's exchanging workshops and reports, a modified version of Delphi method developed by Murry & Hammons (1995) is utilized. The proposed SBSC framework, together with a list of suggested success criteria and success factors, are presented under a hierarchy structure and transmitted anonymously to ten chosen experts in the first round of the Delphi process. We applied an open-question approach in this step and the experts were asked about (1) comments of the SBSC framework, success criteria (SC) and success factors (SF) that the authors have given, comment of how the framework should be adjusted, or any success criteria and factors that they found inappropriate and (2) additional items or suggestions for the framework. In order to facilitate the second round of the Delphi process, we also asked the respondents if they would voluntarily provide their email addresses at the end of this survey. Determining potential group of participants is a critical step of Delphi process. Most research project seeks professional participation (Taylor, 2020), however, it is also recommended to broaden perspectives and limit preference bias by involving groups of respondents with divergent background (Hussler et al., 2011; Cole, Donohoe, & Stollefson, 2013). The representativeness of a panel size is not statistically constrained (Powell, 2003) (Ralitsa). The sample of 10 to 15 respondents with homogenous background is proposed to be tolerable, while several studies have found that the majority of Delphi panels are between 15 and 20 respondents (Hsu & Sandford, 2007). Based on our objectives, the group of participants who was invited are key experts 1) who involved throughout most of the project's activities, 2) play an important role in coordinating and managing projects. After sending out the questionnaire we received responses from 7 experts. Based on their contribution, we finalized and proposed the SBSC hierarchical framework with a list of 18 criteria and 52 success factors. The SBSC is demonstrated in Figure 3.12 while the table 3.13 describes 18 criteria chosen after the first round of Delphi.

SBSC perspectives	Success Criteria	Description	Reference
Finance	Project cost/budget (1)	Meeting requirements of project cost/budget allocation	Kagioglou et al, 2001; Ashley et al., 1987; Freeman and Beale, 1992; Griffith et al., 1999; KPI Working Group, 2000; Chan and Chan, 2004; Wang et al., 2022;
	Project funding capability (2)	Ensuring the funding capability for project activities	KPI Working Group, 2000; Kagioglou et al, 2001; Chan and Chan, 2004;
	Project profitability (3)	Realizing project profitable opportunities	Kagioglou et al, 2001; Wang et al., 2022;



Operation	Project time (4)	Meeting requirements of project duration/schedule	Ashley et al., 1987; Freeman and Beale, 1992; Griffith et al., 1999; KPI Working Group, 2000; Chan and Chan, 2004; Wang et al., 2022;
	Intervention feasibility (NBS) (5)	Ensure feasibility and suitability of selected NBS	Sowińska-Świerkosz and García, 2021; Croeser et al., 2021;
	Project quality (6)	Meeting the technical and professional requirements	KPI Working Group, 2000; Chan and Chan, 2004; Sowińska-Świerkosz and García, 2021; Wang et al., 2022;
	Project management effectiveness (7)	Managing the project is effectively managed	Sowińska-Świerkosz and García, 2021; Huynh et al., 2020;
	Consumption of resources (8)	Sustaining and optimizing consumption of resources	Todorović et al., 2015; Huynh et al., 2020;
	Compliance with legal, environmental and social requirements/standards (9)	Compliance with legal, environmental and social requirements/standards	KPI Working Group, 2000; Chan and Chan, 2004;
	Predictability of the project long-term performance (10)	Ensuring the long-term performance of NBS	Sowińska-Świerkosz and García, 2021; Raymond et al., 2017;
	Participation planning (as Co-creation) and Governance (KPIs) (11)	Strengthening participation approaches and governance architects to support NBS project	Raymond et al., 2017; Sowińska-Świerkosz and García, 2021;
Sustainability	Environmental Outcomes (12)	Project environment performance	Raymond et al., 2017; Wang et al., 2022;
	Social Outcomes (13)	Project social performance	Raymond et al., 2017; Wang et al., 2022;
	Economic Performance (14)	Project economic performance	Raymond et al., 2017; Sowińska-Świerkosz and García, 2021; Wang et al., 2022;
Stakeholder	Stakeholders Satisfaction (15)		KPI Working Group, 2000; Kagioglou et al,



			2001; Chan and Chan, 2004; Wang et al., 2022;
	Stakeholders Commitment (16)		Sowińska-Świerkosz and García, 2021; Wang et al., 2022;
Learning and Growth	Capacity Building/ Enhancement (17)		Wang et al., 2022;
	Knowledge sharing (18)		Wang et al., 2022;

Table 3.14: Success Criteria for SBSC framework

Step 3: Conducting the second iterative round of Delphi

The outcomes of Delphi round one is used to design the questionnaire in the second round. The questionnaire for this round is designed in a semi-structured manner which enables experts concentrate on the current problem (Min, 2015, Taylor, 2020) with open-ended questions for experts to contribute their knowledge (Powell, 2003). The questionnaire consists of three main parts. The first part explains the research objective and collects background information about the profession and experience of the respondents related to the NBS project implementation. The second part introduces the proposed Sustainable Balance Score Card framework with a list of success criteria for the NBS project that corresponds to each perspective. In the second part of the questionnaire is constructed following three parts:

- The experts will be asked open question about their comments and suggestions to refine the SBSC framework.
- The experts are required to rate the importance of each criterion on the five-point Likert scale from 1 (not important) to 5 (extremely important) and responded to open questions that contribute to revision of the proposed list of success criteria
- The experts are required to rate how importance each factor links with each criterion on the five-point Likert scale from 1 (not important) to 5 (extremely important) and responded to open questions that contribute to revision or add more factors that related to achieved each success criteria.

The responses collected from the first semi structure survey can be both quantitative and qualitative data. The themes emerging from analyzing qualitative data and statistical estimations from analyzing quantitative data are gathered to finalize the framework and a list of items which is used to obtain feedback in the next step (Mukherjee et al., 2015). According to the literature review, there are multiple metrics for evaluating consensus such as the interquartile range (IR), cut off rate from average percent of majority opinions (APMO), subjective analysis, specific level of agreement, etc. (Gracht, 2012). However, we adopted the widely known content validity ratio (CVR) technique in this study, which is particularly useful for developing criteria researches (Dohale et al., 2021; Nguyen et al, 2022), the CVR is calculated using the following equation:

$$CVR = \left(\frac{n_{EI} - \left(\frac{N}{2}\right)}{N/2} \right) \quad (1)$$



Where CVR is the content validity ratio, n_{EI} is the number of experts rating the criteria or the factor as important and N is the total number of respondents. Lawshe (1975), asserts that the CVR threshold to select a criterion is 0.29 when there are 40 experts on the panel. However, Lawshe adopted a three level rating scales for each indicator including essential, useful but not essential, and not necessary. As our research employs a five-point Likert scale, consequently, very important and important were compared to be equivalent to essential, neither important nor unimportant is to be useful but not essential, and not important to be equivalent to not necessary. There are two iterative approaches for asking for feedback from the respondents, with reports of feedbacks offered (Fallah and Ocampo, 2021). The respondents can either adjust their answers or provide explanations for their opinions, or the participants are allowed to reassess their responses by referring to the group responses.

In the second round of Delphi study, the adjusted framework and list of criteria and factors are provided to a panel of 35 NBS experts including the experts participated in the first round of Delphi. The panel comprised a variety of professionals and experts who 1) have been directly participating in the implementation of at least one NBS demonstration under Urban Green project and 2) have local or international experience of files related to NBS A panel of diverse professionals was sought based on the aforementioned selection criteria guide, including those with expertise/specialties, government and industry partners with decision-making roles, others with experience in the built environment and construction, or with expertise knowledge of urban NBS. In fact, to reach the group of experts, we first contacted the respondent of the first Delphi round and asked them to suggest a list of suitable experts to attend the second round of Delphi. The proposed list was examined by the authors for relevance. However, after the questionnaires are sent out, we received 25 respondents. Table 3.14 describes the final list of NBS experts representing the professional, affiliated organization, country, educational and expertise background.

Phase II: The Analytic Network Process

In this section, the relative importance weights and rankings of the 18 success criteria selected for the NBS implementation projects in our study are estimated using the process of the Analysis Hierarchy Process (AHP).

The Analytic Hierarchy Process (AHP) is one of the most widely utilized multi-criteria decision method which was introduced by Saaty in 1980 (Goepel, 2018). A vast number of criteria can be structurally analyzed and prioritized using the analytical hierarchy technique, which is based on a valid expert consensus weighting system (Ali and Al Nsairat, 2009; Ameen and Mourshed, 2019a). The application of AHP has been found in numerous fields of studies including health (Ariff et al., 2012), production (Thanki, Govindan and Thakkar, 2016), sustainability (Hsu et al., 2011) as an effective process supporting management decisions. The Analytic Hierarchy Process (AHP) has also been utilized to integrate with Balanced Scorecard frameworks as an effective method for performance assessment and strategy development (Ali and Al Nsairat, 2009; Ameen and Mourshed, 2019b; Nguyen, Tucek and Pham, 2022). In our study, the Sustainable Balanced Scorecard is a strategic management framework that comprises a set of success criteria corresponding to multiple perspectives. Consequently, assessing the relative important of each selected criterion in the context of NBS implementation projects also benefits decision-making and strategy formulation. During AHP process, complex decisions towards multiple aspects of SBSC is translated into a series of paired comparisons, and the consistency of these



evaluations is calculated to deplete biased decisions. The decision-making process is strengthened because the respondent only compares two criteria against each other during the pairwise process and ignores all other criteria. Weight of criteria are calculated based on pairwise comparison inputs by locating the dominant right eigenvector (EV) of a positive reciprocal decision matrix.

Based on the list of experts from the Delphi session, we invited an expert panel for the AHP session. This group of experts includes NBS project managers/coordinators, technicians, research teams, and consultants who have experience in participating in NBS implementation projects in cities. Table y shows the final list of experts and their background, country, occupation and roles in the NBS implementation project illustrating the representative power of the expert panel. A critical step in the AHP process is to define a hierarchical framework with levels representing the goals/objectives and criteria to be managed and prioritized. Drawn on the SBSC framework and Delphi consultation with experts, we proposed a hierarchy model for the success of the NBS implementation project as shown in figure 3.12. The central issue of the SBSC is to achieve “project success” which is considered across five perspectives in the first level of the SBSC, and the second level represents the list of 18 final success criteria of an NBS implementation project. Paired comparison of each of these criteria over another is conducted using the AHP nine-point relative important scale (1-9) proposed by Saaty (1994), the scale is illustrated in table m.

Background	Distribution (%)	City and Country	Occupational affiliation	Roles in the project
Academia/ Research and Development	20%	Several cities	Management	Project Coordinator
		Valladolid, Spain	Researcher	Monitorization
		Liverpool, UK	Researcher	Data Monitoring
		Izmir, Turkey	Researcher	Project Coordinator
Government (State authorities, Local authorities)	48%	Izmir, Turkey	Consultant	On-sites Coordinator
		Izmir, Turkey	Public administration	Architectural Design and Implementation Manager
		Valladolid, Spain	Technician	Implementation Coordinator
		Liverpool, UK	Management	Project Lead and Coordinator
		Izmir, Turkey	Management	Project Coordinator
		Ludwigsburg, Germany	Public administration	Acquisition of Funding
		Quy Nhon, Vietnam	Technician	Technical Staff
Valladolid, Spain	Technician	Implementation Management		
Ioannina, Greece	Consultant	Consultant		
Medellin, Colombia	Technician	Technician	Landscape Architect	



		Valladolid, Spain	Technician	Project Manager
		Esposende, Portugal	Public administration	Project Coordinator
		Mantova, Italy	Public administration	Project Coordinator
Non-government Organizations	16%	Valladolid, Spain	Researcher	Technology Developer
		Liverpool, UK	Researcher	Data Analyst
		Liverpool, UK	Management	Project Support
		Hue & Vinh Yen, Vietnam	Consultant	Design, Delivery and Consultation
Private Businesses/ Companies	16%	Valladolid, Spain	Technician	Project Writer
		Valladolid, Spain	Technician	Monitoring Partner
		Izmir, Turkey	Consultant	Supporting Local Authority and Monitoring Activities.
		Valladolid, Spain	Technician	Project Coordinator

Table 3.15: The background of the panel of expert

Scale	Level of importance	Description
1	Equally important	To contribute equally to the goals
3	Moderately important	Slightly favors one criterion over another
5	Strongly important	Strongly favors one criterion over another
7	Very strongly important	Very strongly favors one criterion over another: demonstrated dominance
9	Extremely important	Highest position in favor one criterion over another
2,4,6,8	Moderately important between levels	Moderate level and further consideration are needed

Table 3.16: The AHP nine-point relative important scale (1-9)

Several software has been developed to assist in the performance and analysis of AHP results, some of which are also applicable for business purposes (Ossadnik & Kaspar 2013; Ishizaka & Labib 2009; Siraj et al. 2015). The AHP process in our study required assessment of 18 criteria which is a relatively complex decision process, therefore, we apply the AHP web-based tools (<https://bpmmsg.com/ahp/ahp-hierarchy.php>), developed by Goepel (2018). This program is a free web-based tool which support AHP planners from collecting data to measuring standards evaluation for analyzing purposes. The data from paired comparisons of 18 criteria are entered to form the decisions matrix. According to Saaty (1990),



the consistency ratio (CR) of the pair-wise comparisons' outcomes is acceptable at the level of less than 0.1, which showed that the judgments were reliable. However, instead of measuring consistency ratio using average random index (Saaty, 2008),

$$CR = \frac{\lambda - n}{(n - 1)RI_n}$$

In this study, we follow Goepel (2018) and use linear fit approach (Alonso and Lamata, 2006), for 18 indicators the CR is:

$$CR = \frac{\lambda - n}{2.7699n - 4.3513 - n} = \frac{CI}{RI} < 0.1$$

3.5.3. Result and discussion:

Delphi results on the contribution and rating importance of each success criteria and success factor to each SBSC perspective

First, we report the average importance scores on the 5 Likert scale of the success criteria and success factors in each perspective of the SBSC hierarchical framework in Table 3.16. After the revision in the first round of Delphi, the SBSC hierarchy received a general consensus from the panel of experts, with no major adjustments made. We calculate the average score to analyze the importance of each success criterion at tier 2 for each perspective. In general, it is observed that the groups earned highest rating of over 4.5 are Long-term performance (O7), Environment Performance (SU1), Social Performance (SU2), revealing final impacts and results of NBS projects remains a top concern for experts' panel. One can argue that as NBS are relatively innovative and new, it's critical to evaluate the project's final outcomes in order to determine whether further adoption and investment are possible. Most of the proposed indicators are found to be relevant with the average rated score at 4.0 or higher. There are two most underrated indicators, Project profitability (F3) and Economic performance (SU3), it is worth noting that these two indicators are related to the Financial dimension of the project. However, these results do not necessarily confirm that these criteria are not relevant to the project. Current NBS projects are still being implemented as pilots in cities with majorly public funding and public involvement as analysis in previous sections. In addition, the economic value assessment of NBS remains a significant challenge, therefore, it can be understood that in the current period for experts these criteria play less important role. Finally, the indicators with high average scores are distributed relatively even in each perspective, all of the indicators in operation and stakeholder perspectives also have a fairly even distribution of average scores above 4.0. The results showing the reasonableness of the indicators towards the perspective in particular and proposed SBSC framework in general.

	Mean	SD	Min	Max
Financial Perspective				
Predictability on Project Cost/Budget (F1)	4.45	0.945	2	5



Funding Capability (F2)	4.45	0.759	2	5
Project Profitability (F3)	3.35	1.182	1	5
Operation Perspective				
Predictability on Project Time (O1)	4.05	0.605	3	5
Intervention Feasibility (NBS) (O2)	4.25	0.639	3	5
Project Quality (O3)	4.5	0.607	3	5
Project Management Effectiveness (O4)	4.3	0.733	2	5
Sustainable and Optimizing Consumption of Resources (O5)	4.3	0.733	3	5
Compliance with The Legislation, Environmental and Social Requirements/Standards (O6)	4.5	0.607	3	5
Predictability of The Project Long-Term Performance (O7)	4.6	0.598	3	5
Co-Creation (Participation Planning) and Governance (O8)	4.05	1.050	2	5
Sustainability Perspective				
Environment Performance (SU1)	4.55	0.605	3	5
Social Performance (SU2)	4.55	0.759	2	5
Economic Performance (SU3)	3.95	1.050	2	5
Stakeholders Perspective				
Stakeholders Satisfaction (ST1)	4.35	0.745	2	5
Stakeholders Commitment (ST2)	4.35	0.745	2	5
Learning and growth Perspective				
Knowledge Sharing (LG1)	4.5	0.946	2	5
Capacity Building/Enhancement (LG2)	4.15	0.671	3	5
Total	4.289		3.35	4.6

Table 3.17: The ratings of SBSC success criteria

We take further analysis to examine the differences in the rating tendency of different groups of experts. The black spider web diagram xx shows the difference of opinion between the technical team compared to other professionals especially the management team, as the technical team is the one that gives the lowest importance score of Finance perspective. The black spider web diagram xy compares the average score of 18 success criteria across different professional groups including Management,



Technician Specialist, and other Supporting roles. The results also highlight different rating references of the Technician group especially on Financial criteria. From the opinion of management team, there were two less important criteria in the evaluation which are Predictability on Project Time (O1) and Co-Creation (Participation Planning) and Governance (O8). Some other criteria besides final-outcomes criteria which are considered as highly important for the entire sample, the management team also rate a relatively high average score for the following criteria: Predictability on Project Cost/Budget (F1), Funding Capability (F2) Project Quality (O3), Compliance with The Legislation, Environmental and Social Requirements/Standards (O6).

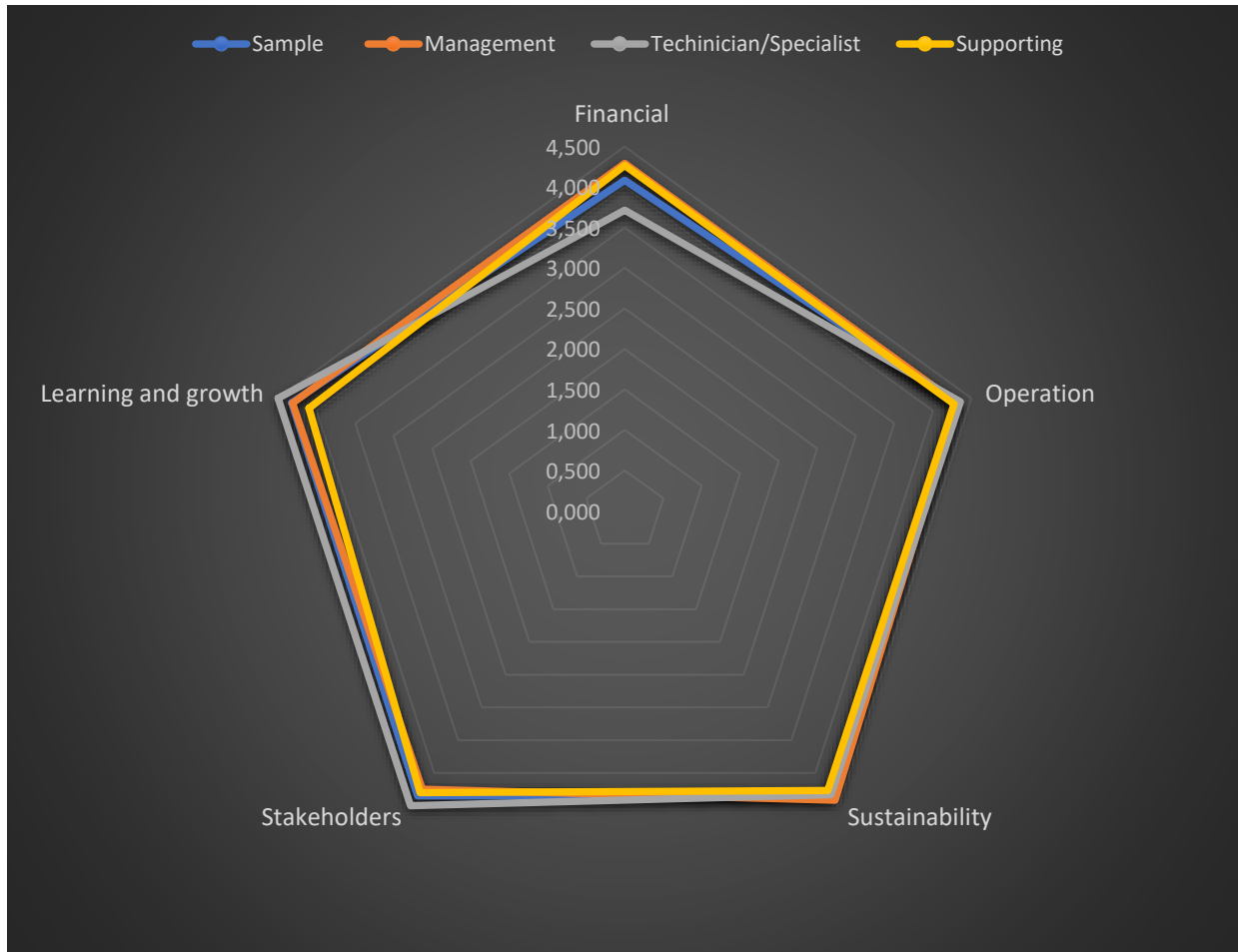


Figure 3.13: Comparison of average score of SBSC perspective



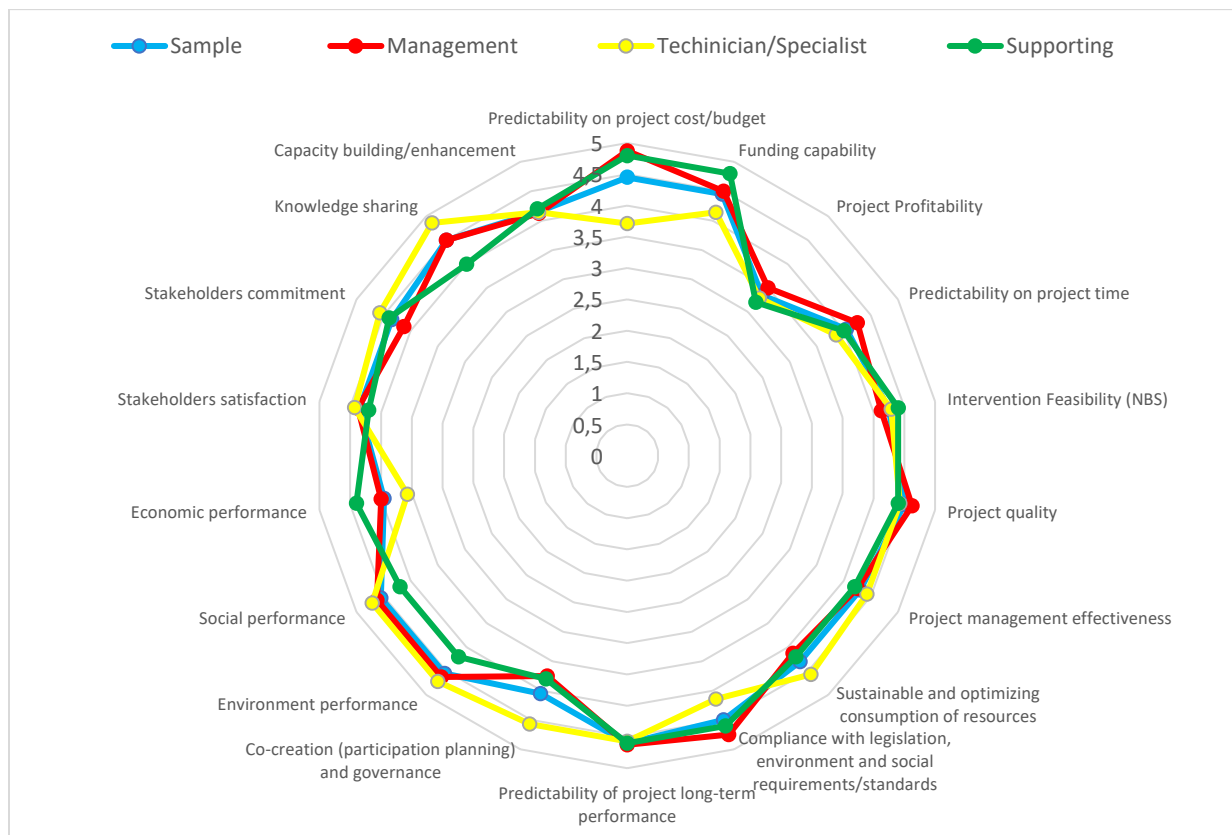


Figure 3.14: Comparison of average score of SBSC success criteria

Based on these two preliminary results, the two criteria considered to be removed from the research framework are Project profitability (F3) and Economic performance (SU3). However, to support the adjustment decision, we perform a T-test (at value of 4.00, and p-value of 0.05) and calculate CVR as shown in Table k. On the other hand, we also revisited the theoretical assessment framework which is built for the project (EKLIPSE). All of the success criteria have consistent validity ratio larger than 0.29, only Project Profitability has a CVR less than that level so we finally decided to exclude this criterion.

Success Criteria	Mean	CVR	Rank (by mean)	T-test (>4.00,0.05)
Predictability of Project Long-term Performance	4.6	0.9	1	0.0001
Environment Performance	4.55	0.9	2	0.0003
Social Performance	4.55	0.9	2	0.002
Project Quality	4.5	0.9	4	0.0008
Compliance with Legislation, Environmental and Social Requirements/Standards	4.5	0.9	4	0.0008



Knowledge Sharing	4.5	0.8	4	0.014
Predictability on Project Cost/Budget	4.45	0.8	7	0.023
Funding Capability	4.45	0.9	7	0.008
Stakeholders Satisfaction	4.35	0.9	9	0.025
Stakeholders Commitment	4.35	0.9	9	0.025
Project Management Effectiveness	4.3	0.9	11	0.041
Sustainable and Optimizing Consumption of Resources	4.3	0.7	11	0.041
Intervention Feasibility (NBS)	4.25	0.8	13	0.048
Capacity Building/Enhancement	4.15	0.7	14	0.165
Predictability on Project Time	4.05	0.7	15	0.358
Co-Creation (Participation Planning) and Governance	4.05	0.6	15	0.417
Economic Performance	3.95	0.5	17	0.583
Project Profitability	3.35	0.1	18	0.988

Table 3.18: Consistent Valid Ratio of 18 success criteria

Following the revision of the list of success criteria, the average score is calculated in order to assess the significance of each success factor at tier 3 with respect to each success criterion. We also ask participants to rate the scores of each success factor to each success criterion on the five Likert scales during the second round of the Delphi process. Table 3.18 calculates and displays the average important score for each factor. The t-test was also run (mean > 4.00, p-value 0.05) for each factor. Project Profitability and the associated success factor were first left out. Second, the weighted average score, the tier 2 success criteria score, and the expert panel's comments on the reasons for the low score were taken into account when revising the critical success factor. Finally, the six success factors highlighted in red in table 3.18 are the excluded factors, while the four italicized criteria are the criteria that were added under suggestions of the panel of experts.



	Mean	S.D	Min	Max	T-test (>4.00, pv:0.05)
CR1 - PREDICTABILITY ON PROJECT COST/BUDGET					
Transparent and efficient plan for cost/budget allocation	4.25	0.851	2	5	0.10
<i>Minimizing cost on compensations</i>	3.90	0.718	3	5	0.73
<i>Carefully consider all costs (including Co-creation), allow for a budget for the costs incurred</i>	Added				
CR2 - FUNDING CAPABILITY					
Ensuring stable project funding	4.50	0.513	4	5	0.00
<i>Seek hybrid funding by combining multiple funding sources</i>	Added				
CR3 - PROJECT PROFITABILITY					
<i>Identifying and maximizing profit return from investment opportunities</i>	3.35	1.226	2	5	0.99
CR4 - PREDICTABILITY ON PROJECT TIME					
Clear and well-controlled project schedule/timeline	4.15	0.671	3	5	0.16
Sufficient deployment plans	4.20	0.523	3	5	0.05
Explicit contractual agreements about timeline	4.30	0.657	3	5	0.03
CR5 - INTERVENTION FEASIBILITY (NBS)					
Considering existing urban-planning/greening strategies	4.35	0.587	3	5	0.01
Considering the needs of residents and society	4.60	0.598	4	6	0.00
Conducting comparative assessments addressed environmental and social challenges to select interventions	4.00	0.649	2	5	0.50
Considering access to suitable technical skills for NBS implementation	4.40	0.598	3	5	0.00
<i>Integrating different NBS typologies and scales in the intervention</i>	3.80	0.834	2	5	0.85
Examining feasibility of project location and reasonable land uses	4.45	0.686	3	5	0.00
CR6 - PROJECT QUALITY					
Comprehensive construction zoning plans	4.05	0.887	2	5	0.40
Clear division of management responsibilities	4.20	0.834	2	5	0.15
Recruiting and managing a diverse team with relevant experience	4.20	0.768	2	5	0.13
Selecting and supplying appropriate materials for intervention (NBS)	4.05	0.945	2	5	0.41
Delivering sufficient technical requirements for intervention (NBS)	4.25	0.716	2	5	0.07
CR7 - PROJECT MANAGEMENT EFFECTIVENESS					
<i>Well-defined and effective organizational structure</i>	3.80	0.894	2	5	0.84
Skills and abilities to use project management tools effectively	3.90	0.852	2	5	0.70
<i>Selecting adequate assessment tools/methods for managing project outcomes, impacts with consideration of trade-offs and risks</i>	3.65	0.988	1	5	0.94



Clearly demonstrated and systematic administrative procedures and standards (as meeting, reporting, etc.,)	3.85	1.040	1	5	0.74
Conducting project risk assessment and risk management	4.10	1.071	1	5	0.34
Enhancing culture of innovation and iterative learning that enables adaptive management	4.00	1.076	1	5	0.50
<i>Seek support from consultants/advisors to manage project</i>	<i>Added</i>				
CR8 - SUSTAINABLE AND OPTIMIZING CONSUMPTION OF RESOURCES					
Project characteristics (technical solutions, design, location, land use, business and finance models) towards sustainable development	4.35	0.745	3	5	0.03
Assessing and monitoring unintended adverse consequences on the ecology arising from interventions or the project	4.45	0.686	3	5	0.00
Localizing NBS into urban-regeneration context (selection of plants and material, design of NBS)	4.65	0.489	4	5	0.00
Exploiting available local human resource, local actors	4.55	0.826	2	5	0.00
CR9 - COMPLIANCE WITH THE LEGISLATION, ENVIRONMENTAL AND SOCIAL REQUIREMENTS/STANDARDS					
Clearly understanding and complying with legal frameworks and regulations	4.70	0.571	3	5	0.00
Ensuring project safety practices during NBS construction	4.60	0.598	3	5	0.00
Transparent process for tendering and contractual agreements	4.40	0.821	2	5	0.02
Limiting influences on health and safety conditions of the project surrounding areas (noise, safety, health issues)	4.30	0.733	2	5	0.04
CR10 - PREDICTABILITY OF THE PROJECT LONG-TERM PERFORMANCE					
Examining long-term development needs for NBS design and maintenance strategies	4.55	0.945	1	5	0.00
Considering potential risky situations that damage NBS during and after implementation	4.45	0.945	1	5	0.02
CR11 - CO-CREATION (PARTICIPATION PLANNING) AND GOVERNANCE					
Examining reliable and consolidated framework enabling shared governance/open participatory/co-creation	4.05	0.759	2	5	0.39
Create knowledge co-production processes to increase openness, transparency, and legitimacy of knowledge from multiple stakeholders	4.05	0.759	2	5	0.39
Improve understanding of different perceptions of urban nature and utilize them during the implementation process to increase the awareness	4.05	0.759	2	5	0.39
Enabling cross-sectoral, inter-department, multi-stakeholders' partnerships for NBS design, implementation and maintenance	4.10	1.021	2	5	0.33
Supporting community-based activities on greening and restoring urban green spaces	4.00	0.858	2	5	0.50
<i>Enhancing creative and adaptive designs for NBS, NBS implementation processes, and participatory approaches</i>	<i>3.85</i>	<i>1.040</i>	<i>2</i>	<i>5</i>	<i>0.74</i>
CR12 - ENVIRONMENT PERFORMANCE					



Identifying, benchmarking and periodically assessing intervention (NBS) outcomes and impacts on environment	4.30	0.979	2	5	0.09
Enhancing creative and adaptive designs that increase NBS environment outcomes	4.35	0.988	2	5	0.06
CR13 - SOCIAL PERFORMANCE					
Identify, benchmark, and assess the social challenges addressed or social benefits generated from the intervention (NBS) (as mental and physical health, social cohesion, social justice)	4.30	0.801	2	5	0.05
Enhancing creative and adaptive designs that increase NBS project social outcomes	4.35	0.875	2	5	0.04
CR14 - ECONOMIC PERFORMANCE					
Identify, assess and document the economic challenges addressed and the economic outcomes generated from the intervention (NBS)	4.05	0.887	2	5	0.40
Identify and incorporate opportunities to enhance economic performance of NBS (more integrity and connectivity)	3.95	1.050	2	5	0.58
<i>Building an NBS economic value assessment framework to support cities in economic valuation</i>	<i>Added</i>				
CR15 - STAKEHOLDERS SATISFACTION					
Considering and prioritizing most pressing social challenges for the right-holders and beneficiaries	4.20	0.894	2	5	0.16
Understanding the needs and challenges to support land owners/adopters	4.20	0.616	3	5	0.08
Identifying opportunities to increase attractiveness of project (toward lenders, vendors, real-estate businessmen and end-users)	4.20	0.768	2	5	0.13
CR16 - STAKEHOLDERS COMMITMENT					
Communicating to wider public and get positive support from society	4.25	0.550	3	5	0.02
Communicating with contractors to effectively plan and monitor implementation difficulties	4.40	0.681	3	5	0.00
Supporting of multiple levels government	4.25	0.786	2	5	0.08
CR17 - KNOWLEDGE SHARING					
Documenting and sharing knowledge, experience and innovative practices, lessons learned to trigger transformative change	4.30	0.979	2	5	0.09
Investigating and continuously improving the tools and models that facilitate NBS implementation	4.20	0.894	2	5	0.16
Documenting and sharing hybrid governance arrangement to enhance policy and regulation frameworks that support NBS uptake	4.20	0.951	2	5	0.17
CR18 - CAPACITY BUILDING/ENHANCEMENT					
Constructing skills training sessions and open sharing platforms	4.10	0.553	3	5	0.21
Forming and maintaining a governance network to enhance further NBS uptake	4.10	0.641	3	5	0.25

Table 3.19: The ratings of SBSC success factor



AHP results on the contribution and rating importance of each success criteria and success factor to each SBSC perspective

In the second phase, in order to determine the weightings of the success criteria of the SBSC framework, we conducted an AHP process. During AHP, the list of 17 success criteria chosen after the Delphi consultation is organized and prioritized through pair-wise comparison techniques. The ranking and weighting of SBSC success factors are presented and analyzed in this section. Due to the complexity of AHP process, participants in this step are limited to key NBS decision maker (participant in Delphi round 1). While our AHP group consensus ratio is quite low at 57.1% given the fact that our sample is quite small and has diverse backgrounds (different cities, different professionals), the consistency ratio is 0.016 which is considered valid (Saaty, 1994; Salmeron & Herrero, 2005; Triantaphyllou & Mann, 1995). The consolidated global priorities of all indicators were synthesized in Figure 3.15. Table 2 reveals the weights and ranks of the success criteria of the SBSC framework for the NBS project, arranged in descending order.

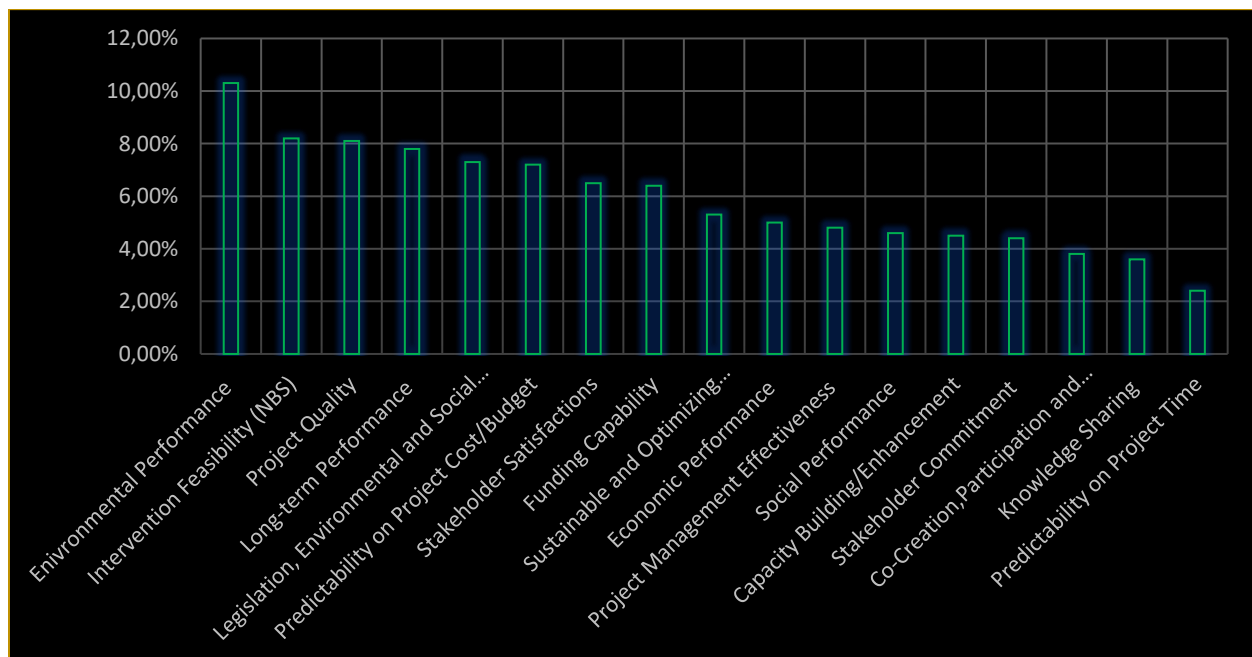


Figure 3.15: The results of AHP weightings of SBSC success criteria

The "Environmental Performance" criterion remains a top priority with 10.3% over the total weight. This result is consistent with previous assessments, confirming the general opinion of managers and experts who implement NBS projects that the ability to address environmental problems or deliver environmental outcome is the most important for managing NBS projects. Other factors in the top 5 of the priority success criteria are "Intervention Feasibility" accounting for 8.2%, "Project Quality" accounted for 8.1%, "Long-term Performance" accounting for 7.8% and "Legislation, Environmental and Social Standards" accounted for 7.3 %. This first group of 5 factors accounts for more than 40% of the total weight, and all of these four factors belong to Operation Perspective of the SBSC framework.



Success Criteria	Priority	Rank	Perspective
Environmental Performance	10.30%	1	Sustainability
Intervention Feasibility (NBS)	8.20%	2	Operation
Project Quality	8.10%	3	Operation
Long-term Performance	7.80%	4	Operation
Legislation, Environmental and Social Standards	7.30%	5	Operation
Predictability on Project Cost/Budget	7.20%	6	Financial
Stakeholder Satisfactions	6.50%	7	Stakeholders
Funding Capability	6.40%	8	Financial
Sustainable and Optimizing Consumption of Resources	5.30%	9	Operation
Economic Performance	5.00%	10	Sustainability
Project Management Effectiveness	4.80%	11	Operation
Social Performance	4.60%	12	Sustainability
Capacity Building/Enhancement	4.50%	13	Learning and growth
Stakeholder Commitment	4.40%	14	Stakeholders
Co-Creation, Participation and Governance	3.80%	15	Operation
Knowledge Sharing	3.60%	16	Learning and growth
Predictability on Project Time	2.40%	17	Operation

Table 3.20: The AHP weightings and rankings of SBSC success criteria

It is important to note that even though the project's financial aspects were not highly valued in the Delphi section, their rankings after the pairwise comparison process were higher than anticipated. In detail, "Project cost" was given a weight of 7.2% (ranks 6), and "Funding capability" was given a weight of 6.4% (rank 8), and "Economic performance" was given a weight of 5.0% (rank 10). Meanwhile, the "Social performance" criterion fall into the group of indicators with less than 5% of total weight, with "Project Management Effectiveness", "Capacity Building/Enhancement", and "Stakeholder Commitment". "Co-Creation, Participation and Governance" (with a weight of 3.8%), "Knowledge sharing" (with a weight of 3.6%), and "Project time" (with a weight of 2.4%) make up the final group of indicators with weights less than 4% each. In this context, the project duration criterion currently has the least weight, which can be attributed to two factors: (1) the NBS projects in Urban GreenUP are nearly conducted as a demonstration for the first time in our front-runner cities, therefore, most activities and phases of the project took longer to complete than anticipated, and (2) under the impact



of the Covid 19 pandemic, the project was almost stalled for 2 years, and a lot of progress was halted which must be re-done afterward.

The weighting results of 17 success criteria of the SBSC framework range from 2.4% to 10.3% with an average weight of 5.89% which demonstrated a fairly proportional distribution of weights for the criteria. The total weight across five SBSC perspective is an increasing order are 8.1% for Learning and Growth Perspective, 10.9% for Stakeholder perspective, 13.6% for Financial Perspective, 19.9% for Sustainable Perspective, and 47.5 % for Operation perspective. The Operation perspective accumulates the largest share due to the complex nature of this perspective with the largest number of criteria and relatively high weightings of these criteria (average weight of this perspective is 5.94%).

Although, currently based on the opinions of experts, the two perspectives of “Learning and Growth” and “Stakeholder”, or the group of “Project Management Effectiveness”, “Capacity Building/ Enhancement”, and “Stakeholder Commitment”, “Co-Creation, Participation and Governance” are less prioritized with lower weighting assigned. These criteria are still selected as important criteria contributed to the SBSC framework for NBS projects the beginning of the assessment process. This suggests that consideration of allocating more resources to achieve these criteria in the future implementation NBS projects could contribute to achieve higher success level of the NBS project.

4. Strategic exploitation strategy and map for NBS project:

In the previous sections of the report, we integrated network governance (formed by actors and their multi-dimensional relationships) and business model (with business canvas components) to build implementation typologies of NBS projects. Characteristics of these implementation typologies are applied to analyze and also be validated by case studies collected from demonstration experience of front-runner cities partners in our project. We also perform a deeper analysis to synthesize the challenges, values and lessons learned from stakeholders as they engage with these implementation models. Finally, we compiled an exploitation pathway table present in section 3.3 and proposed an exploitation strategy for Public and Private entities as described in the table below.

Public – Government/Municipal actors	
Planning level	<ol style="list-style-type: none"> 1. Conduct city diagnosis in which: <ul style="list-style-type: none"> - Identify all existing environmental and societal problems - Identify all opportunities (current or new) for implementing NBS - Assesses condition, capacities and skills, available resources of the city for NBS implementation - Assesses existing policy framework, regulation support NBS 1. Plan for NBS implementation <ul style="list-style-type: none"> - Develop shared visions for city/region development - Align NBS objectives with wider goals of the city urban planning and development plan - Support pilots’ projects of implementing innovative NBS - Programs and actions target stakeholders’ awareness and attraction 2. Enhance stakeholder motivation, participations and foster collaborations



	<ul style="list-style-type: none"> - Seek opportunities to support and foster cross-sector/cross—department collaboration - Provide training opportunity to enhance staff capacities - Joining NBS existing networks - Seek opportunities to connect and establish relevant stakeholders to join implementing NBS
Implementation Level	<ol style="list-style-type: none"> 1. Select NBS typology, sites, exploitation pathways <ul style="list-style-type: none"> - Assess potential zoning areas and land availability - Engage stakeholder and establish collaborating networks - Seek consultation and develop implementation plan - Conduct co-creation and market testing activities to support decision making, utilize multi-criteria assessments tools for making decisions 2. Financing for NBS <ul style="list-style-type: none"> - Estimate budget and identify all potential funding opportunities - Consider hybrid funding mechanisms 3. Procurement for NBS <ul style="list-style-type: none"> - Seeking consultation from expertise/academia on specifications, preparing documentation, assessments on bidding participants - Develop plan for procurements – be flexible and adaptive to the city framework and regulations, allowing for more time - Apply cost-effective vs innovative analysis to convince the authorities - Consider grouping procurement contracts (into themes or plots), utilizing small contract/subcontract with local suppliers, try soft-marketing test methods - Consider integration of different types of procurement processes in which utilize existing partners, in-house services, local businesses - Join NBS network to seek for potential NBS providers 4. Citizen participations and Co-creation <ul style="list-style-type: none"> - Develop co-creations/citizen participations plan from early stage of NBS implementation (estimate budget for these activities) - Enhancing higher level of citizen participation approaches rather at informing and consulting level, interactive sessions are more effective - Seek partners in citizen participation and co-creations activities for example private services, religious centers, NGO, educational institutions as local school, university - Provide support to attract more community-citizen grass roots initiatives for NBS projects - Develop tools to measure citizen perceptions and feedbacks, however, be aware that there might be controversy opinions 5. On-sites executions: <ul style="list-style-type: none"> - Good planning both before and after the execution, determine an agree timetable of works on site with clear milestone delivery dates. - Seeking support from a technical partner to efficiently monitor and manage the



	<ul style="list-style-type: none"> project, ensure regular on-site visits during execution - Regular updates and effective communications to all parties - Be aware of and prepare for unexpected problems (weather issues, modifications, objections from the citizen). - Be careful and ensure to follow safety and other regulations to limit negative impacts on surrounding neighbors, land owners - Agree payment installments post delivery - Monitor the materials on site (where to store materials, check is the contractor is responsible for ordering materials)
NBS further uptakes	<ul style="list-style-type: none"> - Consider to exploit NBS as a part of city/region development plans and strategies - Provide policy instrument to provide incentives to encourage stakeholders to implement NBS (financing support, compensations, certifications, etc.,) - Develop supportive regulations and framework enabling NBS procurements process - Develop supportive regulations and framework enabling collaboration between public and private actors to implement NBS - Develop regulations to support NBS building and zoning - Support the development of framework and tools to measure and demonstrate NBS performance/outcomes - Build NBS platforms, networks for sharing knowledge and enhancing capacity - Support connection of NBS providers and their buyers
Private and other actors as NBS	
NBS volunteer adopter, initiator	<ul style="list-style-type: none"> - Government and Municipality are key to provide supports to encourage their actions, therefore, the stakeholders should acknowledge to available funding and support for uptake NBS - Join NBS network and seek for consultations
NBS suppliers	<ul style="list-style-type: none"> - Understand market and potential pathway to sell products and services, keep update on latest innovative solutions - Enhance capacity, skills, qualities of works and solutions to be able to compete in tendering for large projects - Establish strong partnerships/networks in sector - Seeking assess to capacity building, skill development - NBS demonstration and evidence of the effectiveness - Develop and provide additional services ask advisory, consultation, management, maintenance, etc., for NBS

Table 4.1: Exploitation strategy for Public and Private entities for NBS implementation

Additionally, when working with our partner city, we learned that NBSs are often implemented as projects, and that experience in managing these projects remains a significant challenge. Consequently, an overarching strategic management framework should be proposed and shared that follower cities or



any initiator can refer to as they want to conduct NBS projects in the future. The strategic map (SBSC) for NBS is illustrated in the table below:

Finance Perspective	Project Cost/Budget	Transparent and efficient plan for cost/budget allocation Allow for a budget for the costs incurred	
	Funding Capability	Ensuring stable project funding Seek hybrid funding	
	Project Time	Clear and well-controlled project schedule/timeline Sufficient deployment plans Explicit contractual agreements about timeline	
	Intervention Feasibility	Considering existing urban-planning/greening strategies Considering the needs of residents and society Conducting comparative assessments to select interventions Considering access to suitable technical skills for NBS implementation Examining feasibility of project location and reasonable land uses	
Operation Perspective	Project Quality	Comprehensive construction zoning plans Clear division of management responsibilities Recruiting and managing a diverse team with relevant experience Selecting and supplying appropriate materials for intervention (NBS) Delivering sufficient technical requirements for intervention (NBS)	
	Project Management Effectiveness	Skills and abilities to use project management tools effectively Clearly demonstrated and systematic administrative procedures and standards (as meeting, reporting, etc.,) Conducting project risk assessment and risk management Enhancing culture of innovation and iterative learning that enables adaptive management Seek support from consultants/advisors to manage project	
	Sustainable & Optimizing Consumption of Resources	Project characteristics/goals towards sustainable development Assessing and monitoring unintended adverse consequences on the ecology Localizing NBS into urban-regeneration context Exploiting available local human resource, local actors	
	Compliance with The Legislation, Environmental, Social Requirements/Standards	Clearly understanding and complying with legal frameworks and regulations Ensuring project safety practices during NBS construction Transparent process for tendering and contractual agreements Limiting influences on health and safety conditions of surrounding areas Examining long-term development needs for NBS design and maintenance strategies	
	Project Long-Term Performance	Considering potential risky situations that damage NBS Examining reliable and consolidated framework enabling shared governance/open participatory/co-creation	
	Co-Creation, Participation and Governance	Create knowledge co-production processes to increase openness, transparency, and legitimacy of knowledge from multiple stakeholders Improve understanding of different perceptions of urban nature and utilize them Enabling cross-sectoral, inter-department, multi-stakeholders' partnerships Supporting community-based activities on greening and restoring urban green spaces	
	Environment Performance	Identifying, benchmarking and periodically assessing (NBS) outcomes and impacts on environment Enhancing creative and adaptive designs that increase NBS environment outcomes	
	Sustainable Perspective		



	Social Performance	Identify, benchmark, and assess the social challenges addressed or social benefits generated from (NBS) Enhancing creative and adaptive designs that increase NBS project social outcomes
	Economic Performance	Identify, assess and document the economic challenges addressed and the economic outcomes generated from (NBS) Identify and incorporate opportunities to enhance economic performance of NBS (more integrity and connectivity) Building an NBS economic value assessment framework to support cities in economic valuation
Stakeholder Perspective	Stakeholders Satisfaction	Considering and prioritizing most pressing social challenges for the right-holders and beneficiaries Understanding the needs and challenges to support land owners/adopters Identifying opportunities to increase attractiveness of project (toward lenders, vendors, real-estate businessmen and end-users)
	Stakeholders Commitment	Communicating to wider public and get positive support from society Communicating with contractors to effectively plan and monitor implementation difficulties Supporting of multiple levels government
Learning and Growth	Knowledge Sharing	Documenting and sharing knowledge, experience and innovative practices, lessons learned to trigger transformative change Investigating and continuously improving the tools and models that facilitate NBS implementation Documenting and sharing hybrid governance arrangement to enhance policy and regulation frameworks that support NBS uptake
	Capacity Building/ Enhancement	Constructing skills training sessions and open sharing platforms Forming and maintaining a governance network to enhance further NBS uptake

Table 4.2: Strategic SBSC map for managing NBS projects



5. Conclusion:

The implementation uptake of NBS can bring multiple environments, social and economic benefits to cities and citizen. The NBS are often launched as an integrated large project that combined several exploitation pathways. However, NBS and NBS projects are complicated compared to traditional environmental actions. Implementing and managing such NBS project is challenging since they require unconventional knowledge and skills, while numerous issues might arise if no an overarching strategy in place to manage such projects. Therefore, innovative governance approach, business model, new approaches to stakeholder engagement, co-design and co-implement, lesson learned from practical experience are encouraged to future NBS uptake. In addition, to monitor such innovative projects, it is crucial to present a strategic management framework with a list of recognized success criteria and critical success factors.

Draw on the foundation of previous work and aligning with objectives of the projects, we built a framework to examine implementation typologies of NBS in urban context. We also collected data of case studies from Urban GreenUPs demos and applied the framework to analyze, the case studies also help to validate the framework. Finally, the report takes closer look at the actor-network of each NBS implementation typology to identify values and challenges of different stakeholders while participating in different roles in different types of implementation projects. The results suggest recommendations and strategic approaches facilitating future NBS implementation.

Through work package 7.9 we propose practical implementation typology which integrated both governance and business components, NBS exploitation strategy for public and private entities and strategic map to successfully carried NBS projects in urban context.



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