URBAN GreenUP

D7.8: Report on the Market Opportunities in European and Non-European Countries for Nature-based Solutions

WP 7 , T 7.4 Global market opportunities and international cooperation

Date of document

ORIGINAL – 21st August 2022

Author: RMI

URBAN GreenUP

Technical References

Project Acronym	**URBAN GreenUP**
Project Title	New Strategy for Re-Naturing Cities through Nature-Based Solutions – URBAN GreenUP
Project Coordinator	Raúl Sánchez Fundación Cartif rausan@cartif.es
Project Duration	1 June 2017 – 31 May 2023

Deliverable No.	D 7.8
Dissemination Level	PU
Work Package	WP 7 – Exploitation and market deployment
Task	T 7.4 Global market opportunities and international cooperation
Lead beneficiary	RMI
Contributing beneficiary(ies)	UBO, VAL, LIV, IZM, BIN, SPI, CAR, LUD
Due date of deliverable	M72 – May 31st 2023
Actual submission date	
Submission date of REVISED version	
Submission date of FURTHER REVISED version	
Estimated person-month for deliverable	5

[1] PU = Public

PP = Restricted to other programme participants (including the Commission Services)

RE = Restricted to a group specified by the consortium (including the Commission Services) CO = Confidential, only for members of the consortium (including the Commission Services)

Versions

Version	Person	Partner	Date
V1	Duc Trinh Tran Ha Jenny Tran	RMI	21 August 2022
V2	Vicki Little	RMI	20 Feb 2022
V3	Robert McClelland	RMI	10 March 2023
V4	Duc Trinh Tran	RMI	15 April 2023
V5	Ha Jenny Tran	RMI	28 April 2023
V6	Robert McClelland	RMI	3 May 2023
V7	Robert McClelland Vicki Little Duc Trinh Tran Ha Jenny Tran	RMI	24 May 2023
V8	Duc Trinh Tran	RMIT	27 May 2023
V9	Robert McClelland Vicki Little Duc Trinh Tran Ha Jenny Tran	RMIT	31 May 2023

Table of Contents

LIST OF TABLES

LIST OF FIGURES

1. Executive Summary (under construction)

Over 70% of European populations reside in urban areas. However, extreme weather events and sea level rise are disrupting infrastructure, increasing pressure on public and private stakeholders to address the effects of climate change. Nature-based solutions (NBS) offer a way forward: ***"[social and biological systems] 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."*** . (Sowińska-Świerkosz & García, 2022). NBS comprise products and services (e.g., floodable parks, green roofs, urban farming), that confer environmental, social, and economic benefits including biodiversity gain, human well-being, climate change mitigation, and 'green' jobs (48 types of NBS in 14 categories - Appendix 1).

While NBS offers considerable promise, insight into its market potential, and the drivers and barriers to adoption of NBS at scale is lacking. To support consensus building, the purpose of task 7.8 under WP7 is to **identify and analyse the market opportunities for NBS**.

To achieve that purpose, the report draws on primary and secondary research in six participating cities in the Urban Green-Up program, D 7.8: **Liverpool, Izmir,** and **Valladolid** (front-runner cities) and **Mantova, Ludwigsburg,** and **Medellín** (follower cities); and on the academic and grey literature. Primary data sources included an online survey of 45 NBS stakeholders and eight in-depth expert interviews. Secondary sources included on-line media reportage, websites and publicly available company information. Analysis produced detailed case summaries for each city (Appendix 5).

Key market insights:

- NBS offers political and practical challenges to implementation:
    - Politically challenging – as a **systems intervention** NBS requires understanding of wider context (country, city and community), dynamic social structures and stakeholder power relations between policy makers, business interests, and citizens; as a c**omplex B2B purchasing decision** NBS decisions involve multiple participants including gatekeepers, influencers, deciders, specifiers and end-users in both public and private sectors.
    - Practically challenging - the core benefit is biospheric and social services. As a **sustainability-oriented innovation** (SOI), NBS is transformative vs reinforcing and therefore potentially challenging to system incumbents. In nature NBS is **both a product** (material, tangible) **and a service** (intangible, variable, perishable, inseparable from provider). NBS is thus a potentially controversial and complex set of tangible and intangible benefits, delivered and maintained through sets of novel technical and physical resources and capabilities;
- The most attractive NBS market opportunities world wide are …
    - European
    - Non-European
- Drivers and inhibitors of NBS market growth:
    - Drivers: Resources and competencies …

- Inhibitors: Lack of public-private partnership building, low capabilities in maintenance of NBS post-implementation, and immaturity of independent NBS projects.

Strategic recommendations:

1. Mass customization of products and services
2. Sharing and collaboration
3. Make resources available to all stakeholders

2. Introduction

1.1. Purpose and target groups

WP7 of the Urban GreenUP project focuses on the exploitation and market deployment of NBS, **with the purpose of identifying and analysing market opportunities.**

Specifically, sub package 7.8 studies the market opportunities for NBS in both European and Non-European cities. Drawing on primary and secondary research and both academic and grey literatures, this deliverable presents:

1. An assessment of NBS market opportunities in European and Non-European cities, including size and scope of markets worldwide;
2. Identification of factors essential to NBS market growth presented in a market opportunity analysis framework;
3. Insights into prominent NBS projects in Urban GreenUP cities based on expert interviews;
4. A set of strategic recommendations for implanting and diffusing NBS into urban environments. based on this research.

Key audiences for this report are the partners of the Urban GreenUP (UGU) project, front-runner and follower cities. Additional audiences are NBS stakeholders in other cities and their technical and business partners.

First, this report focuses introduces the concept of NBS and NBS markets. Next, it presents insights from the literature on market configuration, culminating in a conceptual framework for the NBS market. Third, findings are presented from research assessing current NBS market opportunities in front-runner cities of the Urban GreenUP project. Finally, a set of strategic recommendations are presented.

1.2 Contributions from other partners

Partner	Contribution
RMI	Researching NBS market opportunities in front-runner cities of the Urban GreenUP projects Devising methodology for research of D7.8 Distribution, collection, and analysis of survey and interview data for D7.8 Overall D7.8 coordination and writing
UBO	Definition of the deliverable structure Input on Stakeholders, Methodology, Survey questionnaire
Front-runner cities	Coordination of survey distribution and interview planning Provision of secondary data for analysis

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.
UBO	WP7	Exploitation and market deployment
LIV, VAL, IZM, MED, LUD, MAN, BIN, SPI	WP6	Replication and city clustering Coordination of survey distribution and interview planning Provision of secondary data for analysis

3. Nature-based Solutions

Urban greening has a centuries-long history of public investment, including initiatives such as botanical gardens and street planting. However, more recently, the climate emergency has highlighted the practical benefits of living elements in urban infrastructure. Consequently, NBS have emerged as a promising approach to supporting increased environmental and social sustainability in urban areas, supporting the United Nations' sustainable development goals (SDGs).

Approximately 70% of the current European Union population reside in urban areas (Catalogue D 1.1). Increasing building and population density has consequences for social wellbeing, and for the delivery of ecosystem services. While positive outcomes of compact urbanisation include increased economic efficiency from improved productivity and greater access to jobs and services, these can be outweighed by negative social and environmental outcomes including overuse of water, congestion, increased housing costs, and degradation of air quality. [1] Urban dysfunction has significant implications for social cohesion, and therefore for the sustainability and economic viability of cities. Consequently, interest in NBS is increasing, in view of the potential to address the negative consequences of urbanization. The evidence suggests that well implemented NBS can offer both social and environmental benefits, for example, during the COVID-19 pandemic, NBS had positive impacts on mental health, and reduced the recovery times of COVID patients.[1]

2.1 Definition

Drawing on a recent meta-analysis [2], this report conceptualises nature-based solutions (NBS) as **systems interventions**; a set of tools and techniques aimed at mitigating and adapting to climate change and building social and environmental resilience.

Previous approaches (e.g., International Union for the Conservation of Nature (IUCN)) define NBS 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 benefits" [3].* However, the ICUN definition has a wide scope, and is difficult to operationalise. Therefore, this report adopts (Sowińska-Świerkosz & García, 2022)'s definition of NBS:

> ***"[social and biological systems] 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."***

Notably, in marketing terms, NBS take material form in specific 'products' (e.g., floodable parks, green roofs), however the environmental, social, and economic benefits are more or less intangible (e.g., biodiversity gain, human well-being, climate change mitigation, 'green' jobs).

2.2 Applications of NBS

In cities, in the wider domain of climate change SDG (Sustainable Development Goals) #12 Climate Action) NBS offers the potential to mitigate the effects of climate change through reduced greenhouse

[1] Interim Report, W.P. 7.4.

gas (GHG) emissions and provision of additional carbon sinks, and to provide adaptive capacity to the effects of climate change.

Well designed and implemented NBS interventions offer the potential to address challenges including:

- Environmental: water management (flood risk, water scarcity and water quality); coastal resilience to extreme weather events; green space management (support for urban biodiversity, ecosystem services, habitats for species, connectivity); air quality (removal of air pollutants and carbon dioxide, reducing air temperature, increasing oxygen concentration);
- Social: urban regeneration and city resilience; participatory planning and governance supporting the interests of citizens; social justice and social cohesion through opportunities for urban community interaction; public health and well-being through positive psychological and physiological benefits; and
- Economic: opportunities through increased real estate values, and job creation through 'green' business and 'green collar' jobs associated with developing, installing, and maintaining projects.

Catalogue D 1.1 describes 48 types of NBS in 14 categories ranging from green routes to urban farming (Appendix 1).

3. The Market for Urban Nature-based Solutions

3.1 Considerations in developing NBS value propositions

NBS are a set of products and services deliberately introduced into an existing, larger system, in this case a particular city's social and environmental infrastructure. Four important implications arise for design and implementation of marketing strategy: (1) NBS is a systems intervention introduced into a complex social structure with stakeholders including policy makers, business interests and citizens; (2) NBS has attributes of both a product and a service; (3) NBS is a sustainability-oriented innovation; and (4) NBS is a complex business to business (B2B) purchasing decision.

First, an **effective systems intervention** must take account of the wider political, economic, social, technological, environmental, and legal context in particular situations – country (macro), city (meso) and community (micro). Each context has its own set of goal-seeking stakeholders with norms, values, motivations, and preferences; who can be classified as incumbents, challengers, and regulators.[4] It should not surprise us when tensions and conflicts arise, as some will prefer their own set of solutions, and others with a stake in the status quo will resist systems change in ways that are difficult to anticipate. Equally, systems have complex feedback mechanisms and permeable boundaries, resulting in unanticipated outcomes. In short, in complex social systems, both structural and behavioural attributes matter [5].

System stakeholders include diverse groups of influencers, decision makers, specifiers, purchasers, and end users. NBS decision making involves large numbers of separate groups of stakeholders who implement and/or benefit from NBS solutions, and who are likely to have different (and conflicting) perspectives, motivations, and preferences, for example:

- City councils and municipalities may be sponsors or co-investors in NBS seeking to futureproof their cities e.g., addressing heat islands, water pollution, air pollution and creating a more liveable/desirable city for citizens.
- Businesses may design, implement, and maintain NBS, e.g., utilities management companies, architectural practices, environmental consultants, and landscape maintenance firms. In the construction sector both large corporates and SMEs (Small and Medium sized Enterprises) may benefit either as building owners (e.g., invest in green roof, green façade) or as suppliers e.g., installation and maintenance, growing and planting of trees, smart soil providers.
- Citizens and local communities may benefit directly from the result of NBS as individuals (e.g., harvests from urban gardens, employment in maintenance) or in aggregate from enjoying a more liveable city with aesthetic green and blue spaces, opportunities for recreation and rejuvenation, and cleaner air. 'Front end' participants (those who control the physical installation site (e.g., a coastal area, wetlands, a building, a public walkway), those directly involved in design, installation, and maintenance) and 'back end' beneficiaries (e.g., citizens, future generations, non-human actors) are critical stakeholders in the decision-making process.

Perceptions and needs of all stakeholder groups must be considered when designing, delivering, and communicating NBS value propositions to gain initial and on-going public support, and to realise ROI.

Second, we characterise NBS' core product benefit as **biospheric and social services** (e.g., cleaner air, more reliable pollination, improved mental health). Realising these benefits from NBS investment requires **orchestration of both products and services.** The 'product' is the material artefact; **48 types of NBS interventions** (Appendix 1). Supporting those interventions requires **sociotechnical skillsets** (political, engineering, and ecological), enabling initiation, design, installation and maintenance. NBS is thus a complex set of tangible and intangible social and environmental benefits, delivered through an equally complex set of technical and physical resources and capabilities. Successful orchestration of these resources and capabilities is required to realise the benefits from NBS investment.

Third, NBS is a **sustainability-oriented innovation,** I.e., one that is directed at transforming current systems to more sustainable forms. Thus, NBS competitors are both direct (other NBS solutions) and indirect (the current unsustainable status quo). The status quo features 'tried and true' solutions; the traditional (grey) infrastructure that NBS may displace or supplement e.g., concrete and steel roofs, traditional lined drainage systems, surface water storage, and grey water recycling systems. NBS critiques these solutions by implication. As the services infrastructure solutions provide are public and essential, failure of either conventional or NBS is visible and consequential. As a new and (to some) threatening approach to urban infrastructure, NBS will therefore be viewed as riskier; therefore, NBS is likely subject to a larger burden with respect to proof of concept and value delivered.

Finally, the **NBS purchase decision process is complex**. B2B purchasing involves a **buying group,** consisting of public and private decision makers (who sign off), economic buyers (who approve funding), purchase initiators (who notice a need), purchase influencers (who can offer technical advice or wield soft power), end users (who benefit from the purchase), and gatekeepers (powerful but often overlooked individuals who can allow or deny access to decision makers). In designing and developing NBS projects, the needs, and motivations of stakeholders in each of these roles should be considered (Appendix 2).

3.2 Market size

We characterise NBS as part of the fast-growing green technology and sustainability market, located within the wider infrastructure and construction market, valued globally at **USD10.32 billion in 2020,** and projected to reach $74.64 billion by 2030. [3]

Finance Earth identified over 200 NBS transactions, of which 88 met the report criteria where repayable investment has been delivered (Table 1). These transactions represent a total combined value of approximately $1.5 billion equivalent, covering investments occurring from 2002 to 2021.[3]

Models	Revenue streams/ benefits	Activities
Sale of Product and Services (91%)	Commodities	Sales of physical commodities. Largest volume, often linked to established commercial markets. Traditional, perceived to be less risky, however do not deliver high-quality NBS. Can create negative consequences (see discussion below).
	Ecosystem services	Sale of carbon offsetting credits (34% of the transactions), most usual form of ecosystem service identified, often combined with other revenue streams to ensure a viable business case.
	Other services	Rental income – payments to property owners for use of land/property Access/ entry fees – ecotourism, area management - key source of income. Supports nature conservation, creates tourist offering and livelihoods for local communities.
Cost reduction (9%) *Users/ecosystem service beneficiaries invest to reduce operating or capital costs*	Corporate cost savings	Resource-based organisations reliant on natural resources to achieve consumer objectives (e.g., water providers). NBS can provide more cost-effective production solutions vs traditional/grey. Environmental impact bonds (EIB) mechanisms can manage performance risks
	Public grant funding, philanthropic cost savings	Significantly smaller pools vs repayable capital; investors prefer risk-free outcomes. EIBs (Environmental Impact Bonds) can produce target outcomes while reducing upfront risk to the funders and donors (see example).

Table 1: Business models, financial sources & activities in global NBS markets (Source Curran et al., 2021[3])

3.3 Summary

In sum, NBS is a rapidly emerging global innovation market, with an expected size of $US75 billion by 2030. Market participants are public and private sector stakeholders, each with their own goals and motivations, meaning that conflict between stakeholders is to be expected. New and emerging markets are shaped by dominant players (for example dominant political players such as the European Union (EU)), and by market activity including technology innovation and social reaction. The NBS market is currently in this situation of market plasticity[6] .

NBS providers should acknowledge the nature and characteristics of NBS (a systems intervention, a SOI, a complex offer comprised of both material and immaterial elements), and that NBS is a complex B2B purchasing decision in the public-private sphere, with both practical and political implications.

Implications:

- For each NBS application, research is required to develop deep understanding of the needs and motivations of multiple buying decision participants, and their decision journey;
- Public-private partnerships are required to co-develop desirable, feasible, viable and ethically acceptable value propositions;
- Solutions should be co-created; developed through repeated consultation with stakeholders at all levels in both the public and private sector.

- The EU and similar dominant players have an important role to play in market shaping.

With those over-riding considerations in mind, the report proceeds by presenting the findings of stakeholder research.

4. Data collection, analysis, and findings

This section presents results from a survey of stakeholders in Urban GreenUp cities and cluster of cities established as part of the dissemination of project results. The survey was supplemented by eight in-depth interviews with NBS public policymakers and experts in leader and follower cities, and one with a policy expert in the USA.

4.1 Data collection

The survey questionnaire was initially developed by the team at RMIT University Vietnam for the Interim 7.8. report in conjunction with consultations from the team at the University of Bocconi. The initial draft was later refined for organization and additions of necessary details about the opportunities and barriers of the NBS market in each city. The process of refinement lasted approximately 6 months prior to beta-testing processes. The final instrument was pre-tested among the research team at RMIT and Urban GreenUP team in the University of Bocconi to ensure each item was relevant and clear. Then it was translated from English into 5 additional languages including Spanish, Turkish, Italian, Vietnamese, and German. Each version in different languages was pre-tested by the Urban GreenUP representative contact in each flagship city. The questionnaire was administered by Qualtrics and distributed via email provided by the Urban GreenUP project representative in each leader and follower city. Appendix 3 provides the detailed text of the distributed survey and Table 2 shows the detailed summary statistics on the demographic characteristics of survey respondents.

Attribute	% of Sample
Gender	
Female	41%
Male	52%
Prefer not to say	7%
Location	
Liverpool, UK	11%
Valladolid, Spain	7%
Mantua, Italy	15%
Medellín, Colombia	11%
Other cities (Europe, rest of world)	56%
Profession	
Public Administrator	27%
Technician	18%
Consultant	4.5%
Researcher	15.6%
Manager	13.3%
Private sector	17%
Public sector	49%

Academia & NGO	18%
Other professions	6.7%
NBS engagement	
Has authority over adoption of NBS	35.6%
Has experience working with NBS	98%

Table 2. Survey respondents by demographic characteristics

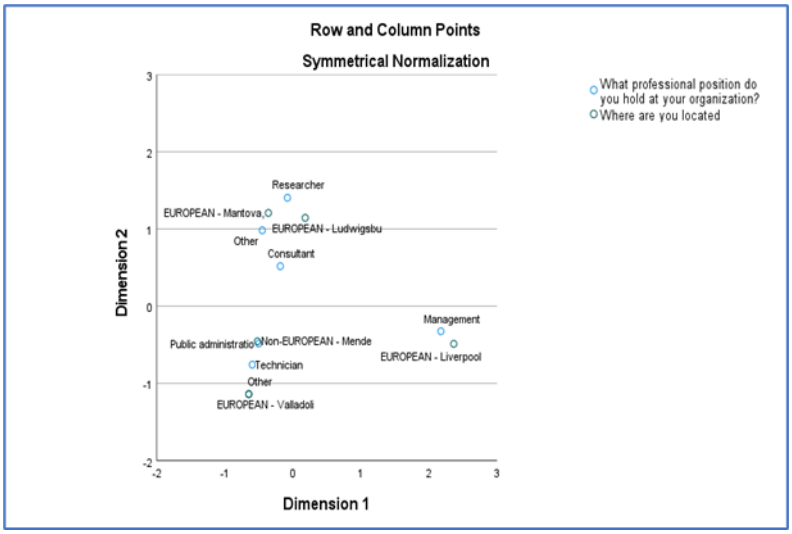


Figure 1. Description of respondents in locations and professionals

To add depth and insight, semi-structured online interviews were conducted with opinion leaders in frontrunner and follower cities (Table 3). Interview topics reflected the views of NBS experts about the top line survey results, and the global outlook for NBS (see interview guide, Appendix 4).

CODE	City	Role, Professional Affiliations	Area of Expertise	Duration Hrs:mins
LU-01	Ludwigsburg	Climate Adaptation Coordinator	Climate change, Climate Adaptation	00:29:25
MA-01	Bocconi (Mantova)	Junior Fellow, Green Center for Research on Geography, Resources, Environment, Energy and Networks	Public Policy, Urban/Rural Sociology	00:33:34
VAL-01	Barcelona	Principal Researcher	Water Science, Waste Management, Microbiology, Limnology, Ecology, Hydrogeology	00:28:19
LIV-01	Liverpool	Senior Project Manager	Ecosystem Management in Navigated Waters	00:24:39
IZ-01	Istanbul	Managing Consultant	Smart solutions, corporate carbon management, urban scale sustainability strategies and actions	00:28:52

VAL-02	Alicante	Architect	Architectural Design	00:30:54
VAL-03	Valladolid	Built environment, architect	Habitat and Efficient Construction	00:45:15
DC-01	Washington D.C. (District of Columbia)	Adjunct Professor, Former US State Department Diplomat	International Climate Negotiations, U.S. International Climate Engagement, Environmental Quality, Conservation, Water and Global Climate Change	00:39:58
Total				**4 hrs 20m**

Table 3. Detailed summary of interviewee profiles, location (coded interviewee field for anonymity)

In addition to the six leader and follower city interviews, two further expert interviews were undertaken to provide insight into policy and climate issues: (1) A leading built environment architect in Spain; (2) A climate negotiator in Washington DC. Interviews were recorded and transcribed in English where possible, or in the native languages of the participants, then translated into English by a research assistant fluent in both languages.

4.2 Data analysis

Survey data was imported into a Microsoft Excel spreadsheet and into STATA 17 for data analysis. Survey responses with missing values for all variables were removed and each variable relabelled using STATA. Then initial data cleaning was undertaken to identify replications and observations with many missing values. A summary statistics table for each relevant variable was produced.

Interview transcripts were read and reread to ensure familiarity. Results are reported in four categories: (1) NBS status, (2) NBS strengths and weaknesses, (3) perceived opportunities and threats for NBS, and (4) recommendations. These results are condensed and written as case summaries for each city to highlight relative strengths and weaknesses; and to identify opportunities and threats (Appendix 5). These descriptive summaries draw on interviews and survey data, and secondary data including the academic and grey literature; and include a collage of flagship NBS images for each city based on interviewee mentions.

We summarise the seven cities as follows:

City	Type	Population (000s)	Flagship projects
Liverpool, UK	Frontrunner	500	Baltic Corridor, Green Walls/Green Facades (commercial district, Jericho Lane/Otterspool)
Valladolid, Spain	Frontrunner	300	Esgueva River Park
Izmir, Turkey	Frontrunner	4367	Parklets in the local Karşıyaka district
Mantua, Italy	Follower	50	Urban Forests of Mantova

Ludwigsburg, Germany	Follower	94	Mobil Green Room
Medellín, Colombia	Follower	2569	The Green Corridor Project
Quy Nhon, Vietnam	Follower	460	Mangrove Forest Parks

Table 4. Summary of leader and follower cities by population and NBS applications

5. Results and problem statement

Table 6 presents survey results ranking buyers for NBS in Urban GreenUP cities (by ranking: 1- most likely to be an NBS buyer, 8-least likely to be an NBS buyer):

Variable	Mean	Std. Dev.	Min	Max
Urban Planner	2.346	1.294	1	5
Ecological Manager	3.5	1.631	1	7
Public Authority	2.038	1.311	1	5
Private Developer	4.077	1.495	1	7
Construction Sector	4.462	1.581	1	7
Businesses for CSR	5.423	1.172	2	7
NGOs	6.154	1.642	1	7
Other	8	0	8	8

Table 5. Summary of NBS buyer likelihood in Urban GreenUP cities

The most likely potential buyers of NBS are public authorities, urban planners, and ecological planners, followed by private sector and private developers. NGOs and businesses for Corporate Social Campaigns (CSR) are the least likely to adopt NBS voluntarily.

- NBS Status:

Most experts felt that citizens were aware of NBS, but did not support implementation (mean response 2.5, “Somewhat Disagree”). They “somewhat agreed” that there was green infrastructure in their cities and that ecosystems were conserved. These results support interview results emphasizing progress in NBS awareness-raising and implementation; and at the same time doubts about citizen support for wide-scale implementations of NBS.

Most respondents define NBS as either a product or service, with a few perceiving NBS as packaged solutions for products and services. Out of all forms and typologies of NBS, green infrastructures are the most prevalent, followed by ecosystem management and protection tools. Blue-green infrastructures are the least mentioned.

- Competitiveness:

Most considered NBS more competitive than traditional solutions owing to health and aesthetic benefits. Some felt that NBS were more competitive due to implementation ease and low cost of initial set-up/implementation.

- Barriers and difficulties of NBS implementation:

Most significant vs traditional solutions were management difficulty, high investment level, low competitiveness, lack of implementation guidelines, and difficulties in the implementation process. Least significant were technological difficulties and public pushback. Overall, NBS stakeholders reported problems with management and maintenance of NBS projects, further confirmed in the interviews.

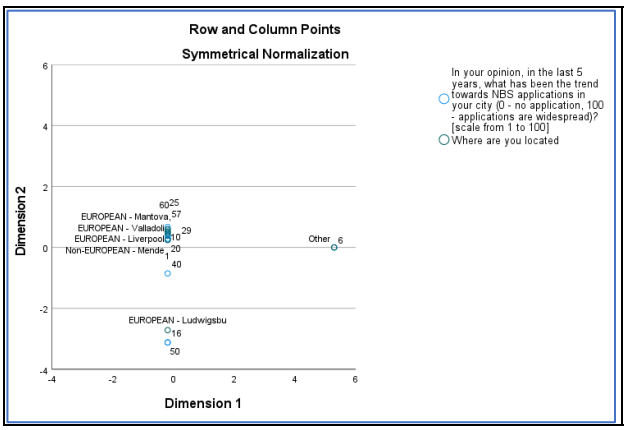
- Ability to improve the status quo:

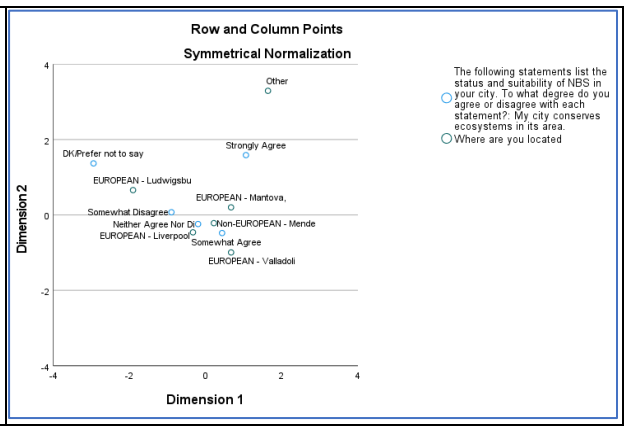
NBS have augmented climate change adaptation and mitigation efforts in Urban GreenUP cities, with respondents reporting improved air quality, restored biodiversity, reconnected urban ecosystems, assistance with green space management, increased green mobility, resolution of heat island problems, enhanced local food production, regenerating urban atmospheres, and advanced water management systems. However, NBS was not seen to influence coastal resilience. This might be due to sample limitations but is worth noting for future research.

- On opportunities of NBS:

Based on the average survey response, NBS can improve economic opportunities and green jobs, public health and well-being, and social justice in cities. There is a demand for more governance guidelines and regulations regarding NBS to further encourage implementation and expansion of existing NBS projects. Finally, all respondents agree that their cities are conducting renovations across all infrastructure projects, which provides an opportunity for NBS implementation on these sites.

The average market growth trend perceived by expert respondents over the past 5 years have been 36 percent (considering two years affected by the COVID-19 pandemic, 2020 and 2021). This means there is a positive horizon for the growth of the global NBS market, despite the global consequences of the pandemic on various fields of business.





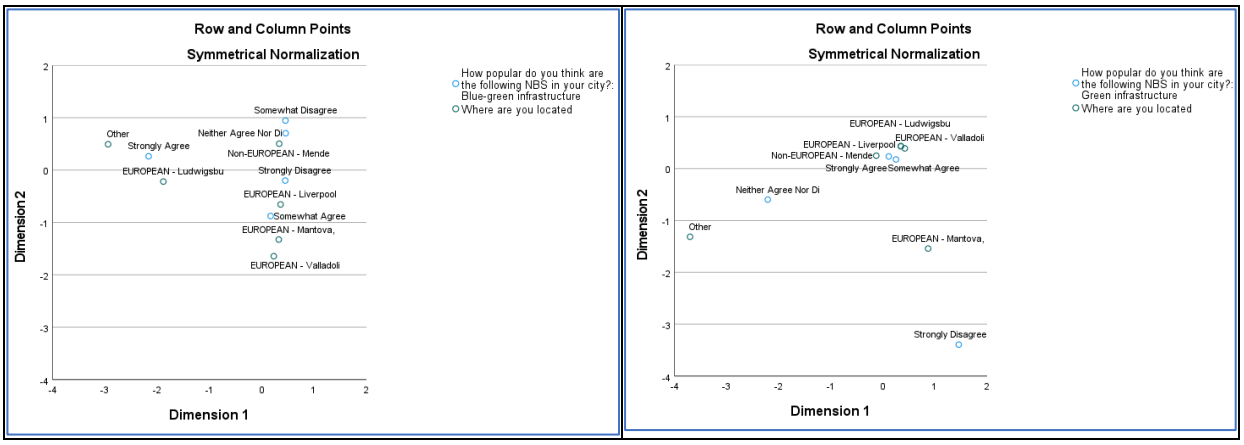


Figure 2. Multidimensional plots of the NBS market perception linked with cities background on infrastructure

NBS Market: Mantova is the city with the highest perception of market growth, followed by Valladolid and Liverpool. Cities with the lowest perception of market growth over the past 5 years are Medellín and Ludwigsburg, clustering (-2) SD from the average growth rates. The plots also indicate that EU cities are more likely to perceive growth than non-EU cities. Cities with higher growth rates are also more likely to adopt green infrastructures, blue-green infrastructures, and conserve ecosystems, which creates significant opportunities for NBS market growth.

4.5. SWOT analysis of cities with regards to NBS uptake and market development

Summary of city strengths and opportunities

City	Strengths	Opportunity
Liverpool, the U.K.	• Coordination capability • Social cohesion - sampled communities are willing to work with public entities in maintaining and implementing NBS • Successful Implementation • Project leadership capabilities • City has shown strong commitments to implementing and promoting NBS	• Develop strong public-private partnerships - transnational with other firms with resources • Integrate NBS with infrastructure projects & educate infrastructural professionals on roles of NBS • Elevated levels of civic engagement • Bridge the expectations gap between technician and citizens • Lack of regulation / policy • Lack of citizen awareness - opportunity to communicate more effectively
Valladolid, Spain	• High levels of citizen awareness • People are highly receptive of the current demonstrations	• City experiencing extreme weather events (heavy rain, flooding,

	and want to see how they can bring it home • Strong government commitment: City has small grants for NBS implementation for citizens and companies	heatwaves, etc.) making it unliveable • Lack of willingness to pay in parts of city without demonstration - > open an opportunity for further awareness-raising/demonstrations • Detailed/technical information demand from citizens
Izmir, Turkey	• Climate change adaptation plan • Ready technology and technical professionals for NBS implementation • The nation and cities themselves have NBS awareness and information campaigns • Education Department working on integrating NBS, climate change, climate adaptation into the national curriculum	• Lack of citizen awareness about NBS and their functions • Lack of private demands for NBS • NBS has been well-received among selected communities - needs to be communicated and marketed in other areas / communities with lower socioeconomic levels • Entrepreneur efforts need funding and support
Mantua, Italy	• Existence of projects dedicated to NBS development • Government involvement in long-term sustainability and climate adaptation planning • Salient, acute climate issues that drives actions from government and citizens • Growing population and high rates of urbanization • Upcoming infrastructure projects • Popular consensus that NBS are beneficial and necessary	• Increase awareness on what NBS can do to improve health and overall wellbeing • Private firms/citizens/universities willingness to establish partnership and sponsorship to implement NBS • Ecosystem services • R&D increased engagement • Increase urban/rural connection reinforcement • Infrastructure projects to build new green areas
Ludwigsburg, Germany	• High levels of citizen awareness • People are highly receptive of the current demonstrations ->	• City experiencing extreme weather events (heavy rain, flooding, heatwaves, etc.) making it unliveable • Lack of willingness to pay in parts of city without demonstration -

	want to see how they can bring it home • City has small grants for NBS implementation for citizens and companies	> open an opportunity for further awareness-raising/demonstrations • Detailed/technical information demand from citizens
Medellin, Colombia	• Technological readiness • Private firm engagement	• Information campaign to raise awareness • Visibility enhancement • Regulation on corporate social responsibility

Table 6. Summary of NBS related status, opportunity for NBS implementation and market

4.6 NBS market opportunities for other EU and non-EU cities

4.6.1. Status of NBS market EU and non-EU

Context of NBS markets

At the global and European level, NBS have become increasingly important as part of the solutions for the climate change adaptation where NBS support major EU policy priorities [7, 8] which include the European Green Deal and its action plan on climate-proofing, resilience-building, prevention and preparedness [9]; the EU Biodiversity Strategy—including the Commission's GI Strategy—aims at restoring and protecting nature (biodiversity and ES) and promoting GI in Europe to build resilient societies [10] ; and the EU Adaptation Strategy. Thus, NBS have become prominent in international policy and business discourse on climate change, social resilience, and market development.[11, 12]

At the cities level, cities have form different alliances to leverage peer support in the climate adaption and mitigation plans in which NBS play a significant role in city funding to address flood protection, water management and urban planning.[13] Among those action plans, large municipalities fund adaptation locally, whereas international and national funding is more important for adaptation in less urban or densely populated territories. About 80% of cities with >500,000 inhabitants have mitigation and/or adaptation plan. [14-16] Differing patterns of adaptation plan and adaptive capacity were identified among European regions. Reviewing of different cities climate adaptation plan and mitigation strategies highlight the integration of NBS in those plans at the urban level as one of main steps in the best practice guide. [17]

Since 2008, The German Green Roof and Wall Association (Fachvereinigung Bauwerksbegrünung FBB) has been constantly monitoring trends that show a market increasing by an average of 5% per year. Across Austria, Switzerland and Germany, a minimum of 10.3 million m^2 of green roofs are installed each year, driven by regulations and policies and the efforts of around 200 small to medium sized enterprises [18]. The NBS market in general may not behave as well as the green roof example across cities in Europe and non-Europe context, as it is applicable to Australia, Germany, and Switzerland only where there were strong policy, incentive, and guideline for the development of the solutions as part of federal, and state programme in those countries.

Individual NBS market (such as green roof) has been more or less well define in the segment and its market because it has been introduced two decades ago and there has been established guideline, standard to support that. However, NBS as a system intervention targeting urban problem (heat island, water management, noise, pollution, urban regeneration…) is just recently get more attention and start to form as a market need from public authorities, organizations, and citizen. NBS as system interventions must consider different functions of NBS and the technological, social, and regulatory characteristics of the interventions zone and broader in the city area. Survey results in European cities and non-European cities from a broad professional background shown that there is a positive correlation with the answer on NBS needs with the worsening of climate change, environmental issues at the cities; cities facing climate change outcomes are 15% more likely to have already adopted NBS in urban settings.

Expert Perception of the NBS market – insights from survey

- Inside vs. Outside Europe: Responding to the question of the growth in the NBS sector in the past five years, there is a small difference in the perceived growth inside versus outside Europe respondents. Respondents within Europe perceive that the market grew by 39.1% over the past five years compared to 34.3% from respondents outside of Europe. Difference not statistically significant based on t-test.

Variable	**Mean**	**Std. dev.**	**Min**	**Max**
Outside Europe				
Market growth over the past 5 years	34.27778	18.95755	1	70
Inside Europe				
Market growth over the past 5 years	39.09091	22.25513	6	70

- By field of business: Respondents from NGOs and Academia perceive the highest growth in the market for NBS. The public sector, including the government and SOE (State Owned Enterprises) perceive the lowest growth rates.

Market Growth over the past 5 years	**Mean**	**Std. dev.**	**Min**	**Max**
Private Business/Companies	39.2	26.32869	10	70
Public Governments	35.75	19.6384	1	70
State-owned Enterprises	25	5	20	30
NGO/Professional Association	57	.	57	57
Academia/R&D	47	15.71623	30	61
Other	6	.	6	6

- By expertise: Respondents with NBS training perceive an average lower market growth rate in comparison to respondents with no NBS training.

Received NBS training	Mean	Std. Dev.	Min	Max
NBStrain = Yes				
Market growth	34.174	20.270	1	70
NBStrain = No				

Market growth	43.500	18.802	10	61

- By Authority levels: Repondents with significant authority tends to perceive the highest growth rates for NBS market (in percentage).

Authority Levels	Mean	Std. Dev.	Min	Max
Final Decision-making				
Market growth	16	16	16	16
Significant Decision-making				
Market growth	41.846	21.295	6	70
Minimal Decision-making				
Market growth	28.889	18.644	1	65
No decision making role				
Market growth	37.833	18.324	20	61

NBS market growth per the respondent for the question on the perception on NBS show that there is general agreement that NBS market is growing. While this is a positive perception of all the respondents, the message and number should take into account that as the people have some how familiar with the NBS project and Urban GreenUp and other under the Horizon, this has a tendency of thinking NBS growing on the background of many NBS implementations in those cities, and projects. The perspective maybe different with other cities that haven't had much exposure to NBS demonstrations. This has an implication for other cities when considering NBS project as the market growth would not be automatically happen. Without proper awareness, understanding and benefits of NBS examples for citizen, politicians then the market development may not have the same as cities under Horizon demonstrations. In addition, taking into account the growth of the green roof report as (5% increase per annual), then the percentage of growth rate under the survey here may have been a little sanguine. Again, it can be attributed to the fact that those cities and respondents are having much more experience with NBS thus their responses are very positive.

- Market segments available:

Market opportunities show existed in European surveyed cities where there are needs from public, organization and cities and the providers ranging from construction, technological, developer and NBS innovative companies (for very tailored made NBS). Overall, from the survey and respondents' interview there can be classified into different market opportunity that can be taken up further for cities in Europe and outside Europe as well. Experience from Urban GreenUP showing however, there is requirements from the technological readiness of the adapted NBS solutions (some of the solutions can be at the level of mass production, green wall, green roof), but other (Valladolid case) will required further technological level, skill, design, and implementation experience. The market for NBS can be classified into several parts as following:

1. The NBS which is ready for mass production on the level of individual and small intervention such as green noise barrier, green wall having the highest market potential and demand based on the interviews because of its popularity, readiness for installation and easy to scale up. Cities can easily support the initiative with minimal investment in those solutions and citizen can replicate by themselves with proper guideline and incentives.
2. NBS which requires technological skills and design site specific, tailor made NBS solutions (such as the green hanging system in Valladolid, the floating island in Liverpool). Those NBS will require specific design and further adaptation for the local conditions thus the demand is less as it is a niche market. The market for this can be foster from collaboration between architecture and material companies for the appropriate solutions.
3. While at the medium scale of NBS such as green route corridors, permeable pavement, the readiness level is also high as the technology is mature. However, due to the scale thus it just can be picked up at the organization or municipality level, thus the market for it more on the technical consultancy and material suppliers for the implementation.
4. Lastly the market on the large scale like river restoration, sustainable drainage. The market for those NBS is similar to other conventional infrastructure implementation because of its size, impacts and stakeholder involved.

In general, technological readiness is less of a problem in NBS adoption and implementation than other barriers for NBS market development (except for some innovative NBS). The market for NBS at the survey cities can interpret somehow at other cities taking into account several factors from the assessment such as the typical challenges, the environmental and institutional support from cities. The most significant hindrance of NBS adoption at a large scale is the lack of funding and maintenance capabilities. NBS market would be further developed in the coming years with the implementation of cities climate adaptation strategies as mentioned above and linking NBS with several Global, European initiatives such as Green Deal, Climate Change Adaptation and Carbon Neutral programs.

- Measures to promote or realize market opportunities for EU and non-EU cities

The report aims to support marketing strategy by identifying core benefits of NBS vs competitors (traditional infrastructures), and to focus on high potential markets and groups of buyers. In B2B (vs business to consumer) markets it is important to identify vertical markets (e.g., industries with needs) and within those industries, on customers or buyers (I.e., firms, organisations, or individuals). We draw on a market segmentation and use a SWOT summary to identify attributes unique to each city relative to other participating cities. Based on this analysis, we make recommendations designed to leverage strengths, address weaknesses, take advantage of opportunities, and mitigate threats. It is important to note that this analysis is a *start*, based on initial discussions with participants (interviews, survey) and with secondary data analysis (publicly available information from websites, news and expert reports). These frameworks require iteration with key stakeholders to build consensus; as the power is in co-creation I.e., developing a shared view of resources, challenges, and the way forward.

Drawing on the previous stakeholder analysis, actors at distinct levels affect market behaviours of actors in other levels. We reflect those interactions in an authorization in leadership framework, which shows the reciprocal nature of public decision making. While public decision makers have formal authority conferred by the electorate, they are constrained by perceptions of legitimacy. If followers do not perceive leaders as legitimate, they will lose power and trust. In the case of NBS, governments

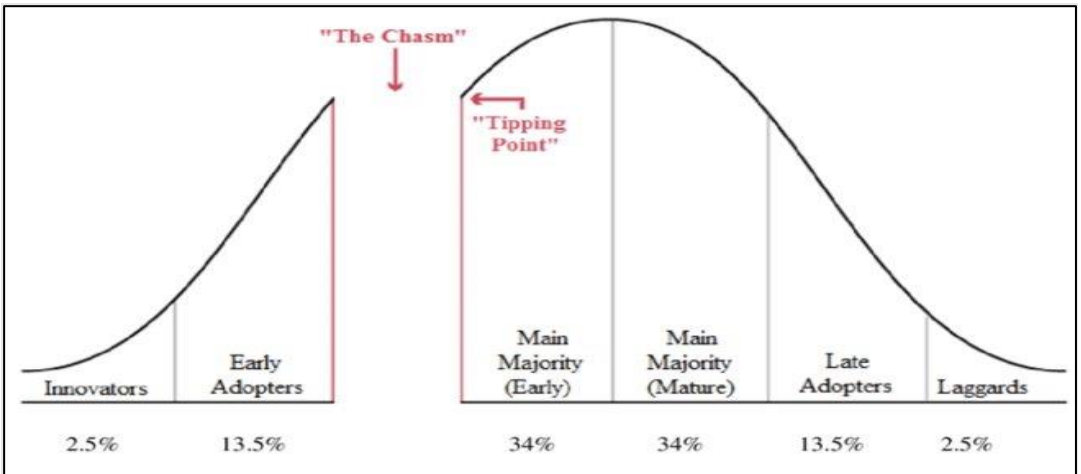
and international institutions have direct formal authority over municipalities via institutional leadership, national and international strategies, funding mechanisms, and regulations. However, they are constrained by municipalities as their policymaking processes need to rely on the municipalities' report, advice and monitored outcomes. At the meso-micro level, similarly, municipalities can control market-participation behaviours through local-level regulations, incentivizing and awareness-raising, and demonstrations. However, they are also subject to the perceptions of system stakeholders (i.e., private firms and citizens) who offer feedback, reports, and civic engagement.

5. Discussion

5.1 Problem statement

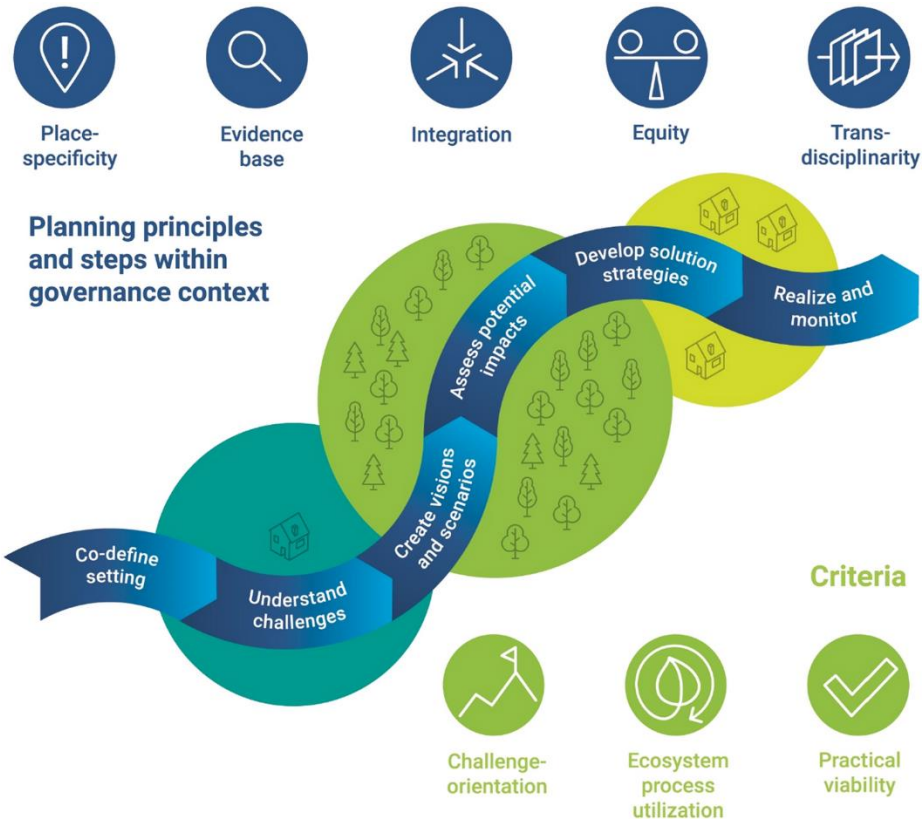
After reviewing the research findings and considering their implications, we frame the core challenge for implanting NBS as one of 'crossing the chasm' [19]. NBS is a systems intervention in the form of a complex sociotechnical innovation (as opposed to, say, a simple innovation such as a better mousetrap). The goal is systems transformation – movement from one (unsustainable) form to another. Vested interests and those who support the status quo will resist. Furthermore, NBS interventions are highly visible, creating new visual cues in the built environment. The built environment has symbolic significance for citizens, tied to a sense of ontological security and identify. Changes in that built environment can be disturbing. For instance, in the case of Medellín, Colombia, citizens have objected to permeated green pavements due to the inconvenience they cause in every-day activities, especially during rainy seasons.

Propensity to adopt or support an innovation depends on the type of innovation, and the outlook and attitudes of the adoptee. New technologies diffuse through social systems over time. A small proportion of the market will actively seek out novelty and change (innovators). Others will welcome it (early adopters). Thus, an innovation will appeal to progressively more risk averse people and organisations (innovators, early adopters, early majority, late majority, laggards as it becomes more technically and socially acceptable [20]. However, for novel or discontinuous innovations, the phenomenon of 'the chasm' confronts innovators (Figure 3):



Diffusion of Innovation: 'The Chasm' and 'The Tipping Point' Once the 'The Tipping Point' has been reached, the marketing of high-tech and innovative products requires a leap across 'The Chasm.' If successful, product sales will increase dramatically after reaching the 'Tipping Point.' If not, the product will most likely not reach the mainstream consumer. SOURCE: Adapted from Roger's Diffusion of Innovation (1962), Moore's Crossing the Chasm (2002) and Gladwell's The Tipping Point (2000)

Figure 3. Diffusion of innovation as applicable for NBS implementation



Beyond the innovators and the early adopters (around 16% of a population), a novel innovation faces an uphill struggle to secure wider support, until it reaches a tipping point, where it becomes an acceptable de facto standard. The majority are sceptical and pragmatic, requiring hard evidence that an innovation is superior to previous solutions. Thus, innovators must consider how to best communicate the social acceptability of a solution (vs the technical benefits), to 'cross the chasm' or reach a causal threshold, and thus gain access to the market majority. Equally, the product undergoes serial iterations as the market matures, from beta versions with the inevitable problems which innovators are happy to trade off against novelty, through to fully worked out mature products, produced through economies of scale and scope as volume builds.

With respect to NBS, we are at the exceedingly early stages. We would argue that lead cities are innovators, and follower cities are early adopters, with respect to NBS. NBS are in the developmental stages, further complicated by the need to tailor solutions to local natural and social conditions, thus limiting learning from replication and iteration – versions are non-comparable. From an innovation standpoint NBS is complex and difficult. We therefore further argue that NBS face several challenges in terms of reaching a tipping point. NBS are highly visible when successful, and failures are even more so, complicated by limitations in knowledge sharing. For instance, in the UK, efforts to engage farmers in adopting NBS are failing due to the lack of cooperation and capacity-building with regards to NBS implementation [21]. Such failures in NBS engagement have been widely covered by the press and anti-NBS groups, making the process of popularizing this innovation that much more difficult. In the public sector, NBS represents an expensive and very visible use of taxpayer funds, and an implicit criticism of current solutions. City infrastructure is part of the built environment, which in turn underpins citizen notions of belonging and ontological security. Hence NBS have symbolic value, in

addition to functional and hedonic value. When successful, NBS may disrupt current beliefs and competencies important to the majority – whether citizen-consumers, NBS suppliers, or municipalities. One of the main challenges is the perception that these solutions are less maintainable or reliable than traditional engineering solutions with respect to, for example, aesthetic impact, impact on traffic flow, and cost-effectiveness (based on our survey results).

Problem: **How can we persuade many cities to adopt NBS? What cities can we classify as 'early' rather than 'late' majority?**

5.2 Implications

To overcome the innovation adoption chasm, it is essential to understand the distinct stages of innovation adoption and the factors that influence them. The innovation adoption process typically involves five stages: Innovators: The first group of people to adopt new innovations. They are often tech-savvy, risk-takers, and enjoy trying out innovative ideas and products. Early adopters: This group is usually made up of opinion leaders and influencers who are open to innovative ideas and willing to take risks. They typically account for about 13% of the market. Early majority: This group tends to be more cautious than early adopters and requires social proof and a proven record of accomplishment before adopting new innovations. They account for about 34% of the market. Late majority: This group is even more cautious than the early majority and tends to adopt new innovations only after they become well-established and mainstream. They account for about 34% of the market.[19] Laggards: The last group to adopt new innovations, often resistant to change and typically only adopt when it becomes necessary. To overcome the innovation adoption chasm, here are some strategies that can be helpful: Focus on early adopters and the early majority: Targeting these groups can help build momentum and create social proof, which can influence the late majority to adopt. Develop a deep understanding of the concerns and needs of different segments of the population: This will enable you to create targeted messaging that resonates with each group. Develop educational messaging for citizens and municipalities supporting the adoption of NBS: This messaging should focus on social and economic benefits rather than technical and functional benefits. Build trust between stakeholders: Use respected spokespeople and opinion leaders, address concerns about reliability and effectiveness, and use consultative/inquiry-based approaches. Provide incentives such as discounts, promotions, and rewards to build positive word of mouth. Work with influential leaders and stakeholders: Develop partnerships and collaborations with them to increase the visibility and credibility of NBS adoption initiatives. Use pilot projects and demonstrations to highlight the benefits of NBS: This can help build momentum and increase adoption rates. Overall, overcoming the innovation adoption chasm requires a targeted and strategic approach that focuses on building awareness, trust, and adoption among early adopters and the early majority. By doing so, it becomes possible to create social proof and build momentum that can influence the late majority to adopt new innovations.

6. Recommendations

6.1 Marketing for NBS

NBS (Nature-Based Solutions) marketing can be done in a number of different methods. Here are a few concepts:

- Framing NBS as a product in a different market: In this strategy, a profitable market is found, and NBS is positioned similarly. NBS can be marketed as a green option to conventional environmental problems, like how electric cars have been marketed as a greener alternative to conventional cars.
- Famed cities for NBS: This strategy emphasises places that have put NBS ideas into practice to appeal to tourists. For instance, a community can promote itself as a must-visit location if it has restored a river and built a lovely greenway. NBS can be sold as an interior design product that enhances air quality and fosters a more tranquil and natural environment in homes and workplaces.
- Branding: By creating a distinctive brand identification for NBS, the organization may become more approachable and recognizable to the public.
- Peer-pressure: NBS can be promoted as a method for enhancing reputation through "peer pressure." Businesses or cities that implement NBS, for instance, can position themselves as sustainability leaders and encourage others to follow.
- Develop a marketing plan to influence public opinion: This approach involves creating a comprehensive marketing plan to educate the public about the benefits of NBS. The plan can include showcasing successful NBS projects, hiding visible failures, and reducing perceived risks associated with NBS implementation.

6.2 Policy and Governance Engagement

Public–private partnerships are key to helping the NBS market overcome the “chasm” for mass adoptions in society. This sub-section outlines some recommendations to improve policy and government engagement regarding NBS:

- Lobby and advocate for policy change: Governments play a significant role in promoting nature-based solutions. Advocacy and lobbying can encourage policy changes that support NBS. For instance, policy changes can incentivize the adoption of NBS and incorporate NBS into national or local environmental strategies.
- Subsidies for lower income populations for individual-level consumption: Governments can offer subsidies for individual-level NBS consumption for lower income populations. This approach can encourage NBS adoption by populations that may not have the resources to invest in NBS without financial support.
- Partnership with conservatory organizations: Partnerships with conservatory organizations can promote NBS and help prevent vandalism. For example, honorary tags can be placed on NBS installations to highlight their importance and deter vandalism.

- Comprehensive stakeholder engagement: Stakeholders' perspectives and needs should be considered in NBS policymaking and governance. This approach can ensure that NBS solutions are well suited to the communities they are designed for and have greater public acceptance.
- Environmental, social, and corporate governance (ESG), and Corporate Social Responsibility (CSR): Environmental, social, and corporate governance (ESG) principles can be incorporated into NBS policymaking and governance to ensure that NBS solutions are aligned with social and environmental goals.
- Engagement with development projects: Infrastructure development projects can have significant impacts on the environment. NBS can be integrated into infrastructure projects to mitigate negative environmental impacts and provide additional benefits, such as improved air quality and reduced urban heat islands.
- Timely engagement: With construction projects ramping up after the COVID-19 pandemic, it is crucial to engage with development projects in a timely manner. Early engagement can ensure that NBS solutions are integrated into the planning process and can achieve the best possible results.

In summary, engaging policymakers and stakeholders is crucial to the successful implementation of NBS. A comprehensive approach that includes policy change, subsidies, partnerships, stakeholder engagement, ESG, CSR, and timely engagement with development projects can promote the adoption of NBS and help achieve environmental and social goals.

6.3 Civic engagement

Here are some civic engagement recommendations for nature-based solutions (NBS):

- NBS project adoption and maintenance led by individuals who care: It is crucial to identify local coalition leaders who are passionate about NBS adoption and maintenance. NBS projects' success relies heavily on ongoing maintenance, and community leaders can help ensure that maintenance is a priority.
- Engage the community in maintenance activities: Local councils, clubs, and other community organizations can be involved in NBS maintenance activities. This approach can help build community ownership and foster a sense of responsibility for NBS projects.
- Engage all communities, not just higher-income ones: NBS projects should be accessible to all communities, regardless of income levels. This approach can promote social equity and ensure that NBS benefits reach all members of society.
- Promote entrepreneurship: Entrepreneurship can help foster innovation and promote the adoption of NBS. For example, individuals and businesses can develop new NBS solutions or services that meet local needs.
- Work with organizations with resourceful personnel: non-governmental organizations (NGOs) and academia can be important allies in NBS adoption and maintenance efforts. These organizations often have many volunteers who are passionate about environmental causes and can help promote NBS adoption.
- Project integrity: NBS projects must be designed and implemented with integrity. This approach can help build trust and credibility with stakeholders and ensure that NBS solutions are effective.

- NBS offset climate change vs. mitigation efforts: The debate between NBS offsetting climate change versus mitigation efforts needs to be resolved. Both approaches can be complementary and should be evaluated in the context of specific environmental challenges and goals.

Overall, civic engagement is crucial to the successful adoption and maintenance of NBS. It is important to engage the community, promote entrepreneurship, work with organizations with many volunteers, and prioritize project integrity. NBS should also be accessible to all communities, and the debate between offsetting climate change and mitigation efforts needs to be resolved.

6.4 Macrosocial Marketing

Macrosocial marketing is indeed a crucial step in promoting the adoption of nature-based solutions (NBS). Here are some recommendations for this approach:

- Advocacy for social change: Advocacy for social change can help create a sense of urgency and promote action around NBS adoption. Advocates can help raise awareness of the benefits of NBS and create a groundswell of support for these solutions.
- Utilize SDGs and other systems of values to raise awareness: The United Nations' Sustainable Development Goals (SDGs) and other value systems can help raise awareness of the importance of NBS. By highlighting the connection between NBS and these value systems, advocates can make a compelling case for NBS adoption.
- Education: Education is key to promoting NBS adoption. However, it is important to focus on what NBS can do to help, rather than just explaining what they are. This approach can help make NBS more tangible and relatable for the public.

We want to end this report with an emphasis that macrosocial marketing is critical in promoting NBS adoption. Advocacy for social change, the utilization of SDGs and other value systems, and education on what NBS can do to help are all important components of this approach. By working together, advocates can help promote NBS adoption and create a more sustainable future.

7. Outlook

Our global search for tools to address and alleviate the severe consequences of the climate crisis have created abundant yet unexplored opportunities for nature-based solutions markets. This report has provided information on the status of the nature-based solutions global markets, conducted market analysis and impact evaluations of nature-based solutions in 08 leading and follower cities under the Urban GreenUP Project and several cities in cluster of cities established in Urban GreenUP as a potential uptake of the project results, demonstration, and knowledge. The report also tries to formulate recommendations based on the insights from survey and interview to further expand the market for nature-based solutions worldwide.

According to our analysis using survey and in-depth interview data on EU expert opinions of each Urban GREENUP city's NBS markets, there are significant opportunities for the growth of nature-based solutions (NBS) markets worldwide. At the national and municipal level, the post-COVID era presents an opportunity to reorient infrastructure-building projects towards addressing climate change. This is due to the heightened awareness of the need for greater preparedness and resilience in the face of

global crises, such as the COVID-19 pandemic and climate change. Governments and municipalities can leverage this opportunity to promote the use of NBS in infrastructure projects. By doing so, they can address climate change and promote the benefits of NBS, such as their ability to provide ecosystem services, reduce carbon emissions, and increase biodiversity. Additionally, the promotion of NBS can lead to job creation and economic growth, making it an attractive option for policymakers and investors alike.

At the individual level, there are sub-sections of global communities that are highly aware of the use of NBS and the benefits they can provide in terms of addressing climate impacts. There is a growing concern among people about the impacts of climate change, and they are looking for solutions. This presents an opportunity to convince them to take up NBS or at least educate them about the existence of NBS as a superior solution to their problem. Educating people about NBS and their benefits can lead to increased adoption of sustainable practices and the use of NBS in their daily lives. People are willing to take action to address climate change, but they often lack the knowledge and understanding of the best solutions available. By educating them about NBS, they can make informed choices and contribute to the growth of NBS markets. In conclusion, the opportunities for the growth of NBS markets are significant and varied, both at the national and individual levels. By promoting the use of NBS in infrastructure-building projects and educating people about NBS, governments, municipalities, and individuals can contribute to a more sustainable future and address the challenges posed by the COVID-19 pandemic and climate change.

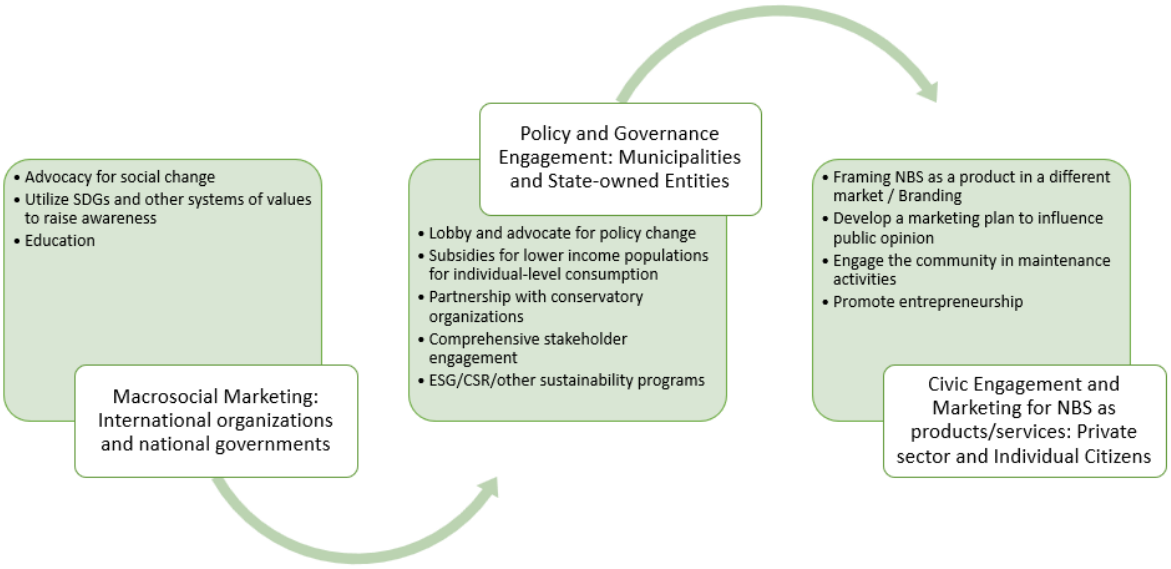
Despite the significant opportunities for the growth of NBS markets worldwide, there remain several concerns that are impeding their growth. One of the main concerns is funding, as many NBS projects require significant investment, which can be a barrier to entry for some organizations and governments. Maintenance is another concern, as NBS projects require ongoing maintenance and management to ensure they continue to function effectively. This can be a challenge, particularly in areas with limited resources or expertise. Another concern is the invisible impact of NBS. While NBS can be effective in addressing climate change and providing ecosystem services, it is difficult to quantify their impact and determine if they are enough to address the scale of the problem. It is also unclear if NBS can "net out" the effects of pollution, damage, and actual climate change impacts, leading to questions about their effectiveness as a long-term solution. According to one of our interviewed experts, "*there is a lack of visible impact, and it can be difficult to convince people to buy into the idea of NBS because the people cannot measure these impacts in comparison to the current rate of environmental pollutions.*" Finally, existing myths surrounding NBS can be a barrier to their growth. Some people believe that NBS are not as effective as traditional engineering solutions or that they are too expensive or difficult to implement. Educating people about the benefits and effectiveness of NBS can help to dispel these myths and promote their use. Overall, while there are significant opportunities for the growth of NBS markets worldwide, there are also concerns that need to be addressed. These concerns include funding, maintenance, the invisible impact of NBS, and existing myths surrounding their effectiveness. Addressing these concerns will be crucial to the continued growth of NBS markets and their role in addressing the challenges posed by climate change.

Based on our results, a market opportunity analysis for the global NBS market can be outlined as follows:

- Customer: The customer base for NBS is highly diverged, with some being highly aware and willing to adopt NBS solutions, while others are confused and unwilling to adopt. This presents an opportunity for NBS providers to educate potential customers and create awareness about the benefits of NBS solutions.
- Technology: The technology for NBS solutions is ready for implementation worldwide, but it remains untapped due to the lack of coordination between private and public sectors. This presents an opportunity for NBS providers to collaborate with both sectors and create a more coordinated approach to NBS implementation.
- Company/Provider: NBS providers are willing and able to provide NBS solutions, but they are mostly serving municipalities and greenwashing corporations. The market for NBS solutions has not yet fully penetrated the B2C market, presenting an opportunity for NBS providers to expand their offerings to target individual consumers.
- Competition: The NBS market is competitive because funding (and individual demand) is scarce. This presents an opportunity for NBS providers to differentiate themselves from their competitors by offering unique NBS solutions and creating a stronger brand reputation. Additionally, NBS providers can explore alternative funding sources to ensure long-term sustainability.

To increase the impact of nature-based solutions (NBS) in combating climate change, international organizations and agreements must take a more proactive role in promoting NBS and creating an enabling environment for their adoption. The Paris Agreement, which is a legally binding treaty signed by almost all countries, aims to limit global warming to well below 2 degrees Celsius above pre-industrial levels. However, the agreement does not have a clear outline of the inclusion of NBS solutions in achieving this goal. International organizations, such as the United Nations, can play a critical role in promoting NBS solutions by creating guidelines and standards for their adoption. These guidelines can include measures to ensure that NBS projects are sustainable, socially inclusive, and equitable. The guidelines can also include financing mechanisms to support the adoption of NBS solutions in developing countries. The EU has been at the forefront of NBS research and development efforts, but its impact on the individual scale may be limited. To address this, the EU can increase its information campaigns to promote NBS solutions and create a market demand for their adoption. This can be done by educating individuals about the benefits of NBS solutions and encouraging them to demand such solutions from their governments and businesses. The EU can also create incentives for businesses that adopt NBS solutions, such as tax breaks or subsidies. Furthermore, international organizations can push for the inclusion of NBS solutions in national climate policies and plans. This can be done by working with governments to develop NBS-specific policies and measures to promote their adoption. The organizations can also provide technical assistance to governments to help them implement NBS solutions. In conclusion, to enhance the impact of NBS solutions in combating climate change, international organizations and agreements must take a more proactive role in promoting NBS and creating an enabling environment for their adoption. This includes creating guidelines and standards for their adoption, increasing information campaigns to create a market demand, and pushing for their inclusion in national climate policies and plans.

We propose the following roadmap to implement our recommendations at distinct levels to foster the growth of the NBS market globally and locally:



To implement each of the recommended steps in the proposed road map, each NBS-adopting entity must hold in mind that NBS implementation and popularization success depends on local communities and cities characteristics. There needs to be a persistent effort to mass-customize NBS products and services to suit each of these community's unique challenges and demands. Furthermore, a global market for NBS can only be fostered with extreme and consistent efforts to share and collaborate research findings, prototypes, as well as policy and technical standards for NBS. Sharing and collaboration can accelerate the pace of NBS implementation across the world to overcome the "chasm" of innovative product disbursements. Lastly, international organizations like the EU needs to make all resources available (especially knowledge and funding) to relevant stakeholders to boost motivation to continue implementing and maintaining NBS. Reports like ours would potentially assist early adopters in their efforts to popularize NBS all over the world.

Appendices

APPENDIX 1: NBS Typologies

Catalogue D 1.1 describes all URBAN GreenUP Nature-Based Solutions (NBS); 48 NBS and 14 categories.

Table 2 14 types of NBS interventions of URBAN GreenUP (Source: NBS Catalogue D1.1, 2018)

Green Route (1 NBS)	**Arboreal interventions** (5 NBS)	**Carbon capture** (1 NBS)	**SUDs** (4 NBS)	**Flood actions** (2 NBS)	**Water treatment** (2 NBS)	**Green pavements** (4 NBS)
Smart soils (3 NBS)	**Pollinators** (5 NBS)	**Vertical GI** (5 NBS)	**Horizontal GI** (5 NBS)	**Pollutant filters** (2 NBS)	**Resting areas** (2 NBS)	**Urban farming** (2 NBS)

The section below describes each group in more detail:

1. **Green routes** include green pathways for recreational, public health and well-being; and transportation linkages.
2. **Arboreal interventions** include *shade trees*, *cooling trees*, *planting and renewal urban trees*, *arboreal areas around urban areas*, *trees re-naturing parking.*
3. **Carbon capture** initiatives include *urban carbon sinks*.
4. **Sustainable drainage systems** (SUDs) include *grassed swales and water retention pounds, suds for green bike lane/parking*; and *rain gardens*.
5. **Flood actions** include *urban catchment forestry*, *hard drainage-flood prevention, unearthed water courses*, *channel re-naturing, floodable parks*.
6. **Water treatments** include *green filter areas; natural wastewater treatments.*
7. **Green pavements** include *hard drainage pavements, green pavements, green parking pavements, cycle-pedestrian green pavement, cool pavement.*
8. **Smart soils** include *enhanced nutrient managing and releasing soil, smart soil production in climate-smart urban farming precinct, and smart soil as substrate.*
9. **Pollinators** include *pollinator verges and spaces (walls/vertical, roofs)*, *natural pollinator modules, compacted modules.*
10. **Vertical green installations** include *fences*, *noise barriers, façades with climbing plants, hydroponic façades, vertical mobile gardens.*
11. **Horizontal GI** include *floating gardens, green covering shelters, electro wetland, green roof, green shady structures.*
12. **Pollutant filters** include *green filter area, urban garden bio- filters.*
13. **Resting areas** include *parklet or pocket park*, *green resting areas.*
14. **Urban farming** includes *climate-smart greenhouses, wastewater treatment by using by-products*; *urban orchards, community composting,* and *small-scale urban livestock*.

APPENDIX 2: Detail of NBS decision participants

Stakeholder groups	Roles in NBS decision making and implementation	Market participants
Initiators: Project sponsors	Identify need, lead resource provision or procurement; provide project support	Initiators - specialist private companies (41%). Aligned corporates (23%) NGOs/ charities (10%)
Initiators/ gatekeepers Policymakers & regulators	Creating NBS markets, underwriting sustained growth through regulatory frameworks.	UN (United Nations), EU, national governments, state, and local municipalities.
Influencers: Project developers	Design and delivery. Must have expertise in conservation and finance to build investment-ready projects.	Conservation NGOs, charities, public sector authorities, private developers, collectives, and partnerships of multiple organisations.
Influencers: Project implementers	Service provision – design, install, maintenance.	Expert designers (urban architects, landscape designers), installers (landscape maintenance firms). Expert and non-expert maintainers – specialist contractors, non-expert council operatives and contractors.
Influencers: Project evaluators	Independent project monitoring and evaluation, outcome quality assurance (financial, social, environmental).	Expert academics/researchers, NGOs, specialist verification authorities.
Influencers: Financial services providers	Providing NBS investment opportunities supporting economic, environmental, and social objectives	Fund managers, financial advisors.
Influencers/ gatekeepers: Funders and investors	Provision of capital for project design, installation, and maintenance.	Public sector (UN/EU, national and local governments) and philanthropic capital (charities, bequests, crowd funding); outcomes linked to organisational and community objectives.
Decision makers: Property owners	Control access to land, marine and coastal areas, physical assets; support is mission critical.	State and municipal authorities Business owners/corporations Community groups
Purchasers: Cheque writers	Facilitation of transaction between NBS buyers and sellers. Acting on organisational directives.	Council/ municipal authority/ corporate/ SME employees. Private citizens (crowd funding, self-initiated NBS)
End-users: Beneficiaries	Receivers of project revenues and service benefits.	Users - citizens and communities, future generations, non-human actors (e.g., insects, birds, animals). Funding receivers - corporations, SMEs, federal, state, local government - leaders, managers, and employees.

APPENDIX 3: Questionnaire (English version)

Questionnaire
Market Potentials for Natural-based Solutions (NBS)
(Work Package 7 – Project Urban GreenUP – 2021)

[ETHICAL CONSENT FORM]

This questionnaire is created to fulfill the purpose of gathering information about the market opportunities of Nature-based Solutions (NBS) in European and Non-European markets under the capacity of Work Package 7 within the EU-funded Urban Green UP Project. Within the scope of this questionnaire, NBS are defined as both the nature related physical solutions and services to address the water, heat, ecosystem management and nature restoration in the city context. The questionnaire will ask participants to provide information about the process, material, direct services for NBS design, construction, and management/maintenance.

A. Please choose your language from the list [code: English – A1, etc.]

1	English	
2	Español	
3	Italian	
4	Turkish	
5	Vietnamese	
6	[Add languages of countries in the list of partners]	

B. Socio-demographic information [code: Question 1 – B1, Question 2 – B2, etc.]

1. Please specify your gender

1	Male
2	Female
3	Non-binary/Third gender
4	Prefer not to say

2. Where are you located?

Locations	[One choice allowed]
EUROPEAN – Liverpool, UK	
EUROPEAN – Valladolid, Spain	
EUROPEAN – Izmir, Turkey	
EUROPEAN - Ludwigsburg, Germany	
EUROPEAN - Mantova, Italy	
NON-EUROPEAN Medellin, Colombia	
NON-EUROPEAN Quy Nhon, Vietnam	
NON-EUROPEAN - Chengdu, China	
EUROPEAN – Aalborg, Denmark	
EUROPEAN – Athienou, Cyprus	
EUROPEAN – Bari, Italy	
EUROPEAN – Bragança, Portugal	
EUROPEAN – Castelfranco Veneto, Italy	

EUROPEAN – Esposende, Portugal	
EUROPEAN – Hegyvidék, Hungary	
EUROPEAN – Ioannia, Greece	
EUROPEAN – Kifissia, Greece	
EUROPEAN – Kladno, Czech Republic	
EUROPEAN – Lviv, Ukraine	
EUROPEAN – Monterosso Almo, Italy	
EUROPEAN – Murcia, Spain	
EUROPEAN – Oslo, Norway	
EUROPEAN – Póvoa de Varzim, Portugal	
EUROPEAN – Santa Pola, Spain	
EUROPEAN – Tampere, Finland	
EUROPEAN – Thessaloniki, Greece	
EUROPEAN – Umeå, Sweden	
EUROPEAN – Vila Franca de Xira, Portugal	
NONEUROPEAN - Hammam-Lif, Tunisia	
NONEUROPEAN – Praia, Cape Verde	
NONEUROPEAN –São Paulo, Brazil	
NONEUROPEAN – Vitória, Brazil	
Other (please specify)	

3. Were you trained in a field related to NBS?

Yes	
No	
Prefer not to say	

4. Please identify your occupational affiliation:

Affiliation	**[Up to 1 choice allowed]**
Private Businesses/Companies	
Public Governments	
State-owned Enterprises	
Non-governmental Organizations or Professional Associations	
Academia/ Research and Development	
International Bodies	
Financial Institutions	
Other (please specify)	

5. How many years have you worked in your occupational affiliation of choice?

1	Less than 1 year	
2	1-2 years	
3	3-5 years	
4	6-10 years	
5	11-20 years	
6	More than 20 years	

6. What level of decision-making authority do you have on the implementation of NBS for your organization?

1	Final decision-making authority (individually or as part of a group)	
2	Significant decision-making authority (individually or as part of a group)	
3	Minimal decision-making or influence	
4	No input	

7. What professional position do you hold at your organization?

1	Public administration	

2	Technician	
3	Consultant	
4	Researcher	
5	Management	
6	Other (please specify)	

8. At the capacity of your current organization, are you a consumer or provider of NBS?

1	Consumer	
2	Provider	
3	Both	
4	Neither	

9. Among the listed NBS below, which one have you been involved with in the implementation process (choose as many as applicable)?

	NBS	
1	Green roof, Green shady structures	
2	Green noise barriers, green fences, or green façade	
3	Rain gardens or Grassed swales and water retention pounds	
4	Sustainable Urban Drainage, Channel re-naturing	
5	Floodable Park, floating gardens, electro-wetland	
6	Green route, urban forest, Shade trees	
7	Cool pavement, partlets, urban garden, green resting area, urban orchard, Green pavements green parking pavements	
8	Pollinator verges and spaces, Pollinator roofs	

C. Information about the city's NBS status

1. The following statements list the status and suitability of NBS in your city. To what degree do you agree or disagree with each statement?

		Strongly disagree	Somewhat Disagree	Neither agree nor disagree	Somewhat Agree	Strongly agree	DK/Prefer not to ans.
1	There is natural infrastructure in my city.						
2	My city conserves ecosystems in its area.						
3	Most people in my city know what NBS are.						
4	Most people in my city support the implementation of NBS.						

2. Below are some examples of barriers or difficulties that may be relevant to adopting NBS. To what extent do you think these barriers/difficulties are relevant to your city?

	Barriers for NBS that are relevant to your city	Strongly disagree	Somewhat Disagree	Uncertain to agree or disagree	Somewhat Agree	Strongly agree	DK/Prefer not to answer
1	Technology readiness						
2	Guideline is not available						
3	High investment compared to other solutions						
4	Difficulty regarding the management of the NBS						

5	Difficult for the implementation of NBS						
6	Cannot be implemented as it will alter the whole or part of the structure which is under protected agreement (e.g., UNESCO site of Mantova)						
7	The initial acceptance of the market or the public						
8	Competitiveness of the NBS compares to traditional or grey infrastructure (new and innovative solutions take time to get used to)						

3. Among the listed nature-involved issues that can be solved or improved using NBS, to what extent do you agree that they apply to your city?

	Issues	Strongly disagree	Somewhat Disagree	Neither agree nor disagree	Somewhat Agree	Strongly agree	DK/Prefer not to ans.
1	Climate change mitigation & adaptation						
2	Air quality						
3	Biodiversity restoration						
4	Coastal resilience						
5	Ecosystem connectivity						
6	Green space management						
7	Green mobility						
8	Heat island						
9	Local food production						
10	Urban regeneration						
11	Water management						

4. Among the listed socio-economic issues that can be solved to improve the implementation process of NBS, to what extent do you agree that they apply to your city?

	Issues	Strongly disagree	Somewhat Disagree	Neither agree nor disagree	Somewhat Agree	Strongly agree	DK/Prefer not to ans.
1	Participatory planning and governance						
2	Potential of economic opportunities and green jobs						
3	Public health and wellbeing						
4	Social justice and social cohesion						

5. The following statements list the different scenarios concerning infrastructure building and renovation opportunities for adoption of NBS in your city. To what degree do you agree or disagree with each statement?

		Strongly disagree [1]	Somewhat disagree [2]	Neither agree nor disagree [3]	Somewhat agree [4]	Strongly agree [5]	DK/Prefer not to answer [6]
1	The current investment in public and private						

	infrastructures in my city is high and increasing.						
2	My city is currently developing new areas.						
3	My city is currently doing renovations in the Old Quarter.						
4	My city is currently offering incentives for public – private partnerships in city infrastructure projects.						

6. How popular do you think are the following NBS in your city?

		Very unpopular	Somewhat Unpopular	Neither unpopular nor popular	Somewhat Popular	Very popular	DK/Prefer not to answer
1	Green infrastructure						
2	Blue-green infrastructure						
3	Ecosystem restoration						
4	Ecosystem management						
5	Ecosystem protection						

7. The following statements list the different scenarios concerning environment-related legislative efforts to adopt NBS in your city. To what degree do you agree or disagree with each statement?

		Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	DK/Prefer not to answer
1	My city has adopted resolutions/decisions/guideline on green infrastructure or NBS to mitigate current and future challenges.						
2	It is common in my city for the public to participate in NBS initiatives (e.g., private homes have green roofs, green walls, etc.).						
3	My city has passed legislation to provide incentives for organizations that adopt NBS.						

8. In your opinion, in the last 5 years, what has been the trend towards NBS applications in your city (0 - no application, 100 - applications are widespread)? [scale from 1 to 100]

D. Market potentials for NBS [code: Question 1 – D1, etc.]

1. In your professional opinion, which one of the following answers describes NBS (choose as many as applicable)?

1	Products	
2	Services	
3	Package solutions of products and services	
4	Investment options	
5	Sustainability options	
6	Other (please specify)	

2. In your professional opinion, which one of the options below describes how NBS is different or better than traditional options (choose as many as applicable):

1	NBS has nature as the center	

2	NBS can help to reverse some negative effects of traditional infrastructure	
3	NBS can help to reduce some Climate Change effects	
4	NBS solutions are self-renewable	
5	NBS can get investment more easily	
6	Most NBS have low start-up capital	
7	NBS are favored by legislation	
8	Other (please specify)	

3. In your professional opinion, how likely do you think the following NBS would be adopted in your city?

		Very unlikely	Unlikely	Neither nor unlikely	Likely	Highly likely	DK/ Preferred not to ans.
1	Green infrastructure						
2	Blue-green infrastructure						
3	Ecosystem restoration						
4	Ecosystem management						
5	Ecosystem protection						

4. Based on your experience, which elements make some NBS more popular/high- potential than others (choose as many as possible)?

Simple technology	
Easy to replicate	
Low cost of setting up/implementation	
Easy to implement into an existing infrastructure	
Low cost of maintenance	
Easy to get commercial value/result	
Have health benefits (e.g., reduce air pollution, etc.)	
Have aesthetic benefit (e.g., attractive, beautiful surroundings)	
Other (please specify)	

5. In your professional opinion, please rank the following groups by potentiality of being a buyer/client/industry for NBS (1 - most potential, 8 - least potential - move the options to the rank that you think suitable):

1	Urban planner	
2	Ecological manager	
3	Public authority	
4	Private developer	
5	Construction sector	
6	Corporation for Corporate Social Campaigns (CSR)	
7	NGOs (non-governmental organizations) and charities/associations	
8	Other (please specify)	

6. Below is a list of common factors that may impact negatively on adoption of NBS institutional factors (administrative, legislative, and governance), social/cultural factors, financial/market factors. Rate each factor from no impact at all to extremely high impact (may stop the NBS from happening).

	Factors that can affect NBS	No impact at all	Low impact	Uncertain if low or high impact	High impact (delay the NBS project)	Extremely high impact (termination of NBS)	DK/Prefer not to answer
1	Institutional - administrative						
2	Institutional – legislative						
3	Institutional – governance						
4	Social/cultural						
5	Financial/market						
6	Technological barriers (e.g., city maintenance workforce)						

7. The statements below list conditions that may drive a city (or a province, a country, etc.) to adopt NBS. To what extent do you agree that each condition applies to your city?

	Driver to adopt NBS	Strongly disagree	Somewhat Disagree	Neither agree nor disagree	Somewhat Agree	Strongly agree	DK/Prefer not to answer
1	Regulatory requirements related to NBS e.g., guidelines for designing companies or contractors to use green certificated materials, solutions.						
2	There are public incentives to use NBS (grants, subsidies, tax credits, etc.)						
3	NBS shows promises (environment, energy, health) to solve the problems of the city.						
4	NBS meets the needs of citizens for more environmental-friendly infrastructure, green space, etc.						
5	NBS are more cost-effective/flexible than traditional solutions.						
6	NBS solves key problems that current traditional solutions cannot resolve for the city (flooding, air pollution, greenhouse gas emissions, etc.)						

8. To what extent do you think the approval of the stakeholders below is important to the implementation of NBS in your city?

	Stakeholders	Not important at all	Slightly important	Moderately important	Important	Extremely important	DK/Prefer not to answer
1	Public Authorities (Municipalities, etc.)						
2	Corporations and businesses						
3	Citizens						
4	NGOs/Associations						
5	Educational institutions						
6	Research institutions						

9. In your professional opinion, how willing are the following stakeholders in paying for potential NBS in your city?

		Not willing to pay at all	Not too willing to pay	Neither willing nor unwilling to pay	Willing to pay	Very willing to pay	DK/Prefer not to answer
1	Public agencies/government						
2	Businesses/companies						
3	Academia/R&D						
4	Society (citizens/local community)						
5	International bodies						

[THANK YOU FOR COMPLETING THE SURVEY. IF YOU HAVE ANY QUESTIONS, PLEASE DIRECT THEM TO [*EMAIL ADDRESS*] FOR ASSISTANCE/CLARIFICATIONS]

[SURVEY ENDS FOR ALL RESPONDENTS THAT ARE NOT AFFILIATED WITH PRIVATE COMPANIES/BUSINESSES, CONTINUES FOR THOSE AFFILIATED WITH PRIVATE COMPANIES/BUSINESSES]

Only fill in this Section of the survey if you are affiliated with private businesses.

E. The role of NBS in private businesses

6.1. Primarily, what best describes your company's offering:

1	Specialized, e.g., in one or a few similar NBS (e.g., only green roof)
2	Multiple NBS solutions, like each other (e.g., all water-related)
3	Wide variety of NBS solutions that require different skills/expertise

6.2. Please choose as many as suitable. Is your company a:

1	NBS Material supplier
2	NBS Consultant provider
3	NBS Construction company
4	NBS Maintenance company
5	NBS Research and Development
6	Other (please specify)

6.3. In your company, how much do NBS-related products/services account for your overall business activities?

1	NBS is a small part of my business	
2	NBS is an important part of my business (e.g., over 50%)	
3	NBS is the only focus of my business (e.g., over 90%)	

6.4. Primarily, does your business deal mostly with:

1	Mostly simple, off-the-shelf solutions that are easy to implement/replicate?	
2	Mostly complex, customizable solutions that require extensive expertise and budget?	
3	Mostly designing and consulting on NBS?	
4	Mostly constructing NBS?	
5	Other (Please specify)	

6.5. In terms of customers, are your clients:

1	Mostly Public (e.g., government or state-affiliated companies)	
2	Mostly Private (e.g., corporations, businesses)	
3	Mostly Individuals (e.g., homeowner, local community)	
4	A mix of public and private	
5	A mix of private and individuals	
6	Other (please specify)	

6.6. Does your company offer NBS services outside of your country?
Yes/No/Prefer not to say

6.7. In terms of origin and location, most of your customers

1	Local (e.g., from your city/area)	
2	Region/national (e.g., various parts of your country)	
3	From outside your country	

6.8. What are some key challenges regarding growing your business (1 - most crucial challenge, 5 - least crucial challenge - move the options to the rank that you think suitable)?

Clients lack awareness of NBS (never heard)	
Clients have awareness, but need more understanding of NBS and its benefits	
Clients have doubts/concerns about NBS implementation/maintenance	
Clients are unwilling to invest/take risk with NBS (financial concerns)	
Other (please specify)	

6.9. From your experience, what are some of the steps you have taken to solve these issues/grow your business (choose as many as applicable)?

1	Use examples/case studies of successful NBS
2	Conduct workshops/training
3	Submit proposals/tenders when there is a bidding opportunity
4	Networking/join trade events
5	Lobby regulators about favorable NBS legislation
6	Other (please specify)

[THANK YOU FOR COMPLETING THE SURVEY. IF YOU HAVE ANY QUESTIONS, PLEASE DIRECT THEM TO [*EMAIL ADDRESS*] FOR ASSISTANCE/CLARIFICATIONS]

APPENDIX 4: Interview Script

Topics	Main Questions
Participant characteristics	1. First, can you please tell me about your own connection to nature - can you tell me about the last time you connected with plants or animals or the outdoors? [probe for gardening, hiking, animal-based activities - and what about gardening? And what about hiking in the country? etc]
participant knowledge - (1) *why* - logic for NBS (wider goals/ intent), (2) *what* they think it is (nature/ characteristics), (3) *how* NBS manifests - history of projects in own city - *what, where, when*	2. Thinking about nature-based solutions, or NBS, can you share your understanding is of what NBSs are, and give me an example?
	3. To what extent have you been involved with the approval, design or implementation of any NBS, and if yes can you talk to us about the experience you have with that NBS (and the implementation process)?
	4. What do you think is/would be the main motivation behind the implementation of NBS in your city?
	5. In your opinion, to what extent do different groups of people (by occupation: NGO, experts, regular citizens) in your city know what NBS are?
Participant opinions/ views/ perspectives on NBS implementation - only for cities that have implemented NBS	6. In your opinion, to what extent do you think NBS projects have affected the lives of citizens in your city? In what ways? [specific to quality of life and wellbeing]
	7. To your knowledge, do people like or dislike the NBS implementations - how have they been received? Can you please give me some examples of very well received NBS and those that have not been as well received?
	8. Thinking now about one of the NBS projects you mentioned earlier, can you tell me what goods and services were required to design, instal and maintain it? Were those goods and services readily available? And would that apply to other projects? [probe issues and problems for that project and projects in general]
Perceptions of current market	9. What opportunities do you think there are for other NBS projects in your city? Where do you think the potential might lie? [probe recommend/ consult/ expertise, design, instal/deliver, service/ maintain, decommission]
	10. Could you tell me about who might provide the main sources of funding for NBS in your city?
	11. To what extent do stakeholders in the public and private sectors cooperate in NBS initiation and implementation? Can you share any incidents where cooperation was particularly good or bad?
Perceptions of the future	12. Thinking now about the future for NBS, in the next five years, do you think the Nbs market will grow/evolve and by how much? And overall? What kinds of opportunities do you see for your business?
	13. The EU has been instrumental in supporting NBS through the Horizon project, what do you think the role of international organizations like the EU should be in future implementations of NBS in your city?
Other issues	14. Finally, are there any other issues you would like to mention that I have not asked about?

Interviewer Instructions:

Beginning of interview

Thank you for agreeing to join us for the interview today. We are interested in your opinions about market opportunities for Nature-based Solutions (NBS) in European and Non-European markets. This research is being conducted for the EU for Work Package 7 of the EU-funded Urban Green UP Project. Within the scope of this project, NBS are defined as nature-related solutions, goods and services that will address the water, heat, ecosystem management, and nature restoration challenges in urban contexts. .

Our research group has already distributed a questionnaire to NBS stakeholders. Now that we have completed the initial analysis of the data, we realise that we need to interview experts such as yourself to gain deeper **insights.**

Consent for recording/transcribing

We would like to record and transcribe this interview so that we capture your opinions. If you agree, please state "yes" to our question as follows: Do you consent to have this interview recorded and transcribed for research purposes under the scope of the Urban GreenUP project?

If consented: **Thank you and we can begin now if you are ready.**

End of Interview

Thank you very much for your time and your input, we very much appreciate it. Would it be possible to contact you again for the purposes of clarification? And finally, would you like a copy of our findings?

APPENDIX 5: Case summaries – All cities

5.1 Front-runner Liverpool, UK

Liverpool is a city of nearly 500,000 people, located in the north-west of England, and known for its rich cultural heritage, iconic landmarks, and thriving economy. In recent years, Liverpool has also emerged as a leader in promoting sustainability. The city has invested in renewable energy (wind turbines and solar panel installations) and is home to green spaces such as Sefton Park, which features a boating lake, playgrounds, and a Victorian Palm House. The city's commitment to sustainability and green initiatives has attracted a growing number of environmentally conscious businesses and residents. Overall, Liverpool is a prime example of a city committed to promoting sustainability to create a more liveable, resilient, and green urban environment.

With respect to NBS, through the Urban GreenUP project, Liverpool has developed a comprehensive plan to promote green infrastructure and NBS including green roofs, urban forests, and the restoration of natural habitats such as wetlands and riverbanks. Liverpool has also implemented sustainable transportation systems, including the development of cycle routes and the promotion of electric vehicles.

Strengths	Weaknesses
• **Coordination capability** • Social cohesion - sampled communities are willing to work with public entities in maintaining and implementing NBS • Successful Implementation • Project leadership capabilities • City has shown strong commitments to implementing and promoting NBS	• Need to navigate bureaucracies / onerous regulatory hurdles • Ability to create highly visible and approachable NBS interventions - cannot create the love [fashionable, Instagram-able, relatable]
Opportunities	**Threats**
• **Develop strong public-private partnerships - transnational with other firms with resources** • Integrate NBS with infrastructure projects & Educate infrastructural professionals on roles of NBS • High levels of civic engagement • Bridge the expectations gap between technician and citizens • Lack of regulation / policy? • Lack of citizen awareness - opportunity to communicate more effectively	• Economic/social issues crowding out environmental priorities • Reduction of EU funding • Political advocacy

Liverpool has implemented several nature-based solutions through the Urban GreenUP project to tackle environmental challenges and promote sustainability (Figure x):

1. Green roofs and walls: Installation incentives in public and private buildings throughout the city to address urban heat island effect, improve air quality, and provide habitat for wildlife. Partnership between Liverpool City Council, The Mersey Forest and Liverpool University and is funded through the EU Horizon 2020 project Urban GreenUP.
2. Urban forests: Carbon dioxide absorption, reduced air pollution, shade and cooling, habitat for wildlife, contribute to biodiversity.
3. Natural water management: Restoring natural wetlands and riverbanks to reduce flooding risks and improve water quality for more resilient and sustainable urban environments.
4. Sustainable transportation: Network of cycling routes, to encourage cycling as a sustainable mode of transportation; supplemented by e-buses and taxis to reduce emissions
5. Renewable energy: Wind turbines and solar panels generate clean energy, reducing carbon footprint and dependence on fossil fuels.
6. Green spaces and parks: provide recreational opportunities for residents and visitors, help to improve air quality, reduce noise pollution, and provide habitat for wildlife.

Overall, Liverpool's NBS have positioned the city as a leader in sustainability and livable urban environments. Based on our findings from the expert perception survey on the market opportunity for nature-based solutions and interview with local representatives involved in the Urban GreenUP project, the Liverpool market for nature-based solutions is affected by the following strengths, weaknesses, opportunities, and threats:

Strengths and weaknesses

Coordination capability and strong social cohesion. The city of Liverpool has shown significant efforts in coordinating with local councils, communities, and citizens to enhance their awareness of nature-based solutions either through directing citizens to demonstration sites or educating them on the benefits of NBS [interview, LIV-01]. Sampled communities are willing to work with public entities in maintaining and implementing NBS in local communities. According to our interview with the municipality representative, there is a “small army of volunteers” in Liverpool that is self-organized to work on different NBS sites. According to our expert, these people “like to do a good deed” and have been “visiting once a month to pollinated sites and […] weeding [these sites]” to help maintain NBS demonstrations. And since the activity is led by willing and able volunteers, it comes with no cost to the government while indicating that there is at least some level of engagement in the site as communities are “taking ownership of the sites themselves.” This example, while relatively small-scale, shows that there is relatively strong social cohesion and increasing engagement in the Liverpool NBS market.

> *“Yeah. And small army of volunteers and it's organization 1000 service many possible one to choose day night. They need at different sites and they do like a good deed as a big activity. So they've been visiting once a month and 1/2 pollinated sites and they've been weeding. So it's good exercise for them but bending, stretching and carrying and it's free for us. And of course, we're engaging them in the site and they're taking ownership sites and all these things as well.”*

The second key strength is project leadership capabilities, built through experience, and an established team of experts and providers. Key to it is Juliet Staples, the project leader, who has several years of experience and utmost dedication to the project.

Opportunities and threats

Based on our survey analysis and interview with Liverpool UrbanGreenUP representative, here are some opportunities for the NBS market in Liverpool:

- Develop strong public-private partnerships: transnational with other firms with resources: Liverpool can leverage public-private partnerships to drive NBS initiatives, combining the resources and expertise of both sectors to create a more sustainable and resilient city. Liverpool can also explore transnational partnerships with other cities and firms to share knowledge and best practices and to access funding opportunities.
- Integrate NBS with infrastructure projects & Educate infrastructural professionals on roles of NBS: Liverpool can integrate NBS into infrastructure projects to make them more sustainable and resilient, while also educating professionals in the infrastructure sector on the role of NBS in supporting ecosystem services.
- High levels of civic engagement: Liverpool has a tradition of high civic engagement, with active and informed citizens. This presents an opportunity for NBS initiatives to be co-created with citizens, leveraging their knowledge and expertise to create sustainable solutions that meet their needs.
- Bridge the expectations gap between technician and citizens: Bridging the expectations gap between technicians and citizens can lead to more effective implementation of NBS. By involving citizens in the design and implementation of NBS, Liverpool can ensure that NBS meet the needs and expectations of the community, while also leveraging the expertise of technicians.
- Lack of regulation / policy: The lack of regulation or policy around NBS in Liverpool presents an opportunity for the city to develop its own policies and regulations that promote the use of NBS. This can create a supportive environment for NBS implementation and attract investment to the city. Liverpool needs to immediately take up their opportunities to lobby and push for new legislation and policy directly related to NBS in order to grow this market. *According to our survey, all of the respondents from Liverpool agree that there is no guideline available for the adoption, implementation, and maintenance of NBS.*
- Lack of citizen awareness - opportunity to communicate more effectively: Despite high levels of civic engagement, there may be a lack of citizen awareness about the potential benefits of NBS. Liverpool can seize the opportunity to communicate more effectively with citizens, leveraging the existing channels of engagement to raise awareness and build support for NBS initiatives. This can be done through targeted campaigns, education programs, and other forms of public outreach.

5.2 Front-runner Valladolid, Spain

Valladolid is a small city of nearly 300,000, located in the north-western part of Spain, in the region of Castilla y León. The city's history dates back to Roman times, and is known for its beautiful architecture, rich cultural heritage, and vibrant atmosphere. In recent years, Valladolid has also gained recognition for its efforts to become a more sustainable and greener city, gaining a reputation for creating a more liveable and resilient urban environment for its residents and visitors (cite).

Valladolid has embraced NBS by implementing a range of NBS, such as green roofs, urban forests, and water management systems, improving the city's overall aesthetics and providing environmental benefits, including reduced heat island effects, improved air quality and biodiversity:

- Esgueva River Park: A polluted urban river was transformed into a functional green space. The park includes trails and paths, sports and recreational facilities, and habitat for local wildlife; while improving water quality and mitigating flood risks.
- Green Roofs: public buildings e.g., Valladolid City Council headquarters, to reduce the urban heat island effect, improve air quality, and provide habitat for pollinators.

- Urban Forests: e.g., Pisuerga River Forest, which enhances biodiversity and provides recreational opportunities for residents.
- Green Spaces: e.g., Campo Grande Park, enhances aesthetics and provides environmental benefits, such as air quality and mitigating heat island effects.
- Water Management: permeable pavement, green roofs, and rain gardens, to reduce the amount of stormwater runoff and improve water quality.
- Bike Lanes and Pedestrian Streets: To encourage active transportation and reduce air pollution.
- Sustainable Buildings: e.g., ECOBOX, which uses renewable energy sources, green roofs, and sustainable materials to reduce its environmental impact.

Strengths	Weaknesses
• High levels of citizen awareness • People are highly receptive of the current demonstrations and want to see how they can bring it home • Strong government commitment: City has small grants for NBS implementation for citizens and companies	• Lack of human resources – Climate adaptation team in charge of NBS also has a lot of other responsibilities • Not open to lobbying and other policy advocacy efforts / climate change adaptation department not involved in
Opportunities	**Threats**
• City experiencing extreme weather events (heavy rain, flooding, heatwaves, etc.) making it unlivable • Lack of willingness to pay in parts of city without demonstration -> open up an opportunity for further awareness-raising/demonstrations • Detailed/technical information demand from citizens	• Economic/social issues crowding out environmental priorities • Reduction of EU funding • Political advocacy

Key strengths and weaknesses

Some strengths of the nature-based solutions (NBS) market in Valladolid include:

- Strong government commitment: The local government in Valladolid is committed to implementing NBS solutions to address environmental challenges and enhance sustainability. This commitment is reflected in various policies and initiatives that promote NBS implementation in the city.
    - Our expert has pointed us to the availability of grants for NBS adoption from the city of Valladolid. One example of a nature-based solution grant program in Valladolid, Spain is the "Green Roofs" program. This program provides financial assistance to homeowners and businesses who want to install green roofs on their buildings. The green roofs help to improve air quality, reduce energy consumption, and increase urban biodiversity, among other benefits. The program provides up to 50% of the total cost of the green roof installation, with a maximum grant of €20,000. To be eligible for the grant, the green roof must meet certain criteria, including using locally sourced materials, incorporating native

plant species, and being designed and installed by a qualified professional. The Green Roofs program is just one example of the many ways that Valladolid is supporting the implementation of nature-based solutions in the city. By providing financial incentives and technical support for NBS projects, the city is encouraging citizens and businesses to take an active role in promoting sustainability and environmental protection.

- High level of public awareness and participation: There is a high level of public awareness and participation in NBS projects in Valladolid. The local government has implemented various communication and education campaigns to raise public awareness about NBS and involve the public in NBS projects.
- Collaborative partnerships: There are strong partnerships between the local government, private sector, and non-governmental organizations (NGOs) in Valladolid to promote NBS implementation. These partnerships facilitate knowledge sharing, resource pooling, and collaboration on NBS projects.
- Strong technical expertise: There is a high level of technical expertise in NBS implementation in Valladolid. The local government and other stakeholders have invested in training and capacity building for technical professionals to ensure the effective implementation and maintenance of NBS projects. Overall, these strengths provide a solid foundation for the NBS market in Valladolid to continue to grow and contribute to sustainable development in the city.

Key opportunities and threats

Some potential market opportunities for NBS in Valladolid are:

- Climate-related services: With the city experiencing extreme weather events, there may be opportunities for businesses to offer services related to climate adaptation and resilience, such as flood prevention or heatwave mitigation. Valladolid has experienced heavy rain and flooding in recent years, and the city is also susceptible to heatwaves due to its inland location. There may be opportunities for businesses to offer services related to flood prevention or heatwave mitigation, such as urban greening projects, green roofs, or other climate adaptation measures.
- Awareness-raising campaigns: The lack of willingness to pay in some parts of the city presents an opportunity for organizations to create awareness campaigns that emphasize the importance of environmental issues and demonstrate the benefits of investing in sustainable practices. In some parts of Valladolid, there is a lack of willingness to pay for environmental initiatives or services. This presents an opportunity for organizations to create awareness campaigns that emphasize the importance of environmental issues and demonstrate the benefits of investing in sustainable practices, such as reducing energy costs or improving public health.
- Technical services: The demand for detailed/technical information from citizens suggests an opportunity for businesses or organizations to provide services that can help citizens navigate complex environmental regulations or understand the environmental impact of certain practices. There is a growing demand for detailed and technical information from citizens in Valladolid, particularly around environmental regulations and sustainability-related practices. This presents an opportunity for businesses or organizations to provide services that can help citizens navigate complex environmental regulations or understand the environmental impact of certain practices, such as carbon footprint assessments or environmental impact assessments.

On the other hand, some of the threats include:

- Economic and social issues: The prioritization of economic and social issues over environmental concerns could lead to a lack of investment in sustainable practices and hinder the growth of green businesses. Valladolid faces economic and social challenges, including a high unemployment rate and a significant portion of the population living in poverty. These challenges may lead to a lack of investment in sustainable practices and hinder the growth of green businesses.
- Reduction of EU funding: The reduction of EU funding could limit the resources available for environmental initiatives and make it more difficult for businesses to access financing for sustainability-related projects.
- Political advocacy: Political advocacy against environmental regulations or initiatives could create obstacles for businesses operating in the green economy and lead to a less favorable business environment for sustainability-focused ventures. While Valladolid has taken steps to address environmental issues, such as introducing a low-emission zone in the city center, there may be political advocacy against environmental regulations or initiatives. This could create obstacles for businesses operating in the green economy and lead to a less favorable business environment for sustainability-focused ventures.

5.3 Front-runner Izmir, Turkey

Izmir (population 4.4 million) is in the western part of Turkey. Izmir has made significant strides towards sustainability and becoming a green city. The city has implemented numerous initiatives and programs to address environmental challenges and improve the quality of life for its residents. Izmir is well-known for its commitment to sustainability, and the city has been recognized for its efforts towards becoming more environmentally friendly. Izmir has also prioritized urban transportation as a part of its sustainability efforts. The city has invested in cycling infrastructure, pedestrian-friendly areas, and public transportation to reduce the number of cars on the road and improve air quality. The city has also implemented electric buses and hybrid taxis to further reduce emissions.

Izmir has implemented several NBS initiatives, including green roofs, vertical gardens, and rainwater harvesting systems, to improve air quality, reduce the urban heat island effect, and enhance the city's aesthetics. These initiatives not only contribute to the city's environmental sustainability but also create more livable spaces for residents:

- Kültürpark: A large urban park designed to mitigate urban heat island effects and air pollution; includes green roofs, green walls, and rainwater harvesting systems, which help to reduce the amount of runoff and improve air quality.
- Alsancak Green Street: Pedestrian-friendly area that incorporates a green corridor with trees and plants. The area was redesigned to encourage walking and cycling and improve air quality by reducing traffic.
- Konak Pier: Renovated historical building that has been transformed into a shopping mall incorporating green roofs and vertical gardens, which help to reduce the building's energy consumption and mitigate the urban heat island effect.
- Seferihisar Eco-Center: Community center designed to be environmentally sustainable. Incorporates passive solar design, green roofs, and rainwater harvesting systems, which help to reduce the building's environmental impact.
- Urban Agriculture: Several initiatives aim to reduce the city's carbon footprint and promote local food production including community gardens, rooftop gardens, and vertical gardens to provide residents with access to fresh, locally grown produce.

Natural disasters are frequent in Izmir, with the prime example of the recent Kahramanmaras earthquake. In 2020, Izmir an earthquake caused significant damage to the city's infrastructure and buildings, highlighting the importance of sustainability and resilience in urban planning and development. The earthquake presented an opportunity to reimagine and rebuild the city with a focus on sustainability, and in particular the need to rebuild damaged buildings and infrastructure in a way that is more sustainable and resilient. Waste management was also highlighted. NBS such as composting and recycling programs can reduce waste and improve waste management systems. Finally, the earthquake highlighted the importance of community engagement and participation in sustainability efforts. NBS such as community gardens and urban agriculture can be used to engage residents in sustainable practices and provide them with access to locally grown produce. In conclusion, the earthquake in Izmir presented significant challenges to the city's sustainability efforts, but it also presented an opportunity to rebuild the city in a more sustainable and resilient way. Therefore, besides helping Izmir with their sustainability efforts, NBS can play a critical role in addressing these challenges and creating a more sustainable and liveable urban environment for Izmir's residents.

Strengths	Weaknesses
• Climate change adaptation plan • Ready technology and technical professionals for NBS implementation • The nation and cities themselves have NBS awareness and information campaigns • Education Department working on integrating NBS, climate change, climate adaptation into the national curriculum	• Insufficient human resources for implementation and maintenance of NBS • Lack of material resources for NBS implementation and maintenance (machineries, automobiles, raw materials, etc.) • Bad implementation examples • Weak coordination at the local government levels
Opportunities	**Threats**
• Lack of citizen awareness about NBS and their functions • Lack of private demands for NBS • NBS has been well-received among selected communities - needs to be communicated and marketed in other areas / communities with lower socioeconomic levels • Entrepreneur efforts need funding and support	• Natural disasters • Other priorities crowding out NBS • Greenwashing / CSR instead of NBS demand from private firms' needs • EU funding drying up too soon for the market to survive by itself

Strengths and Weaknesses

The strengths of the nature-based solutions market in Izmir and Turkey overall are:

- Government support: The fact that the government has a climate change adaptation plan in place and is actively working to integrate NBS into the national curriculum shows a commitment to promoting sustainable solutions and supporting the growth of the NBS market.
    - Our interview expert has pointed us to explore the Turkish Climate Change Adaptation Strategy and Action Plan. Turkey has a National Climate Change Adaptation Strategy and Action Plan, which was approved in 2011 and updated in 2015. The plan aims to increase Turkey's resilience to climate change impacts through a range of measures, including improving water management, enhancing biodiversity and ecosystem services, promoting sustainable agriculture, and enhancing public health. The plan is implemented by a range of government agencies, and progress is monitored and reported through a regular review process.
- Availability of technology and professionals: The presence of ready technology and technical professionals for NBS implementation means that there is already a foundation for the growth of the market. This can help to accelerate the adoption of NBS and make it more accessible to a wider range of stakeholders.
- Awareness campaigns: The fact that both the nation and cities themselves have NBS awareness and information campaigns in place means that there is already a high level of awareness of the benefits of NBS. This can help to create demand for NBS solutions and drive market growth.
- Education and training: The integration of NBS, climate change, and climate adaptation into the national curriculum means that there is a focus on developing the knowledge and skills necessary to support the growth of the NBS market. This can help to create a pool of skilled professionals who can contribute to the development and implementation of NBS solutions.
    - The Turkish government is taking steps to integrate NBS and climate change into education at all levels. In 2013, the Ministry of Environment and Urbanization signed a memorandum of understanding with the Ministry of National Education to integrate environmental education into the national curriculum. As part of this effort, the government has developed a range of resources and training programs for teachers, including materials on climate change and nature-based solutions. In 2018, the Ministry of Environment and Urbanization launched a project to develop a Nature-Based Solutions Curriculum for secondary school students. The curriculum includes modules on topics such as urban greening, wetland conservation, and forest management. The project also includes training for teachers and the development of educational materials. At the university level, many Turkish universities offer courses and degree programs in environmental science, climate change, and related fields. In addition, the Turkish government has established several research centres focused on climate change and environmental issues. Overall, these efforts to integrate nature-based solutions and climate change into education are helping to raise awareness and build capacity for sustainable development in Turkey.

The weaknesses of the nature-based solutions market in Izmir, Turkey are:

- Insufficient human resources: One of the biggest challenges for the NBS market in Izmir is the lack of trained professionals to implement and maintain these solutions. This can slow down the adoption of NBS and limit their effectiveness.
- Lack of material resources: Another challenge is the lack of material resources, including machineries, automobiles, and raw materials, needed for NBS implementation and maintenance. This can make NBS more expensive and difficult to implement.
- Bad implementation examples: In some cases, poorly implemented NBS projects can lead to negative outcomes, such as increased flood risk or damage to ecosystems. These failures can

undermine confidence in NBS and discourage investment in future projects. From our expert interview, we have retrieved some examples of bad implementations in Turkey:

> *"For example, when they have the some a permeable surfaces with like a brakes. Uh, they got dislodged or something like that, so people are not comfortable in waters coming out, their feet are getting wet and stuff like that."*

Indeed, these examples are getting much more frequently reported:

> *"Those kinds of things happened a lot lately."*
>
> *"And for some of the NBS solutions, people always ask for car parks and stuff like that and whenever the local government tries to do something greenery which makes it impossible for people to park, [people] complain a lot, but they want the green elements, but they don't want their [life to get inconvenient]…"*

- Weak coordination at the local government levels: Coordination between different government agencies, as well as between the government and private sector, can be weak. This can lead to inefficiencies, duplication of effort, and a lack of coherence in NBS projects.

Addressing these weaknesses will require a concerted effort from all stakeholders, including the government, private sector, and civil society. This may involve investing in training and education programs to build human capacity, developing partnerships with the private sector to mobilize material resources, and strengthening coordination mechanisms to improve project design and implementation.

When comparing the strengths and weaknesses of the nature-based solutions market in Izmir and Turkey overall, we can see that the strengths are largely related to the government's commitment to promoting sustainable solutions and building capacity for NBS implementation. On the other hand, the weaknesses reflect challenges that are common to many emerging markets, such as limited resources and weak coordination mechanisms. The strengths of the NBS market in Izmir, Turkey reflect a promising foundation for the growth of sustainable solutions. However, addressing the weaknesses will be critical to realizing the full potential of NBS and driving meaningful impact.

Opportunities and Threats

Some opportunities for the NBS market in Izmir, Turkey in response to the identified weaknesses include:

- Communication and education campaigns: There is an opportunity to increase awareness among citizens about the benefits of NBS and their functions, and to educate the public on how NBS can contribute to sustainable development, especially as the nation has identified these campaigns as their national interest. This can be done through targeted communication and education campaigns, as well as through the integration of NBS topics into the national curriculum.
- Creating private sector demand: To create private sector demand for NBS, there is an opportunity to showcase successful NBS projects to private sector stakeholders, and to engage with them to identify opportunities for NBS solutions in their operations.
- Expansion to other communities: NBS has been well-received in selected communities, and there is an opportunity to expand NBS solutions to other communities, especially those with lower socioeconomic levels. This can be done by working with local governments and community organizations to identify suitable NBS projects, and by providing technical support and funding where necessary.

  - Diversification of income: The NBS market can provide opportunities for communities to diversify their income sources, especially for those engaged in traditional agriculture or other industries that are vulnerable to climate change impacts. Therefore, a route through which we could expand and popularize NBS to other communities, especially low-income ones, can be through the introduction of income opportunities that this market brings to such communities.
- Funding and support for entrepreneurs: There is an opportunity to provide funding and support for entrepreneurs who are developing NBS solutions. This can be done through grants, loans, and other financial instruments, as well as through mentorship, training, and technical support. By capitalizing on these opportunities, the NBS market in Izmir and Turkey can address some of the weaknesses and continue to grow and contribute to sustainable development in the region.

On the other hand, the threats to the strengths of the market that we have identified include:

- Natural disasters: As Turkey is known for earthquakes, natural disasters such as earthquakes, floods, and landslides can pose a threat to the implementation and maintenance of NBS projects. These disasters can damage NBS infrastructure and negatively impact the natural ecosystems that NBS seeks to protect.
- Other priorities crowding out NBS: The government may have other priorities that take precedence over NBS implementation, such as disaster relief and reconstruction efforts following a natural disaster. This can result in limited resources and attention being directed towards NBS implementation, which can slow down the growth of the NBS market.
- Greenwashing/CSR instead of NBS demand: Private firms may prioritize greenwashing and CSR initiatives over the adoption of NBS solutions. This can result in limited demand for NBS solutions from the private sector, which can slow down the growth of the NBS market.
- EU funding drying up too soon: The NBS market in Izmir and Turkey may rely on EU funding to support its growth and development. However, there is a risk that EU funding may dry up before the NBS market is fully established and sustainable, which can result in a lack of funding and support for NBS projects. By recognizing these threats, the NBS market in Izmir and Turkey can take measures to mitigate their impact and continue to grow and contribute to sustainable development in the region.

To mitigate these threats, it is important to have strong government policies that prioritize NBS implementation and ensure adequate funding and resources are allocated towards NBS projects. Public-private partnerships can also be formed to promote the adoption of NBS solutions and ensure that private firms are committed to their sustainability goals. It is also important to have strong communication and education campaigns that raise awareness about NBS among citizens, businesses, and local communities, and highlight the benefits of investing in NBS solutions. In addition, it is important to consider the impact of natural disasters and climate change on the region and implement NBS solutions that can help mitigate these risks. By taking these steps, the NBS market in Izmir and Turkey can continue to grow and contribute to sustainable development, even in the face of potential threats.

5.4 Follower - Mantua, Italy

Mantua (population 49,300), located in Italy, has made significant progress towards sustainability, including transportation solutions such as cycling infrastructure and pedestrian-friendly areas, to reduce the number of cars on the road and improve air quality. The city has also implemented an electric bus system to reduce emissions.

The city recognizes that NBS can play an important role in addressing environmental challenges while also enhancing the quality of life for its residents:

- Restoration of Wetlands and Mincio River: Mantua has restored the wetlands and Mincio River to improve water quality, reduce flood risks, and enhance biodiversity. These areas provide numerous ecosystem services that benefit the city and its residents.
- Green Roofs and Walls: Mantua has implemented green roofs and walls in public and private buildings to improve energy efficiency, reduce the urban heat island effect, and improve air quality.
- Urban Forests: Mantua has implemented urban forests, which are areas of greenery within the city, to provide numerous environmental benefits, such as reducing air pollution, improving water quality, and providing habitat for wildlife.
- Sustainable Transportation: Mantua has implemented cycling infrastructure, pedestrian-friendly areas, and electric buses to reduce the number of cars on the road and improve air quality.
- Sustainable Building Projects: Mantua has implemented sustainable building projects that incorporate NBS, such as green roofs and walls, to improve energy efficiency and air quality.
- Green Spaces: Mantua has implemented green spaces, such as parks and gardens, throughout the city to provide residents with access to nature, improve mental health and well-being, and reduce the urban heat island effect.

The market for nature-based solutions in Mantua is growing as the city continues to prioritize sustainability. The demand for green infrastructure and sustainable transportation solutions is increasing, with more opportunities for NBS providers to offer their services in the city. Additionally, there is growing interest in sustainable building projects that incorporate NBS, such as green roofs and walls, to improve energy efficiency and air quality. Mantua's commitment to sustainability and its focus on nature-based solutions demonstrate the city's dedication to creating a liveable and environmentally friendly urban environment for its residents. The market for nature-based solutions in Mantua is growing, presenting opportunities for providers to offer their services and contribute to the city's sustainability goals.

STRENGTHS	WEAKNESSES
• Existence of projects dedicated to NBS development • Government involvement in long-term sustainability and climate adaptation planning • Salient, acute climate issues that drives actions from government and citizens • Growing population and high rates of urbanization • Upcoming infrastructure projects • Popular consensus that NBS are beneficial and necessary	• Lack of a system and responsibility-taking for maintenance • Funding shortages • Lack of maintenance capabilities • Technological difficulties
OPPORTUNITIES	**THREATS**
• Increase awareness on what NBS can do to improve health and overall wellbeing • Private firms/citizens/universities willingness to establish partnership and sponsorship to implement NBS • Ecosystem services • R&D increased engagement • Increase urban/rural connection reinforcement • Infrastructure projects to build new green areas	• Tensions between stakeholders • NBS visible failures making it hard to convince stakeholders to adopt them

Key strengths and weaknesses

According to our survey results, we have identified numerous strengths for the NBS market in Italy:

- Existence of projects dedicated to NBS development: Mantua has already launched various projects dedicated to NBS development, which indicates a strong commitment to sustainability and climate resilience.
- Government involvement in long-term sustainability and climate adaptation planning: The government in Mantua has shown a strong commitment to long-term sustainability and climate adaptation planning, which provides a supportive environment for the development and implementation of NBS initiatives.
- Salient, acute climate issues that drives actions from government and citizens: The presence of salient and acute climate issues in Mantua has driven actions from both the government

and citizens to address these issues, creating a sense of urgency and momentum for NBS initiatives.

- Growing population and high rates of urbanization: Mantua has a growing population and high rates of urbanization, which creates a need for sustainable solutions to manage urban growth and protect the city's natural environment.
- Upcoming infrastructure projects: Upcoming infrastructure projects in Mantua provide opportunities to integrate NBS into the design and construction of these projects, creating more sustainable and resilient infrastructure.
- Popular consensus that NBS are beneficial and necessary: There is a popular consensus in Mantua that NBS are beneficial and necessary for the city's long-term sustainability and resilience, which provides a supportive environment for the development and implementation of NBS initiatives.

On the other hand, Italy cities' NBS markets have limitations inhibiting growth as well:

- Lack of a system and responsibility-taking for maintenance: NBS require ongoing maintenance to remain effective, but there may be a lack of a system or clear responsibility-taking for maintenance in Mantua. This can result in the deterioration of NBS over time, reducing their effectiveness.
- Funding shortages: Implementing NBS can require significant funding, and there may be shortages of funding available in Mantua. This can limit the scale and effectiveness of NBS initiatives.
- Lack of maintenance capabilities: NBS maintenance requires specialized knowledge and skills, and there may be a lack of maintenance capabilities available in Mantua. This can make it difficult to maintain NBS and reduce their effectiveness over time.

"I think that there's a lot of maintenance for for the green roof also probably maintenance is higher considering also the degree of technology of of nature-based solution. I don't know for example the Sats they need maintenance or more maintenance of green walls."

- Technological difficulties: Implementing NBS can require the use of technology, such as sensors or monitoring systems, but there may be technological difficulties in Mantua. This can limit the effectiveness of NBS and make it difficult to track their performance over time.

Key opportunities and threats

In the near future, cities in Italy should focus on taking up the following opportunities to push for growth in their NBS markets:

- Increase awareness on what NBS can do to improve health and overall wellbeing: There may be an opportunity to increase awareness among citizens, private firms, and government officials on the benefits of NBS for health and overall wellbeing. This can help generate support for NBS initiatives and increase their implementation.
- Private firms/citizens/universities willingness to establish partnership and sponsorship to implement NBS: Private firms, citizens, and universities may be willing to establish partnerships and sponsor NBS initiatives in Italian cities. This can help provide funding and resources for the implementation of NBS.
- Ecosystem services: NBS can provide a range of ecosystem services, such as air and water purification, and there may be an opportunity to leverage these services in Italian cities. This can help generate support for NBS initiatives and increase their implementation.

- R&D increased engagement: There may be an opportunity to increase engagement in research and development related to NBS in Italian cities. This can help identify new NBS solutions and improve the effectiveness of existing ones.
- Increase urban/rural connection reinforcement: There may be an opportunity to reinforce the connection between urban and rural areas in Italian cities through the implementation of NBS. This can help increase the flow of ecosystem services between urban and rural areas and support the sustainable development of both areas.
- Infrastructure projects to build new green areas: Infrastructure projects, such as road or building construction, may provide an opportunity to build new green areas and implement NBS. This can help increase the amount of green space in Italian cities and provide additional benefits such as flood control and improved air quality.

Threats:

- Tensions between stakeholders: The implementation of NBS may require collaboration and coordination between various stakeholders such as government agencies, private companies, and communities. However, tensions between stakeholders, such as conflicting interests or a lack of trust, may hinder the successful implementation of NBS.
- NBS visible failures making it hard to convince stakeholders to adopt them: The failure of NBS initiatives may make it difficult to convince stakeholders to adopt them. This can result in a lack of support and funding for NBS initiatives, limiting their effectiveness.

5.5 Follower - Medellín, Colombia

Medellin (population 2.6 million), located in Colombia, is well-known for its commitment to sustainability and has been recognized for its efforts toward becoming more environmentally friendly. Medellin has also prioritized sustainable transportation as a part of its sustainability efforts. The city has invested in cycling infrastructure, pedestrian-friendly areas, and public transportation to reduce the number of cars on the road and improve air quality.

One of the key features of Medellin's sustainability efforts is its focus on preserving and enhancing its natural resources. The city has implemented numerous initiatives to protect and restore its natural areas, including wetlands, forests, and river ecosystems. These initiatives provide numerous ecosystem services, such as improving water quality, reducing flood risks, and enhancing biodiversity. Additionally, Medellin has implemented several sustainable building projects, such as the eco-library park, which is built with recycled materials and features a green roof. The city has also implemented waste reduction initiatives, including recycling and composting programs. One of Medellin's notable initiatives is the Urban GreenUP project, which is aimed at implementing NBS to reduce the city's urban heat island effect and improve its resilience to climate change. The project involves the implementation of green roofs, green walls, and green corridors throughout the city. Overall, Medellin's commitment to sustainability and its efforts towards implementing nature-based solutions demonstrate the city's dedication to creating a more liveable and environmentally friendly urban environment for its residents while preserving its natural resources.

The Urban GreenUP project in Medellin is aimed at implementing nature-based solutions (NBS) to reduce the city's urban heat island effect and improve its resilience to climate change. Here are some examples of NBS implemented under the project:

- Green Roofs: The project has implemented green roofs on several buildings throughout the city. These roofs help to reduce the urban heat island effect, improve air quality, and provide habitat for birds and insects.
- Green Walls: The project has implemented green walls on several buildings to reduce the urban heat island effect, improve air quality, and enhance the visual appeal of the city.
- Urban Parks: The project has implemented several urban parks throughout the city, including the creation of a green corridor along the Medellin River. These parks provide residents with access to nature, improve mental health and well-being, and reduce the urban heat island effect.
- Stormwater Management: The project has implemented green infrastructure, including rain gardens and bioswales, to manage stormwater and reduce the risk of flooding.
- Sustainable Transportation: The project has implemented cycling infrastructure, pedestrian-friendly areas, and public transportation to reduce the number of cars on the road and improve air quality.
- Citizen Engagement: The project has engaged citizens in the design and implementation of NBS, creating a sense of ownership and promoting a culture of sustainability in the city.

Overall, the Urban GreenUP project in Medellin demonstrates the city's commitment to sustainability and implementing NBS to address environmental challenges. These initiatives provide numerous benefits, including improved air and water quality, reduced flood risks, enhanced biodiversity, and improved mental health and well-being.

STRENGTHS	**WEAKNESSES**
• Technological readiness • Private firm engagement	• Maintenance capabilities • Limited, and mostly public, funding • Lack of resources
OPPORTUNITIES	**THREATS**
• Information campaign to raise awareness • Visibility enhancement • Regulation on corporate social responsibility	• NBS' inconvenience / cleanliness • Lack of genuine motivation to implement NBS

Key strengths and weaknesses

Medellin, Colombia has made significant strides in the development and implementation of Nature-Based Solutions (NBS) in recent years.

- One of its key strengths is its technological readiness, with a number of innovative NBS projects and tools being developed and implemented in the city. For example, Medellin has established a number of green roofs, vertical gardens, and urban forests to help mitigate the urban heat island effect, improve air quality, and increase biodiversity.

  "I think it it's easy to to invest in, in, in a technology for for one."

- Another strength of Medellin's NBS market is the engagement of private firms in the development and implementation of NBS projects. This has led to increased investment in sustainable infrastructure and green technologies, and has helped to spur innovation and creativity in the NBS sector.

However, there are also several weaknesses that present challenges for the development and implementation of NBS in Medellin.

- One key weakness is the limited funding available for NBS projects, with most funding coming from the public sector. This can make it difficult to scale up successful pilot projects or implement large-scale NBS initiatives. Another weakness is the limited maintenance and monitoring capabilities for NBS in the city. Without ongoing maintenance and monitoring, NBS can become degraded or ineffective over time, which can undermine their benefits and potentially lead to negative environmental impacts.
- There is also a limited public awareness and understanding of the benefits of NBS in Medellin, which can hinder the adoption and implementation of these solutions. This highlights the need for more effective communication and engagement with the public on the benefits of NBS, as well as the need to integrate NBS into broader sustainability and climate resilience education programs.
- Finally, challenges in implementing NBS in informal settlements and marginalized communities can also be a weakness in the NBS market in Medellin. These communities may lack access to the resources and support needed to implement NBS projects, or may face other barriers related to land tenure or access to financing. This highlights the need for inclusive and equitable NBS planning and implementation processes that prioritize the needs and perspectives of all stakeholders.

Key opportunities and threats

Medellín has several opportunities to develop its Nature-Based Solutions (NBS) market.

- One of the key opportunities is through an information campaign to raise awareness of the benefits of NBS. This can help to increase demand for NBS and encourage more public and private investment in these solutions. The campaign could be targeted at businesses, citizens, and policymakers to ensure that everyone is aware of the importance of NBS and how they can contribute to a more sustainable and livable city.

"That solutions, I mean you can have a pollination box for instance and you have to be aware people of the problems of insects in in cities and how important they are. So I think to have good maintenance and a lot of information is very important."

- Another opportunity for Medellín is to enhance the visibility of its NBS projects. By making these projects more visible to the public, the city can help to raise awareness of the benefits of NBS and attract more investment in these solutions. This could be achieved through various means such as social media campaigns, public events, and informational signage in public spaces.
- Medellín also has an opportunity to leverage corporate social responsibility (CSR) regulations to encourage more private sector engagement in NBS. By requiring companies to invest in NBS projects as part of their CSR initiatives, the city can incentivize private sector investment in NBS and increase the pool of resources available for these solutions. This can help to ensure

the long-term sustainability of NBS projects and their continued success in addressing key environmental and social challenges in the city.

By taking advantage of these opportunities, Medellín can position itself as a leader in the development and implementation of NBS. The city can leverage its technological readiness, engage with private firms, and collaborate with stakeholders to promote the use of NBS as a key solution to the challenges it faces.

In Medellin, there are also several threats to the implementation of Nature-Based Solutions (NBS) that should be addressed to ensure the success of NBS projects.

- One such threat is the inconvenience and cleanliness of NBS. While NBS can provide many benefits to the community, such as improved air quality and stormwater management, some residents may view NBS as a nuisance due to the maintenance required or perceived negative impacts on the aesthetics of the city. To mitigate this threat, it is essential to raise awareness and educate the public about the benefits of NBS and how they contribute to the long-term sustainability of the city. Another threat to the NBS market in Medellin is the lack of genuine motivation to implement NBS. While the city has made some strides towards sustainable development, there may still be resistance to adopting NBS due to competing priorities or a lack of political will.

  "If you have a a proper pavement then it's it's clean and and it it looks better. Instead of some plans that of course you have to to take care of of of that gardens you have to take care of of all the plans and you there's some maintenance and it's very important to to keep it well so but if if if you explain everything I mean it's not sometimes it's not a garden so it's it you you have to find."

- Additionally, there may be a perception that NBS is too expensive or too risky to implement, leading to a lack of investment in these projects. To address this threat, it is essential to engage stakeholders and demonstrate the value of NBS through case studies and pilot projects. It is also critical to establish clear policies and regulations to support the development and implementation of NBS and provide incentives to encourage private investment in these projects. In addition to these threats, limited funding is another challenge facing the NBS market in Medellin. While there is some public funding available for NBS projects, there is a need for increased private sector investment to scale up and sustain these initiatives over the long term.

  "I mean you can make a a a solution and then you implement it, but then the hardest way is is to is to keep it going. I mean it's nice when you have your, your new infrastructure infrastructure and and they say wow, this is very nice with all the plans and very nice everything and and and also you have invested in in, in technology."

To overcome this challenge, it is essential to establish clear incentives and mechanisms for private investment in NBS, such as tax breaks or subsidies. It is also important to build public-private partnerships to leverage resources and expertise from different sectors. Overall, there are several opportunities for the NBS market in Medellin, but it is essential to address the threats to ensure the

success of these initiatives. By raising awareness, engaging stakeholders, establishing clear policies and regulations, and incentivizing private investment, the city can unlock the potential of NBS to enhance the well-being of its residents and promote long-term sustainability.

5.6 Follower - Ludwigsburg, Germany

Ludwigsburg, located in Germany, is a city that has made significant strides towards sustainability and implementing nature-based solutions (NBS) to address environmental challenges. The city is well-known for its commitment to sustainability and has been recognized for its efforts towards becoming more environmentally friendly. One of the key features of Ludwigsburg's sustainability efforts is its focus on preserving and enhancing its natural resources. The city has implemented numerous initiatives to protect and restore its natural areas, including wetlands, forests, and river ecosystems. These initiatives provide numerous ecosystem services, such as improving water quality, reducing flood risks, and enhancing biodiversity. Ludwigsburg has also prioritized sustainable transportation as a part of its sustainability efforts. The city has invested in cycling infrastructure, pedestrian-friendly areas, and public transportation to reduce the number of cars on the road and improve air quality. Additionally, Ludwigsburg has implemented several sustainable building projects, such as the Schloss Ludwigsburg, a historic building that has been renovated to be more energy-efficient. The city has also implemented waste reduction initiatives, including recycling and composting programs. Overall, Ludwigsburg's commitment to sustainability and its efforts towards implementing nature-based solutions demonstrate the city's dedication to creating a more liveable and environmentally friendly urban environment for its residents while preserving its natural resources.

Ludwigsburg has implemented several nature-based solutions (NBS) to address environmental challenges and improve the quality of life for its residents. Here are some examples of NBS in Ludwigsburg:

- Restoration of Wetlands and River Ecosystems: Ludwigsburg has implemented several initiatives to restore wetlands and river ecosystems, which provide numerous ecosystem services such as improving water quality, reducing flood risks, and enhancing biodiversity.
- Green Infrastructure: Ludwigsburg has implemented green infrastructure projects such as green roofs, green walls, and urban forests to reduce the urban heat island effect, improve air quality, and enhance biodiversity.
- Sustainable Transportation: Ludwigsburg has invested in cycling infrastructure, pedestrian-friendly areas, and public transportation to reduce the number of cars on the road and improve air quality.
- Sustainable Building Projects: Ludwigsburg has implemented sustainable building projects, such as the renovation of historic buildings to be more energy-efficient, to reduce the city's carbon footprint.
- Waste Reduction Initiatives: Ludwigsburg has implemented several waste reduction initiatives, including recycling and composting programs, to reduce waste and promote a circular economy.
- Green Spaces: Ludwigsburg has implemented green spaces, such as parks and gardens, throughout the city to provide residents with access to nature, improve mental health and well-being, and reduce the urban heat island effect.

Ludwigsburg's NBS demonstrates the city's dedication to sustainability and creating a more livable and environmentally friendly urban environment for its residents. These initiatives provide numerous

benefits, including improved water and air quality, reduced flood risks, enhanced biodiversity, and improved mental health and well-being.

STRENGHS	WEAKNESSES
• High levels of citizen awareness • People are highly receptive of the current demonstrations -> want to see how they can bring it home • City has small grants for NBS implementation for citizens and companies	• Lack of human resources – Climate adaptation team in charge of NBS also has a lot of other responsibilities • Not open to lobbying and other policy advocacy efforts / climate change adaptation department not involved in
OPPORTUNITIES	**THREATS**
• City experiencing extreme weather events (heavy rain, flooding, heatwaves, etc.) making it unlivable • Lack of willingness to pay in parts of city without demonstration -> open up an opportunity for further awareness-raising/demonstrations • Detailed/technical information demand from citizens	• Economic/social issues crowding out environmental priorities • Reduction of EU funding • Political advocacy

The Ludwigsburg NBS market has several strengths:

- One of its main strengths is that the citizens have a high level of awareness about the importance of NBS. They are interested in seeing how they can implement NBS in their own lives and businesses. This high level of receptiveness is fueled by the ongoing demonstrations happening in the city.
- Another strength of Ludwigsburg's NBS market is the availability of small grants for NBS implementation by both citizens and companies. This encourages more people to participate and implement NBS solutions in their daily lives.

However, the city also has several weaknesses that could pose a challenge to the development of its NBS market.

- One of these is the lack of human resources dedicated to climate adaptation and NBS. The climate adaptation team responsible for NBS also has other responsibilities, which could lead to delays and slower progress.
- Another weakness is the lack of policy advocacy efforts and the climate adaptation department's limited involvement in climate-related political decisions. This could make it difficult to gain support and funding for NBS initiatives from policymakers.
- Finally, the city also relies heavily on external funding sources for larger NBS projects. This makes it vulnerable to potential funding cuts or changes in funding priorities.

APPENDIX 6: SURVEY DESCRIPTIVE STATISTICS

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Gender	38	1.553	.645	1	4
Location	38	4.684	1.861	1	8
NBStrain	38	1.263	.446	1	2
Job	38	2.763	1.822	1	8
Job year	38	4.421	1.222	1	6
Auth	38	2.763	.82	1	4
Position	38	2.895	1.752	1	6
Role	38	2.132	.963	1	4
NBS status suitabi~1	31	3.419	1.409	1	5
NBS status suitabi~2	31	3.484	.962	2	5
NBS status suitabi~3	31	2.516	1.338	1	5
NBS status suitabi~4	32	2.625	1.129	1	5
Barriers 1	30	3.367	.999	2	5
Barriers 2	31	3.742	1.154	1	5
Barriers 3	31	3.839	1.068	2	5
Barriers 4	31	4.161	.898	2	5
Barriers 5	30	3.867	1.074	1	5
Barriers 6	29	2.207	1.146	1	5
Barriers 7	32	3.125	1.238	1	5
Barriers 8	30	3.4	1.276	1	5
Natural outcome 1	31	4.645	.486	4	5
Natural outcome 2	30	4.367	.85	2	5
Natural outcome 3	30	4.433	.728	2	5
Natural outcome 4	23	2.565	1.647	1	5
Natural outcome 5	29	4.448	.572	3	5
Natural outcome 6	30	4.533	.507	4	5
Natural outcome 7	28	4.357	.731	3	5
Natural outcome 8	27	4.481	.58	3	5
Natural outcome 9	26	3.885	.993	2	5
Natural outcome 10	30	4.433	.626	3	5
Natural outcome 11	26	4.577	.643	3	5
Socio economic out~1	30	4.2	.664	2	5
Socio economic out~2	27	4.259	.764	2	5
Socio economic out~3	30	4.467	.681	2	5
Socio economic out~4	27	3.889	1.086	2	5
Infras buildandren~1	27	3.37	1.079	2	5
Infras buildandren~2	28	4.071	.858	2	5
Infras buildandren~3	28	3.393	1.133	1	5
Infras buildandren~4	27	3.074	.997	1	5
Popularity greenin~e	30	4.133	.86	1	5
Popularity bluegre~t	30	3.333	1.155	1	5
Popularity Ecosysr~e	30	3.7	.837	2	5
Popularity ecosysm~t	29	3.517	.829	2	5
Popularity ecosysp~t	30	3.567	.858	2	5
NBSRegulation gove~1	30	3.267	1.112	1	5
NBSRegulation gove~2	29	2.69	1.072	1	5
NBSRegulation gove~3	28	2.5	1.232	1	5
market grow 5yrs	29	36.103	20.018	1	70
NBSadoption like~ GI	29	4.379	.677	2	5
NBSadoption like~BGI	29	3.966	.823	2	5
NBSadoption likeli~R	27	4.074	.829	2	5
NBSadoption likeli~M	26	4.192	.749	2	5
NBSadoption likeli~P	28	4.143	.756	2	5
NBS potentialbuyes~P	26	2.346	1.294	1	5
NBS potentialbuyes~M	26	3.5	1.631	1	7
NBS potentialbuyes~A	26	2.038	1.311	1	5

NBS potentialbuyes~D	26	4.077	1.495	1	7
NBS potentialbuyer~S	26	4.462	1.581	1	7
NBS potentialbuyes~R	26	5.423	1.172	2	7
NBS potentialbuye~Os	26	6.154	1.642	1	7
NBS potentialbuye~rs	26	8	0	8	8
Negative factors N~1	28	4.143	1.008	2	5
Negative factors N~2	28	3.786	.957	2	5
Negative factors N~3	28	3.929	.94	2	5
Negative factors N~4	28	3.214	1.228	1	5
Negative factors N~5	28	3.929	.94	2	5
Negative factors N~6	28	3.321	1.188	2	6
Drivers NBSadoptio~1	28	4.179	.819	1	6
Drivers NBSadoptio~2	28	4.357	.87	2	6
Drivers NBSadoptio~3	28	4.214	.876	1	5
Drivers NBSadoptio~4	28	4.357	.951	1	5
Drivers NBSadoptio~5	28	3.679	1.307	2	6
Stakeholders appro~1	29	4.724	.797	1	5
Stakeholders appro~2	29	4.172	.848	1	5
Stakeholders appro~3	28	4.25	.967	1	5
Stakeholders appro~4	29	3.552	1.152	1	5
Stakeholders appro~5	29	4.069	.961	1	5
Stakeholders appro~6	29	4.069	.884	1	5
Stakeholders wtp 1	29	3.724	.96	2	5
Stakeholders wtp 2	29	3.379	1.115	1	6
Stakeholders wtp 3	28	3.357	.989	1	5
Stakeholders wtp 4	29	2.931	.842	2	4
Stakeholders wtp 5	29	3.793	.902	1	5
D1	5	1.8	.837	1	3
D3	5	2.4	.894	1	3
D4	5	3	1	2	4
D5	5	3.6	1.517	1	5
D5 6 TEXT	0	.	.	.	.
D6	5	1.4	.548	1	2
D7	5	2	0	2	2
NBSbusinessgrowth ~1	3	3.667	.577	3	4
NBSbusinessgrowth ~2	3	2	1	1	3
NBSbusinessgrowth ~3	3	3	1.732	2	5
NBSbusinessgrowth ~4	3	2.667	1.528	1	4
NBSbusinessgrowth ~5	3	3.667	2.309	1	5
D9 6 TEXT	0	.	.	.	.
clus 1	31	2.226	.92	1	4
NBSdefn 1	29	3.69	1.538	1	6
NBSdefn 2	7	3.571	1.512	2	5
NBSdefn 3	4	3.75	.957	3	5
NBSdefn 4	2	4.5	.707	4	5
NBSdefn 5	1	5	.	5	5
NBSdefn	28	4.357	.989	2	5
Europe	45	.6	.495	0	1

References

1. Ahlfeldt, G., et al., *Demystifying compact urban growth: Evidence from 300 studies from across the world.* 2018.
2. Sowińska-Świerkosz, B. and J. García, *What are Nature-based solutions (NBS)? Setting core ideas for concept clarification.* Nature-Based Solutions, 2022. **2**: p. 100009.
3. *Finance Earth. 2021. A Market Review of Nature-Based Solutions: An Emerging Institutional Asset Class (commissioned by the Green Purposes Company).*
4. Layton, R.A., *Formation, growth, and adaptive change in marketing systems.* Journal of Macromarketing, 2015. **35**(3): p. 302-319.
5. Domegan, C., et al., *Marketing systems: a listen, learn, leverage framework.* Journal of Macromarketing, 2020. **40**(3): p. 380-395.
6. Nenonen, S., et al., *A new perspective on market dynamics: Market plasticity and the stability–fluidity dialectics.* Marketing Theory, 2014. **14**(3): p. 269-289.
7. Bizottság, E., *EU research policy, what nature-based solutions are, background, news and documents. Naturebased solutions research policy*. 2021.
8. Faivre, N., et al., *Nature-Based Solutions in the EU: Innovating with nature to address social, economic and environmental challenges.* Environmental research, 2017. **159**: p. 509-518.
9. *European Commission (2021f) EU climate action and the European Green Deal. In: Energy, Climate change, Environment. European Commission website.* May 28 2023]; Available from: https://climate.ec.europa.eu/eu-action/european-green-deal_en.
10. Hermoso, V., et al., *The EU Biodiversity Strategy for 2030: Opportunities and challenges on the path towards biodiversity recovery.* Environmental Science & Policy, 2022. **127**: p. 263-271.
11. Chausson, A., et al., *Mapping the effectiveness of nature-based solutions for climate change adaptation.* Global Change Biology, 2020. **26**(11): p. 6134-6155.
12. McQuaid, S., et al., *Innovating with nature: factors influencing the success of nature-based enterprises.* Sustainability, 2021. **13**(22): p. 12488.
13. Aguiar, F.C., et al., *Adaptation to climate change at local level in Europe: An overview.* Environmental Science & Policy, 2018. **86**: p. 38-63.
14. Reckien, D., et al., *Climate change response in Europe: what's the reality? Analysis of adaptation and mitigation plans from 200 urban areas in 11 countries.* Climatic change, 2014. **122**: p. 331-340.
15. Reckien, D., et al., *How are cities planning to respond to climate change? Assessment of local climate plans from 885 cities in the EU-28.* Journal of cleaner production, 2018. **191**: p. 207-219.
16. Mertz, O., et al., *Adaptation to climate change in developing countries.* Environmental management, 2009. **43**: p. 743-752.
17. Pasimeni, M.R., et al., *The interplay between urban mitigation and adaptation strategies to face climate change in two European countries.* Environmental Science & Policy, 2019. **95**: p. 20-27.
18. Kabisch, N., et al., *Nature-based solutions to climate change adaptation in urban areas: Linkages between science, policy and practice*. 2017: Springer Nature.
19. Moore Geoffrey, A., *Crossing the chasm: marketing and selling high-tech products to mainstream customers*. 1999, New York: HarperBusiness.
20. Rogers, E.M., *Diffusion of innovations*. 2010: Simon and Schuster.
21. Wilson, S., *Government plans to use nature to combat climate change are 'at severe risk of failure'*.