



URBAN GreenUP

**D7.12: First evaluation of market opportunities in EU
and non-EU countries regarding NBS (Interim)**

***WP 7 , T 7.4 Global market opportunities and
international cooperation***

Date of document

ORIGINAL – 31st August, 2020 (M39)

REVISED – 22nd December 2020 (M43)



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URBAN GreenUP

SCC-02-2016-2017

Innovation Action – GRANT AGREEMENT No. 730426

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 2022 (60 Months)

Deliverable No.	D 7.12
Dissemination Level	PU/PP/RE/CO ¹
Work Package	WP 7 - WP EXPLOITATION AND MARKET DEPLOYMENT
Task	T 7.4 Global market opportunities and international cooperation
Lead beneficiary	19 (RMI)
Contributing beneficiary(ies)	Partner number (partner short name), partner number (partner short name)...
Due date of deliverable	31 August 2020
Actual submission date	31 August 2020
Submission date of REVISED version	18 December 2020
Submission date of FURTHER REVISED version	22 December 2020
Estimated person-month for deliverable	

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Versions

Version	Person	Partner	Date
V1	Lena Bucatariu	RMI	14 August 2020
V2	Tran Duc Trinh	RMI	19 August 2020
V3	Robert McClelland	RMI	19 August 2020
V4	Lena Bucatariu	RMI	20 August 2020
V5	Benedetta Lucchitta & Edoardo Croci	UBO	24 August 2020
V6	Raquel Marijuan Cuevas	CAR	25 August 2020
V7	Raúl Sánchez	CAR	28 August 2020
V8	Lena Bucatariu	RMI	29 August 2020
V9	Benedetta Lucchitta	UBO	30 August 2020
V10	Lena Bucatariu	RMI	31 August 2020
V11	Robert McClelland	RMI	7 December 2020
V12	Tran Duc Trinh	RMI	11 December 2020
V13 – REVISED	Lena Bucatariu	RMI	13 December 2020
V14 – REVISED	Lena Bucatariu	RMI	18 December 2020
V15 - REVISED	L. Bucatariu/R. McClelland	RMI	22 December 2020

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0 Executive summary

This Interim report is a precursor in preparation for D7.8: Report on the market opportunities in European and non-European countries for the implementation of NBS – M60 The interim introduces the market for NBS, followed by a discussion of the Nature Based Solutions concept and their use, from the perspective of both public stakeholders (e.g. municipal bodies, city council) and private stakeholders (e.g. architecture firms). In the local government view, simple NBS can be seen as products with relatively easy off-the-shelf implementation (e.g. pollinator planting), while more complex NBS (e.g. green living wall) are a customized solution requiring extensive planning and adaptation to unique local conditions. For private companies, NBS are their final product, for which they provide a mix of services such as technical design, consulting services, materials sourcing, to best suit the client's problem (e.g. energy savings).

To assess how competitive NBS are, there is a discussion on the advantages of green solutions (deliver multiple ecosystem services, more adaptive) compared with grey/traditional, including examples of NBS that can be integrated with or substituted by grey/traditional infrastructure (e.g. traditional flow regulators or flood control channels can be converted to/integrated with SUDs). To further understand opportunities available for NBS, several sectors appear promising, e.g. landscaping/landscape architecture, tree planting, construction of buildings, construction of drainage and sewage systems, etc.

Next, a brief overview of current NBS diffusion in EU countries is given (UK, Spain, Turkey, Italy, Germany) as well as in non-EU countries (Colombia, Vietnam), followed by a characterization of each URBAN GreenUP city in terms of current NBS situation. Separated between EU and non-EU cities, there are summaries of the respective regulatory, economic (incentives, cost of NBS), and social context (citizen's awareness and engagement) with any barriers or constraints encountered. A sample SWOT analysis is used to summarize key city's Strengths (e.g. city has past experience with NBS projects), Weaknesses (e.g. lack of skilled companies to implement NBS), Opportunities (e.g. possibility to insert NBS as a requirement for urban planning), and Threats (e.g. possible re-allocation of funds away from NBS due to pandemic/other crises).

To prepare for the public and private survey in D 7.8, market demographics are discussed, including the five stakeholder groups, namely: public agencies/government (e.g. municipalities, city councils, etc.); businesses/companies (architects, SMEs, etc.); academia/R&D (academic and research institutes); society (citizens & local communities), and international bodies (standardisation bodies, EC, etc). To better understand which specific NBS are high-potential to capture the market segments, a number of factors are proposed for assessment e.g. key sectors with interest and willingness to pay for NBS, NBS that are easier to adopt/implement, NBS that are easier to integrate into an existing infrastructure, etc.

Finally, the last chapter defines the methodology for the market survey that will be conducted in D 7.8, including sample size, language, dissemination of online survey by partners, process of data analysis. Two draft questionnaires are also proposed, one survey to assess NBS opportunities for public and private stakeholders and one survey draft to gauge citizens' understanding of NBS and engagement/willingness to pay for NBS.



1 Introduction

This section gives a brief introduction of the market for NBS, followed by contributions from other partners and connections with other WPs; lastly, a preview of all chapters is provided.

Nature-Based Solutions (NBS) have emerged as an approach to promoting sustainability in urban areas, due to the growing number of people living in our cities (approximately 70% of the current European Union population, Source: Catalogue D 1.1). The impacts this has on building density and the use of environmental resources has affected the functionality of many socio-economic and ecological systems and the delivery of ecosystem services. This includes the pollution and overuse of water and terrestrial resources, exacerbation of natural hazards, decline in quality of life, and degradation of air quality, leading to a myriad of impacts on the quality of urban environments and their human populations, with significant implications for the sustainability and economic viability of European cities.

The ongoing COVID-19 situation is providing unique opportunities for NBS, such as:

- NBS benefit for mental health for people affected by pandemic:

have been identified as viable instruments with positive impact on the mental and physical wellbeing of residents (Bratman et al., 2019;

Davern et al., 2016; Hartig et al., 2014)

Source: Fastenrath, S., Bush, J., & Coenen, L. (2020). Scaling-up nature-based solutions. Lessons from the Living Melbourne strategy. *Geoforum*, 116, 63-72.

- Philippines – NBS investment for faster recovery after pandemic:

INVESTMENT in “green” infrastructure can help the Philippines bounce back faster and become more resilient after the pandemic, according to a report published by the Climate Bonds Initiative (CBI) and prepared with the Securities and Exchange Commission (SEC) and the Asian Development Bank (ADB).

“The significant scaling-up of investment in green infrastructure is critical for the Philippines to meet its climate commitments — including meeting global emission reduction pathways under the Paris Climate Change Agreement

Source <https://www.bworldonline.com/green-infrastructure-investment-seen-potentially-supercharging-phl-recovery/>

To understand the market for NBS in cities, it is important to assess the competitive environment, i.e. gray/traditionally built infrastructure that have the potential to be displaced or integrated with NBS, for example: grey roofs, traditional drainage systems, surface water storage, grey water recycling systems, and others. Another important component of the market is represented by the clients or customers who implement and/or benefit from NBS solutions. To illustrate, on the public side, city councils and municipalities may be sponsors or co-investors in NBS as a way to mitigate some of the city’s pressing needs e.g. heat island, water pollution, air pollution, in order to create a more livable/desirable city for its citizens. On



the private side, companies and businesses may have a more or less direct involvement in and benefit from NBS, for example utilities companies may be interested in water management benefits that NBS can offer, architecture firms offer NBS as their final product and depend on revenue from consulting, technical designs, feasibility studies for NBS. Building construction sector and SMEs may benefit either as direct client/owner (e.g. invest in green roof, green façade) or as a supplier of services and materials e.g. installation, planting of trees, sale of smart soil, etc. Finally, citizens and local communities may benefit directly from the result of NBS (e.g. fruits from urban orchard, employment in maintenance) or more holistically by having a more livable city with aesthetic green and blue spaces, opportunities for recreation and rejuvenation, cleaner air, and so on.

1.1 Contributions from other partners and connection with other WPs

Partner	Contribution
RMI	<p>Researching activities on grey solutions that can be complemented/substituted by NBS</p> <p>Researching activities on sectors/industries that can benefit from NBS</p> <p>Elaboration of possible positioning strategy for NBS</p> <p>Elaboration of methodology for survey of D7.8</p> <p>Elaboration of survey questionnaire for public/private and survey for citizens</p> <p>Overall D7.12 coordination and writing</p>
UBO	<p>Definition of the deliverable structure</p> <p>Input on Stakeholders, Methodology, Survey questionnaire</p> <p>Review of D 7.12 draft (multiple review rounds)</p>
CAR	Review of D 7.12 draft (two reviewers)
LIV	<p>Public view of NBS as a solution/package</p> <p>Overview of LIV</p> <p>Questions for 7.12 (ANNEX)</p>
SGR	Private view of NBS for business/company
BIN	<p>Overview of Quy Nhon NBS</p> <p>Public view as a solution/package</p> <p>Table for 7.12 (ANNEX)</p>
MAN	<p>Public view as a solution/package</p> <p>Brief overview of current situation in MAN</p> <p>Table for 7.12 (ANNEX)</p>
IZM	<p>Overview of IZM</p> <p>Table for 7.12 (ANNEX)</p>
VAL	<p>Overview of VAL</p> <p>Table for 7.12 (ANNEX)</p> <p>Public view as a solution/package</p>

Partner	Contribution
	Link to Country report for NBS in Spain (Spanish language) Review draft of D7.12
All partners	All cities and partners will be involved in a workshop to refine the survey questions for D7.8: Report on the market opportunities in European and non-European countries for the implementation of NBS – M60) and in disseminating the final survey to stakeholders for answers

This Interim report is connected with D7.8: Report on the market opportunities in European and non-European countries for the implementation of NBS – M60) as it lays the foundation for market evaluation and defines the draft survey questionnaires for public/private and citizens.



2 NBS concept and NBS in the URBAN GreenUP countries

This section covers briefly the concept, definition and examples of NBS and their use both from the view of local government and from the view of private companies. Next, there is a discussion on the difference between green and grey solutions, the type of traditional solutions that can be replaced by or integrated with NBS and an overview of the sectors that can adopt NBS. For each URBAN GreenUP country, NBS diffusion will be analysed based on multiple criteria, including examples of cities that have NBS within each country (or Green Infrastructure/green alternatives as a proxy for countries where there are no NBS), types of NBS (or Green Infrastructure/green alternatives) available, stakeholders relevant to NBS and their involvement, and an evaluation of how widely NBS are adopted currently or have potential for the future (or Green Infrastructure/green alternatives as a proxy for countries where there are no NBS).

2.1 Concept of NBS and their use

Most recent concepts added to the revised version:

Concepts that are currently used as part of the urban greening lexicon include Green Infrastructure (GI) and Ecosystem-Based Adaptation

(EBA). Nature-Based Solutions (NBS) is the latest addition (Nesshöver et al., 2017).

NBS, GI and EBA hold in common:

- All are systemic approaches to solve sustainability issues
- embedded in inter- and transdisciplinary research and rely on participatory governance (Pauleit et al., 2017).
- all promote the principle of multifunctionality. Pauleit et al. (2017)

Differences between NBS GI and EBA:

- EBA and GI as a subset of NBS
- GI focusses less on the role of biodiversity and is less action oriented than NBS.
- GI may offer guidance on practices to integrate NBS into urban planning.
- Conversely, Nesshöver et al. (2017) conceptualise GI as an application of NBS with an explicit focus on infrastructure
- EBA is conceptualised as a more systemic approach

to manage the natural environment including a specific focus on

inclusion and participation.

- Finally, Kabisch et al. (2016) conceptualise

NBS as more innovative than related concepts in the sense that it builds

on them but targets urban sustainability issues more explicitly.

Sources Dorst, H., van der Jagt, A., Raven, R., & Runhaar, H. (2019). Urban greening through nature-based solutions—Key characteristics of an emerging concept. *Sustainable Cities and Society*, 49, 101620.



Historical data that may or may not be included in final report:

History - all existing concepts to date by year: ecological restoration, ecological engineering, etc.

Source: de Jesús Arce-Mojica, T., Nehren, U., Sudmeier-Rieux, K., Miranda, P. J., & Anhuf, D. (2019). Nature-based solutions (NBS) for reducing the risk of shallow landslides: Where do we stand?. *International Journal of Disaster Risk Reduction*, 41, 101293.

This section refers briefly to the definition of NBS, EKLIPSE challenges that NBS address and examples of NBS solutions in the URBAN GreenUP project.

Source: from Catalogue D 1.1.

Nature-Based Solutions (NBS) have emerged as an approach to promoting sustainability in urban areas, due to the growing number of people living in our cities (approximately 70% of the current European Union population). The European Commission defines NBS as: *‘solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience’*

The primary purpose of NBS is to address EKLIPSE challenges that cities are facing, such as water management (NBS contribution to flood risk, water scarcity and water quality); coastal resilience (NBS can protect communities against extreme events); green space management: (NBS can aid urban biodiversity, provide ecosystem services, habitats for species, connectivity); Air quality: (NBS can help remove air pollutants and carbon dioxide, reducing the air temperature and increasing oxygen concentration); urban regeneration (NBS can restore city resilience); Participatory planning and governance (NBS can focus on the interests of citizens); social justice and social cohesion (opportunities for interaction in NBS in urban areas); Public Health and Well-being: (positive psychological and physiological benefits); and potential of economic opportunities and green jobs: (increased real estate value, attract “Green businesses” and create “Green-Collar Jobs”).

The Catalogue D 1.1 describes all URBAN GreenUP Nature-Based Solutions (NBS); there are 48 NBS divided into 14 groups according to their category. The groups are:

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)	Pollinator (5 NBS)	Vertical GI (5 NBS)	Horizontal GI (5 NBS)	Pollutants filter (2 NBS)	Resting areas (2 NBS)	Urban farming (2 NBS)

Table 1 NBS of URBAN GreenUP . (Source: NBS Catalogue D1.1, 2018)

The section below describes each group in more detail:

Green route provides green pathways for recreational, public health and well-being opportunities, as well as transportation linkages. Arboreal interventions include *Shade trees*,



Cooling trees, Planting and renewal urban trees, Arboreal areas around urban areas, Trees re-naturing parking. Carbon capture initiatives includes *Urban carbon sink*. SUDs (Sustainable Drainage systems), for example *Grassed swales and water retention pounds, SUDs for green bike lane/parking; and Rain gardens.*

Flood actions include *Urban catchment forestry, Hard drainage-flood prevention, Unearth water courses, Channel re-naturing, Floodable park.* Water treatment can be *Green filter area; Natural wastewater treatment.* Green pavements include *Hard drainage pavements, Green pavements, green parking pavements, Cycle-pedestrian green pavement, Cool pavement.* Smart soils include *Enhanced nutrient managing and releasing soil, Smart soil production in climate-smart urban farming precinct, and Smart soil as substrate.*

Pollinator include *Pollinator verges and spaces, Pollinators walls/vertical, Pollinator roofs, Natural pollinator's modules, Compacted pollinator's modules.* Vertical GI include *Green fences, Green noise barriers, Green façade with climbing plants, Hydroponic green façade, Vertical mobile garden.* Horizontal GI include *Floating gardens, Green covering shelters, Electro wetland, Green roof, Green shady structures.* Pollutants filter include *Green filter area, Urban garden bio-filter.* Resting areas include *Parklet or pocket park, Green resting areas.* Urban farming includes *Climate-smart greenhouses, Waste water treatment by using by-product; Urban orchards, Community composting, and Small-scale urban livestock.*

2.1.1 Local government view of NBS

While the previous section covered the definition and uses of NBS with examples of solutions, the current section analyzes how NBS are perceived in the market by the stakeholders who can benefit from or make use of NBS. More specifically, this section covers the different viewpoints of public and private stakeholder groups. The view of public stakeholders is crucial at all stages of NBS adoption, especially when making decisions about which NBS solutions to consider, why, and who can implement them.

Concerning NBS in the perspective of local government, the following points of view have been proposed:

Direct contribution from LIV (distinction between simple and complex NBS, difficulty of bidding due to insufficient expertise in one company):

- Simple, easily replicable NBS solutions can be seen as off-the-shelf products (LIV)
 - Easily replicated with minimum changes at the site
 - Cities can encourage planners and developers to incorporate a package solution for NBS to address local issues (where previously proven to be successful) into schemes
 - Current NBS examples: pollinator planting, tree planting
 - Future NBS examples (with more experience and results from NBS trials): simple lake floating ecosystems for biodiversity, very basic type of rain garden
- More complicated (expensive) NBS should be packaged & consulted individually (LIV)
 - Require extensive planning and consideration, adaptations to unique site conditions



- Examples: green living wall (it must be considered building orientation and light, the species composition and planting design, irrigation, the strength and composition of the supporting structure, potential fire risk)
 - Should consult with land owners, stakeholders/interested parties
- to facilitate buy-in and ownership of the schemes
- to ensure top quality result
- to promote understanding and appreciation of the multiple benefits of a complex NBS
- View on package solutions in bidding for/delivery of NBS (LIV)
 - Difficult to find ONE environmental organization or company that has all the skills needed for the delivery of different NBS (currently most companies specialize in one type of NBS)
 - Most contractors bidding for a whole/complex package with a range of NBS solutions may require detailed direction and support from the city council and may struggle to meet the quality tender specifications

Direct contribution from VAL (emphasis on need for adaptation, possibility for standardized bidding and supplier contracts):

- Need for adaptation of NBS (VAL)
 - Solutions must be adapted to the particular case of the city in the specific location. There are no standard solutions; even tree species must be selected. Cities must first have technical support (service), and then launch the bidding process for implementation.
 - NBS can be sold as products, but they must always be adapted to local conditions. For example, NBS products are: green roof, vertical garden, green canopies, green noise barrier, SUDs such as the green gutter, detention pond, retention pond, and green filtering pavement, among other. But there must always be a technical service that carries out a specific project for a place. Solutions cannot be standardized, as there must exist an specific technical-economic project.
 - The consulting service is not standard. Each company can quantify the price according to its own assessment. A high specific expertise in NBS design is essential.
- Public bidding is feasible with standardized elements (VAL)
 - The technical project can be tendered through open work processes (for the construction of the NBS). Bidding criteria can be adapted to ensure the best value for money. Scoring for the tendering processes can be included by technical criteria, which are mathematically quantifiable (to avoid subjective interpretation). For example, a higher score can be given in the tender to companies that provide more green area (more square meters), more number of trees, or more linear meters of SUDs.
 - Implementation can also be done as supply contracts (e.g., for trees). (VAL)

View from BIN (package solution, to be incorporated into green urban recovery plan; limited options for bidding as only one company has the expertise):

- A package solution for green tree system development here is essential, to incorporate it into the local green urban recovery orientation plans.



View on bidding (currently, few or just one suitable contractor) (BIN):

- The NBS package solution may face some limitations in bidding. For now, the greenery system in Quy Nhon city implemented by the Green Park and Urban Lighting Joint Stock Company is the only option of the city; they have long-standing solutions and experiences. Selection of contractors to implement NBS without competition between different contractors may be unsatisfactory in terms of specifications, NBS quality and even financial matters.

Package solution to address the following issues (BIN):

- Some green tree species in the street green area have developed quite well and have confirmed their suitability in the process of natural interaction with the specific soil, weather and climate conditions in the region, although the green tree system has not developed synchronously and has not been linked together.
- The strata structure of the entire urban area is not uniform. Most of the inner city area is sandy ground, along Thi Nai lagoon in the West and Northwest of flooded land, only suitable for some typical crops; it is difficult to create a diversity of species in the same area.
- There are still many areas of bad land, fallow, less favorable for the cropping system, especially rocky mountains.

Some steps being taken to improve the situation (BIN):

- To solve this situation, the Government has had many policies to develop a green tree system for key cities, among which is Quy Nhon city. And the Quy Nhon city government has made a big decision and is determined to strengthen the green array system for the entire city. That is the opportunity to apply the NBS package of the project to refer to detailed information to make appropriate choices with the city decisions in the green urban restoration planning.

View from MAN (package solution, insert in regional/national public procurement platforms)

- NBS package solution or individual components package (particularly consulting services) can be useful if inserted in regional or national public procurement platforms.
- Advantage: an easy solution to increase NBS application.

2.1.2 View of private companies

Added from literature (partial match):

- *NBS for flood management has 'psychological benefits giving back communities some control over flooding and its impacts. It can also engender greater preparedness for flooding.'* (RB: Private sector).
- **Source:** Bark, R. H., Martin-Ortega, J., & Waylen, K. A. (2020). Stakeholders' views on natural flood management: Implications for the nature-based solutions paradigm shift?. *Environmental Science & Policy*, 115, 91-98.



NBS for flood management is seen as superior to grey 'because hard defences are deteriorating and/or inadequate to deal with climate change impacts.'

Source: Bark, R. H., Martin-Ortega, J., & Waylen, K. A. (2020). Stakeholders' views on natural flood management: Implications for the nature-based solutions paradigm shift?. *Environmental Science & Policy*, 115, 91-98.

More primary data will be collected in the later stages of the report during regular meetings by accessing partners in the task ACC,SGR,CEN,CFT, DEM – as corporate partners it is very relevant to have their opinion or their perspective on this matter and their external connections/network to support.

After analysing the perspective of public entities, this section turns towards how private companies perceive NBS. This is an important step in the process of NBS diffusion as many businesses can be either direct owners/clients of NBS e.g. a building owner interested in Green façade, or benefit commercial from selling services and materials/manufacturing associated with the NBS (e.g. technical designs, smart soils, etc).

View from SGR (NBS is the final product, provide consulting services and technical designs, can serve either public or private client, focus on adapting the solution to the client's specific needs and local conditions):

- NBS is the final products, business depends on NBS
- Offer consulting services and technical designs
 - Design the complete technical design of the NBS to implement (not just parts)
 - Examples: Green Shady Structures, Green Cover Shelters in Valladolid
 - SGR designs all elements including structure, waterproofing, substrate, vegetation and irrigation system
- Adapt solutions to meet specific client needs
 - Example 1. The Green Shady structures needed to be detachable from the facades in case of fire.
 - ➔ Solution: adapted the design to be light textile canopies easy to lower down
 - Example 2. The Green Cover Shelters were going to be implemented over an existing structure and it has a low load capacity
 - ➔ Solution: chose a very light green roof system; didn't cover the complete surface of the deck.
- Examples of public v. private NBS
 - PUBLIC: Vertical garden for a city council – client wants to choose location
 - SGR will study local conditions of free space, temperature conditions, use of the people, water requirements, proposal several options of location that meet the client's objectives
 - PRIVATE: High electricity expenses for the building's air conditioning
 - SGR will offer energy efficiency study
 - Write an improvement project based on green walls & roofs implementation
- Challenge: many people do not know the benefits of NBS and see them only as decorative elements



- ➔ Solution: SGR will introduce benefits of the NBS and support with studies
- ➔ Installing NBS in the cities is an opportunity to publicize the benefits
- Examples of results/benefits that clients value: Energy savings, air quality improvement, heat island reduction, etc.

2.2 Green or grey: which and when can NBS replace traditional solutions

As supported by research, the market for NBS is viable compared to grey infrastructure – although NBS may not always be superior to grey infrastructure but rather a good combination of both is the most reasonable approach.

Most recent findings added to the revised version:

Examples of costs and annual co-benefits (Euro) for various NBS/grey:

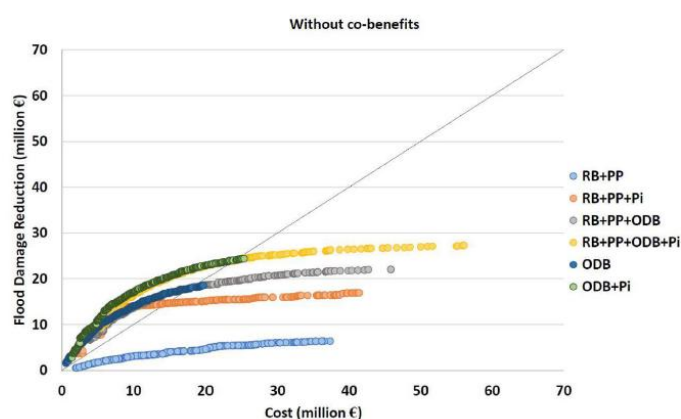
(RB: Rainwater Barrel, PP: Pervious Pavement, ODB: Open Detention Basin, Pi: Pipes): Pervious pavement costs 160 Euro/ m², yields 86Euro/m² as annual co-benefit

Table 1
Cost and co-benefits values for each selected measure (RB: Rainwater Barrel, PP: Pervious Pavement, ODB: Open Detention Basin, Pi: Pipes).

Measure	Cost	Annual co-benefit
RB	1040	30
PP	160	86
ODB	350	0
Pi (mm)		
800	720	0
1000	895	0
1500	1530	0
2000	2950	0
2500	3615	0

Example table 1: From Source

Net present value calculation of NBS v grey and combinations for flood damage reduction



Example figure 1: From source

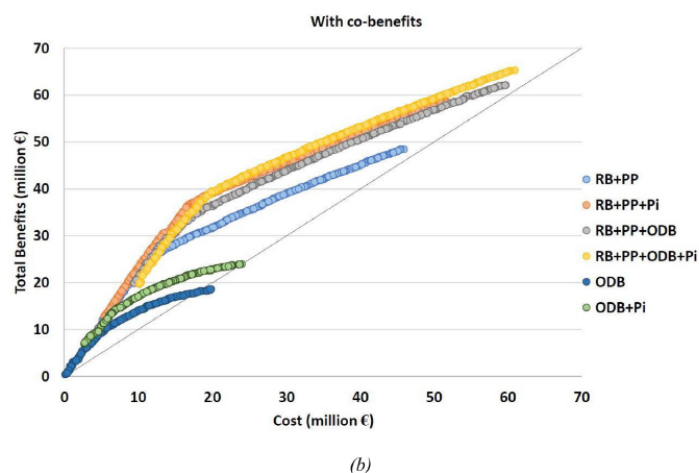


Fig. 4. Pareto fronts obtained for the six strategies selected with (a) cost minimisation and flood risk reduction maximisation as objectives (b) cost minimisation and total benefits maximisation as objectives (grey line: costs = benefits).

Example figure 2: From source

Sources: Alves, A., Vojinovic, Z., Kapelan, Z., Sanchez, A., & Gersonius, B. (2020). Exploring trade-offs among the multiple benefits of green-blue-grey infrastructure for urban flood mitigation. *Science of the Total Environment*, 703, 134980.

Costs savings for wetlands – capital and operating costs:

- An example of driving down the cost of wastewater treatment, integrated constructed wetlands, typically cost 10–50% of the capital cost of grey options (e.g. activated sludge systems) and are likely to incur only 10–25% of the operating costs of grey alternatives (Zhou et al. 2009).

Cost advantages of NBS in investment compared to grey (USA-UK-EU-China)

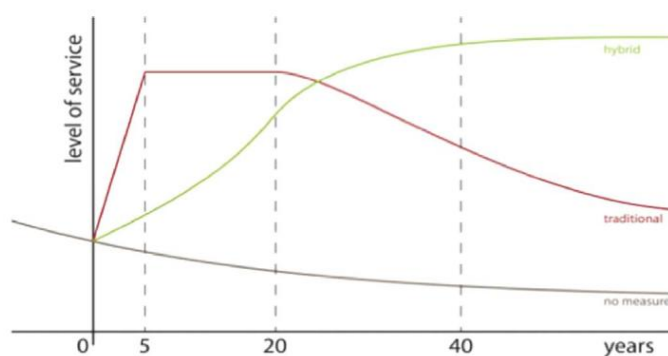


Fig. 2. Grey versus Green infrastructure qualitative natural capital dynamics. From Altamirano et al. (2013).

Example figure 3: From source

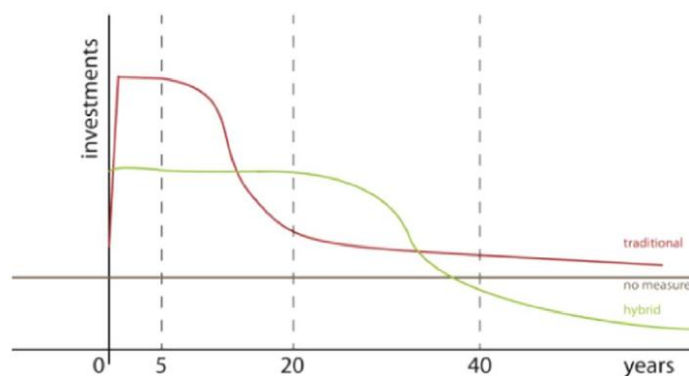


Fig. 3. Grey versus Green infrastructure qualitative capital investment and operational expenses required. From Altamirano et al. (2013).

Example figure 4: From source

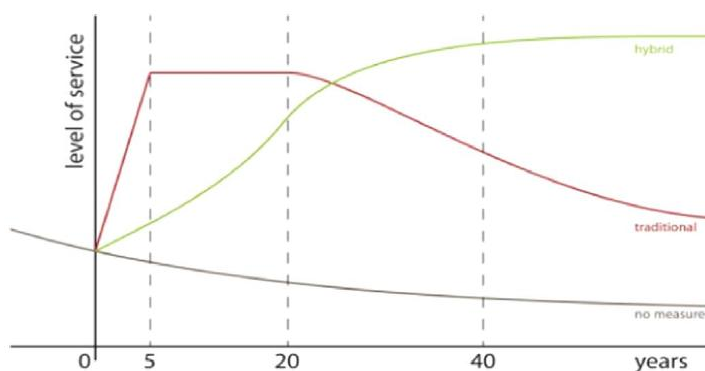


Fig. 4. Grey versus Green infrastructure time required to achieve specified levels of services. > From Altamirano et al. (2013).

Example figure 5: From source

Source Denjean, B., Altamirano, M. A., Graveline, N., Giordano, R., Van der Keur, P., Moncoulon, D., ... & Pengal, P. (2017). Natural Assurance Scheme: A level playing field framework for Green-Grey infrastructure development. *Environmental research*, 159, 24-38.

Colombia – examples of stormwater NBS integrated (hybrid) with grey

- Disadvantages of traditional grey stormwater (redirects water away through pipes, etc, single purpose, stationary, reaching end of life, less useful for pollution prevention, etc)
- NBS advantages: can capture and infiltrate water where it falls, reduces runoff, preserves quality and quantity of water
- Recommended combined hybrid: instead of replacing current infrastructure, NBS should be used to supplement current

stormwater management networks.

- Advantages of integration:

- increase network resilience and flexibility
- taking pressure off existing systems
- delaying the need to build centralized infrastructure
- and reducing energy used for conveyance.

Source: Gordon, B. L., Quesnel, K. J., Abs, R., & Ajami, N. K. (2018). A case-study based framework for assessing the multi-sector performance of green infrastructure. *Journal of environmental management*, 223, 371-384.

While the previous section focused on how public and private stakeholders view NBS, this section includes an overview of the debate between nature focus vs. NBS as a complement to grey/built infrastructure including some advantages of NBS over grey or traditional solutions. The section concludes with examples of grey solutions that can be integrated with or replaced by NBS as well as examples of sectors that can adopt NBS.

Grey solutions are important to understand in the market evaluation because traditional infrastructure is part of the competitive environment for NBS, i.e. the market can be penetrated by focusing on specific grey/traditionally built infrastructure that has the potential to be displaced or integrated with NBS, for example: grey roofs, traditional drainage systems, surface water storage, grey water recycling systems, and others.

As a corollary, it is important to identify the sectors that can benefit most from NBS adoption, i.e. industries that have pressing needs for more ecological, green alternatives either voluntary e.g. to proactively improve their offering to the ultimate customer (e.g. construction of buildings, landscape architecture) or to comply with policy/mitigate problems (e.g. stormwater management).

Source: Catalogue D1.1 section 4, Pp. 209 – 217:

The literature identifies a debate between seeing NBS as one option for environmental specialists from among various environment and landscape choices e.g. GI, ecosystem services, biomimicry, hard and soft engineering practices (Pontee et al., 2016) while others see NBS as a complement not a replacement (Liquete et al., 2016). More specifically, the question arises whether NBS mimic or represent only natural systems and practices or there is scope to integrate a more technological approach to their use in practice. Moreover, there is still some discrepancy between where NBS should be situated in the range of environment and landscape practices currently being used to shape urban development (e.g. GI, ecosystem services, biomimicry, hard and soft engineering practices), and how this influences the choices being made by built environment specialists (Pontee et al., 2016). This is a crucial debate for NBS, as Nesshöver et al. (2016) promote NBS as a direct challenge to existing grey infrastructure practices and argue that NBS are needed to promote a transition to a more socio-economic and ecological approach to urban management; Liquete et al. (2016) consider NBS as a companion and not a replacement for engineered solutions.



NBS focus on nature at their core

A key aspect of the debates supporting NBS has been the subtle shift in emphasis that places 'nature' at the centre of development debates. This has extended the discussions of human-environmental interactions inherent in green infrastructure planning, a major departure from the broader policy/practice evaluations proposed in the more generic 'green space' literature (Albert & Von Haaren, 2014; Hansen & Pauleit, 2014). The NBS literature concentrates on the inclusion of 'nature' in its widest sense in all development, and promotes the ecological value of NBS as of equal importance to socio-cultural and economic benefits (Kabisch et al., 2016). While green infrastructure planning promotes a human-environmental paradigm for urban development that locates nature within the broader discussion of development (Austin, 2014), NBS differs from this approach as 'nature' becomes the central aspect (Kabisch et al., 2016; Sinnett, Smith, & Burgess, 2015).

NBS as complementary to grey/built infrastructure

Although the principles of green space planning, greenways, ecosystem services and green infrastructure remain central to the promotion of NBS, concepts such as "green space planning" terminology are still common, which encourages the presentation of NBS as a complementary rather than transformative approach to urban development. NBS therefore is not separate from water and engineered solutions, but a way of complementing these practices from a more ecological perspective (Nesshöver et al., 2016). Moreover, van Wesenbeeck et al. (2014) state that NBS are one of the family of options among a broader range of solutions to urban development, not the only one.

NBS balance between people, technology, the environment and policy

Also, Fink (2016) proposes that in addition to natural resource management that "green technology" in the form of green walls, roofs and ecologically sensitive buildings, and other NBS help to develop equilibrium between people, technology, the environment and policy to achieve a more sustainable balance of meeting social needs, supporting ecological systems and economic growth within urban areas.

NBS contribute to more resilient and sustainable systems

NBS aid urban adaptation by providing choice for planners, developers and architects within nature/technology/built infrastructure debates and can be used to reverse some of the cost, maintenance and delivery issues associated with engineered solutions such as channelization or hardscaping of urban areas (van Wesenbeeck et al., 2014). Consequently, some have suggested that NBS should not be used to "solve" problems, but to promote greater interactivity between people/nature to support the development of resilient and sustainable systems (Scott et al., 2016). This, as argued by Connop et al. (2016), is context driven; and although we can identify practices that can be utilised in alternative urban and climatic locations, NBS should reflect the physical and socio-economic needs of a location.

To sum up, key advantages of NBS over grey solutions are their ability to deliver all 4 ecosystem services: supporting, provisioning, regulating, and cultural services. Additionally,



NBS can delivery co-benefits such as socio-cultural, economic, and for governance. To illustrate, NBS are more responsive to change than regular systems, they complement engineered solutions and other sustainable options such as GI (Green Infrastructure) in a more ecological way and are more context-specific, that is NBS can be adapted to reflect the physical and socio-economic needs of each location, including the local political agenda (Kabisch et al., 2016; Lique et al., 2016; Nesshöver et al., 2016).

2.2.1 Grey solutions that can be substituted or integrated with NBS

After discussing literature highlights on the green vs grey debate in the previous section, the current section mentions some examples of grey solutions that can be integrated with NBS or replaced by them. As mentioned, it is necessary to include a discussion of grey/built/traditional solutions because they represent the competitors of NBS and a very familiar option for urban planners, architects, construction companies, and other relevant sectors.

Based on Petsinaris, Baroni, & Georgi (2020), the Table below lists some examples of grey solutions that have been identified as candidates to be integrate with NBS or replaced by NBS.

The list is not comprehensive, and partners with technical expertise will be invited to refine the table during future project meetings by highlighting grey or traditional current options that can be integrated or replaced by NBS, which NBS can be implemented at city level or not, and to give examples of specific NBS that are being implemented in URBAN GreenUP that have been used to integrate with or substitute/replace an existing grey/traditional infrastructure.

Grey or traditional solution that exist now (to be refined with input from partners)	Can be implemented in cities? Yes/NO(to be refined with input from partners)	NBS that can be integrated/substituted for the grey solution (to be refined with input from partners)	Examples of NBS from URBAN GreenUP that were used to integrate/substitute this grey solution (to be refined with input from partners)
1. Traditional cooling of buildings			
2. Grey/traditional roofs		Green roof (source: catalogue D1.1)	
3. Grey/traditional façades		Green façade (source: catalogue D1.1)	
4. Grey/traditional pavements		Green pavement (source: catalogue D1.1)	
5. Cooling water fountains (outdoor water spraying)			
6. Dikes	Cannot be implemented in cities		
7. Floodwalls			
8. Longitudinal barriers on rivers (or dams)		Hard drainage-flood prevention (source: catalogue D1.1)	
9. Temporary and demountable flood barriers			
10. High-water channel			

Grey or traditional solution that exist now (to be refined with input from partners)	Can be implemented in cities? Yes/NO(to be refined with input from partners)	NBS that can be integrated/substituted for the grey solution (to be refined with input from partners)	Examples of NBS from URBAN GreenUP that were used to integrate/substitute this grey solution (to be refined with input from partners)
11. Compartmentalisation			
12. Storm surge barriers (or gates)			
13. Groynes, breakwaters and artificial reefs			
14. Higher quays			
15. Quay walls / sheet pile walls			
16. Sluices and pumping stations			
17. Dry flood-proofing			
18. Wet flood-proofing			
19. Floating and amphibious housing			
20. Floating or elevated roads			
21. Raising coastal land			
22. Upgrading drainage systems / increasing pipe capacity		SUDs	
23. Flow regulators		SUDs	
24. Smart regulation of the sewage system		SUDs	
25. Flood control channels		SUDs	
26. Surface water storage		Floodable park (source: catalogue D1.1)	
27. Underground water storage			
28. Backflow blocker			
29. Pump well with check valve			
30. Separate sewers		SUDs (source: catalogue D1.1)	
31. Greywater recycling systems		Green filter area (source: catalogue D1.1)	
Wastewater treatment		Constructed wetland (source: catalogue D1.1)	
32. Desalination			
33. Air extraction		Urban Garden Biofilter	

Table 2 Grey solutions that can be substituted or integrated with NBS (Source: Petsinaris, Baroni, & Georgi, 2020)

As seen above, a majority of grey solutions can be integrated/replaced with NBS, such as SUDs for separate sewers, flood control channels, flow regulators; Urban Garden Biofilter can be used to substitute/complement air extraction; Constructed wetland can complement/integrate with wastewater treatment, green roofs can replace traditional grey roofs, and so on.

2.2.2 Sectors that can adopt NBS

After discussing examples of grey/built infrastructure that can be integrated or replaced by NBS in the previous section, the current section mentions some examples of sectors that can adopt NBS. As mentioned, it is necessary to include a discussion of sectors relevant to NBS

because they represent opportunities for market penetration when bringing NBS to cities and countries.

Based on Petsinaris, Baroni, & Georgi (2020), below are some examples of sectors that can adopt NBS.

The list is not comprehensive, and partners with technical expertise will be invited to refine the table during future project meetings by giving examples of NBS from URBAN GreenUP .

NBS	Products/sectors	Examples from URBAN GreenUP (to be refined with input from partners)
Green roof	manufacturers and suppliers of green roof components; green roof installation; green roof maintenance; landscaping; construction of buildings; landscape architecture	
Vertical GI/Pollinator wall/green wall/ Green façade	green facades, green/living walls; manufacturers and suppliers of components; vertical green wall installation; maintenance; landscaping; construction of buildings; landscape architecture; architectural design	
Urban parks/Green corridors/Urban green space/Urban garden	landscaping; landscape architecture; tree planting; green space maintenance; construction of transport infrastructure	
Electro wetlands/green filter area/wetland/natural waste water treatment	Ecological restoration; ecosystem management and maintenance; landscaping; landscape architecture	
SUDS/swales/ Rain gardens	SUDS; stormwater management; landscaping; landscape architecture; manufacturing of SUDS components; SUDS maintenance; construction of buildings; construction of transport infrastructure; water management; construction of drainage and sewage systems	
Restauration of lake/river bank	Ecological restoration; ecosystem management and maintenance; landscaping; landscape architecture	
Green pavement/green parking pavement	pervious/permeable pavements; SUDS; landscaping; landscape architecture; stormwater management; construction of transport infrastructure; water management; construction of drainage and sewage systems	

Table 3 Sectors that can adopt NBS (Source: Petsinaris, Baroni, & Georgi, 2020)

As seen above, NBS can be targeted at a number of industries and sectors, such as:

- landscaping/landscape architecture (for Urban parks/Green corridors/Urban green space/Urban garden, green pavement/green parking pavement; restoration of lake/river bank; SUDs/swales/rain gardens; Electro wetlands/green filter area/wetland/natural waste water treatment, etc.)
- water management (SUDs/swales/rain gardens; Electro wetlands/green filter area/wetland/natural waste water treatment, etc.)
- construction of buildings (green roof, pollinators, etc.)

To sum up, NBS have high potential to complement or integrate with various grey and traditional infrastructure at city level and can be viable options to target specific sectors including landscaping/landscape architecture, urban planning, water management, construction of buildings, and others.

2.3 Current NBS diffusion in EU and non-EU countries

2.4 NEW SECTION – GLOBAL MARKET TRENDS FOR NBS AND RELATED SECTORS

Possible outline:

- a. North America
 - i. Overview and countries/regional (e.g. Canada, USA, Mexico)
- b. Latin America
 - ii. Overview and countries/regional outside UGU
 - iii. UGU country – Colombia
- c. Asia
 - iv. Overview and countries/regional outside UGU
 - v. UGU country – Vietnam
- d. Europe
 - vi. Overview all (e.g. Poland, etc)
 - vii. Within UGU project
 - viii. National & Regional
- e. Rest of the world (Africa, Middle East, Etc)

This section is being revised extensively based on

Nature-Based Solutions and Buildings – The Power of Surfaces to Help Cities Adapt to Climate Change and to Deliver Biodiversity by Enzi et al, 2017. (see summary of chapter 10 below) – chapter and its bibliography

Examples of green reports (see sample reports for market opportunities in green building infrastructure, green roofs, horticulture, smart soils, etc.)



Source: Enzi, V., Cameron, B., Dezsényi, P., Gedge, D., Mann, G., & Pitha, U. (2017). Nature-Based Solutions and Buildings—The Power of Surfaces to Help Cities Adapt to Climate Change and to Deliver Biodiversity. In *Nature-Based Solutions to Climate Change Adaptation in Urban Areas* (pp. 159-183). Springer, Cham.

Chapter in the *Nature-based solutions to climate change adaptation in urban areas: Linkages between science, policy and practice*. Kabisch, N., Korn, H., Stadler, J. and Bonn, A., 2017. Springer Nature.

Also, a possible new outline is proposed with several examples of market report summaries from different sectors (green construction, green roofs, smart soils, horticulture, etc.). A more solid structure will be agreed based on discussions with the WP leader and other partners.

Summary of Chapter by Enzi et al, 2017:

Globally, the need for infrastructure investment, is forecast to reach \$94 trillion by 2040, and a further \$3.5 trillion will be required to meet the United Nations' Sustainable Development Goals for electricity and water. Analysis suggested that to meet the Sustainable Development Goals (SDGs) for universal access to electricity and water and sanitation in all low- and middle-income countries where access levels are currently less than 100 percent would cost a total of \$5.8 trillion between 2016 and 2030. Two-thirds of this figure relates to electricity and one third to water (including sanitation)². That is the total investment that will create a portion of the market for NBS to co-implement to improve the current condition meeting the needs for health and aesthetic and mitigating climate challenges or replacing existing grey infrastructure as research and application has plenty of evidence showing benefits of NBS in the infrastructure and building sector especially in urban area³.

Market potential for NBS is divided by different typology of solutions from more well-known and popular NBS such as green roof, green wall to the lesser well-know of SUDs bioswales and other innovative solutions such as electrowetland, biosoil etc. There has not been a good survey carried out to assess the market potential for all the NBS solutions, it is maybe of the diversity of the NBS solution that prevent such comprehensive assessment. For typical NBS such as Greenroof, with its extensive development and incentive (both from policy and from environmental factor), the most recent estimation of global market for green roofs and walls is predicted to amount to € 6.8 billion by 2017⁴.

Most of the cities with a high density of green roofs are in Austria, Germany and Switzerland. The German market, along with Switzerland and Austria, is the most mature. This is due to the fact that these countries were the first to adopt policies and incentives for green roofs. In Germany, the green roof has been incorporated into the building code. Up to 2015, 86 million m² of green roofs had been installed in Germany and many flat roofs are already greened. The green roof and green wall market in those countries has been estimated to increase by an average of 5% per year German Green Roof and Wall Association (Fachvereinigung

² Oxford Economics Ltd, 2017. Global Infrastructure Outlook: Infrastructure Investment needs 50 countries, 7 sectors to 2040

³ NBS Market Potential through Synergies at International Level: An assessment of case studies and the scope for international mainstreaming. Think Nature project - Development of a multi-stakeholder dialogue platform and Think tank to promote innovation with Nature based solutions.

⁴ European Federation of Green Roofs and Walls – EFB 2015



Bauwerksbegrünung FBB)⁵.

Across Austria, Switzerland and Germany, a minimum of 10.3 million m² of green roofs are installed each year, driven by regulations and policies and the efforts of around 200 small to medium sized enterprises. The majority of companies involved in the green roof industry also have the knowledge and skills to contribute to the internal and external vertical greening of our building stock. According to the survey conducted in 2015 by European Federation of Green Roofs and Walls – EFB then the yearly sale figure of green roof is at €254.000.000 in Germany and €51.300.000 in Switzerland.

The companies operating in the NBS sector, specifically green roof and green wall are mostly from the building industry which uptake or acquire new technology in NBS to apply in the development and construction sector. The industry participants follow direct product distribution channels together with third-party maintenance service providers, thereby maintaining operational efficiency and cost-effectiveness of the business. Thus, it can be distinguished as the development and the maintenance sub-sector within the NBS market. In addition, market players are engaged in providing training sessions related to installation and maintenance of living roofs to the architects and contract managers.

Europe has traditionally been the market leader in green roof and wall technology in 2019 and is likely to continue its dominance over the projected period. This growth is attributed to the research and innovation policies by the European Commission for implementing nature-based solutions. Germany is witnessing a notable product demand since the government in the country is continuously designing and encouraging living roof policies. The market in Asia Pacific is also expected to witness a notable growth over the forecast period on account of rising number of construction activities in countries, such as China, Japan, and India. In addition, rapid urbanization in the region is anticipated to benefit the market growth. Skyrise Greenery Program launched in the region, that encourages the installation of living roofs on residential and commercial buildings, is projected to promote the market growth over the near future. In addition, cities such as Tokyo and Hong Kong are developing living roof policies to tackle the growing environmental issues⁶.

Then, each sector will be discussed in more detail, following some of the examples below:

EXAMPLE 1 GLOBAL – NATIONAL MARKET for Green Building Materials

Global Green Building Materials market is anticipated to reach USD 364.6 billion by 2022. In Green Building Materials, the recycled products are mainly used as a material, which improve the quality of life and production environment. To address several environmental challenges the green building materials are working in construction industry, comprising natural resource depletion, loss of biodiversity, atmospheric pollution, contamination of fresh water resources, and anomalous climate change.

In addition, the low maintenance and operational pressure and costs of environmental regulations relating to productions are the key factors that propel the green building materials

⁵ Enzi, V., Cameron, B., Dezsényi, P., Gedge, D., Mann, G. and Pitha, U., 2017. Nature-Based Solutions and Buildings–The Power of Surfaces to Help Cities Adapt to Climate Change and to Deliver Biodiversity. In Nature-Based Solutions to Climate Change Adaptation in Urban Areas (pp. 159-183). Springer, Cham.

⁶ Green Roof Market Size, Share & Trends Analysis Report By Type (Extensive, Intensive), By Application (Residential, Commercial, Industrial), By Region (North America, APAC, MEA), And Segment Forecasts, 2020 - 2027



industry worldwide. On the other hand, irregular application of energy guidelines and extremely price-sensitive customers may restrain the growth of market. The green building materials market is anticipated to grow at a significant CAGR of 11.2% in the upcoming period as the scope, product types, and its applications are increasing across the globe.

Green building materials industry may be explored by type, applications, and geography. The market may be explored by product as Structural, Interior, Exterior, and Others. Amongst the products, structural products segment accounted for 60%. This segment is anticipated to raise at a CAGR of 11.4% over the upcoming period.

Green building materials market may be explored by application as Framing, Insulation, Roofing, Interior Finishing, Exterior Siding, and Others. The “Insulation” segment is projected to reach 85.9 billion by 2022. However, high stages of energy maintenance, and growing construction activities in the commercial and residential sector are anticipated to help in the development of this sector in the upcoming period.

Moreover, Roofing segment is the second foremost market; followed by framing segment in the years to come. Increasing acceptance of non-toxic recycled rubber roofing owing to its superior durability and weather-resistance is anticipated to propel the demand for roofing products in the forecast period.

North America has been at the forefront with regards to green building materials industry and will continue to rule the roost in the years to come. The North America estimated to account for the major share of 35% of the global volume in 2016. The region is estimated to continue to be a foremost user over the forthcoming period. This inclination is anticipated to remain in the upcoming period due to the construction codes and promising policies regarding usage of products in the building manufacturing, coupled with growing transformation and innovation activities.

Some of the key players that fuel the growth of the green building materials market include Interface, AMVIC Building Systems, Alumasc Group Plc, Binderholz GmbH, BASF SE, and Bauder Ltd. The leading companies are taking up partnerships, mergers and acquisitions, and joint ventures in order to boost the inorganic growth of the industry.

Market Segment:

Green Building Materials Product Outlook (Revenue, USD Billion; 2012 - 2022)

- Structural
- Exterior
- Interior
- Others

Green Building Materials Application Outlook (Revenue USD Billion; 2012 - 2022)

- Framing
- Insulation
- Roofing
- Exterior Siding
- Interior Finishing
- Others



Green Building Materials Regional Outlook (Revenue; USD Billion, 2012 - 2022)

- North America
- Europe
- Asia Pacific
- Rest of the World

Source <https://www.millioninsights.com/industry-reports/green-building-materials-market>

EXAMPLE 2 GLOBAL – NATIONAL market report for green building materials

Green Building Materials Market – Growth, Trends, And Forecast (2019 – 2024)

The market for green building materials is expected to grow at a CAGR of around 10% during the forecast period of 2019 – 2024.

The Green Building Materials market is highly competitive and consists of a number of major players: Alumasc Group PLC, BASF SE, Bauder Ltd, Binderholz GmbH, CertainTeed Corporation (Saint-Gobain), Chengdu Onekin Green Building Materials Co.,Ltd, DowDuPont, Forbo International SA, GreenFiber LLC, Interface Inc., Kingspan Group, LafargeHolcim, Novagard Solutions Inc., Owens Corning, PPG Industries Inc., RedBuilt, LLC, Reward Wall Systems Inc. (Fox Blocks), Sika AG, Soben International Eco Ltd, Structurlam Mass Timber Corporation, ZinCo and others

<https://www.marketinsightsreports.com/reports/08071392643/green-building-materials-market-growth-trends-and-forecast-2019-2024/inquiry?Mode=70>

North America dominated the market across the globe with government efforts & regulations to mandate the usage of green building materials, and greater awareness among the population

Key Market Trends:

Residential Segment to Witness Strong Growth

– Green building construction in the residential sector is increasing due to the rising number of building regulations & policies mandating energy-efficient structures. This has created a market for environment-friendly and energy conserving materials used in residential construction.

– With the growing public awareness, rising income levels, the use of green building materials, and growing trend of energy-efficient structures in high-rise residential buildings and townships are likely to further boost the demand for green building materials in the coming years.

– In the Asia-Pacific region, countries such as China and India, have already been facing environment pollution-related problems, which has grasped the attention of governments to take initiative in this regards. Moreover, power shortage problems in developing nations like India, South Korea, Sri Lanka, and others, is likely to promote the concept of green building construction to promote daylight harvesting.

– On the other hand, the green building construction sector in North America and Europe is already widely popular. Thus, growing renovation projects in North America, and recovering construction industry in Europe are likely to further increase the consumption of green building materials over the forecast period (2019-2024).

North America Region to Dominate the Market

– North America region dominated the global market share in 2018. The construction sector has been witnessing growth in the region due to increased demand for houses, and rise in



renovation projects.

- Various government efforts and regulation mandates, such as Leadership in Energy and Environmental Design (LEED), Green Building Certification, subsidies for green housing projects, etc., have been driving the construction of green buildings in the region.

- United States witnessed noticeable investment for residential construction in 2018, and the trend is expected to remain the same in the near future.

- Similarly in Canada, Toronto and Vancouver have become hotspot for construction, propelled by a hot real estate market. Developers have been looking forward for good returns on investment in the country, particularly with high-density residential projects.

- Mexico has also been witnessing high housing demand, for which the country is attracting noticeable investment into construction.

- For instance, in January 2019, IDB Invest, a private sector institution of the Inter-American Development Bank (IDB) Group, granted a local currency financing program for MXN 150 million (Mexican pesos) to the Mexican company Procsa, in order to finance for land acquisition, development and commercialization of housing for low & middle income families in the country.

- Hence, such favorable trends in North America construction industry is expected to continue driving the demand for green building materials market over the forecast period.

Source:

https://markets.financialcontent.com/stocks/news/read/40461804/green_building_materials_market

EXAMPLE 3 GLOBAL – NATIONAL MARKET for smart soils – biochar market study

Global Market Expected to Witness CAGRs of 13.85% and 11.65%, by Revenue and Volume, Respectively

As per the analysis, the global biochar market is expected to show a compelling growth with a CAGR of 13.85% in terms of revenue and 11.65% in terms of volume during the forecasting period 2019-2027.

North America Leads the Biochar Market in Terms of Revenue and Volume

Pyrolysis is the Most Preferred Technique for the Production of Biochar

Agriculture & Livestock Application to Dominate the Application Segment

North America is predicted to be the largest market in terms of revenue for the growth of the biochar market during the forecasted years. The biochar market in the North American region is primarily fueled by the initiatives taken by regional groups like Canadian Biochar, Alberta Biochar, and Illinois Biochar. Along with that, efforts made to commercialize the production & application of biochar products and the standardization of biochar production plants are anticipated to contribute to the development of the biochar market.

Some outstanding competitors in the biochar market are Pacific Biochar, Biochar Now, LLC, Biogreen-Energy, Tolero Energy, Cool Planet Energy Systems, Inc., Airex Energy, ArSta Eco,



Carbon Gold, Phoenix Energy, Earth Systems Pty Ltd., AirTerra and Agri-Tech Producers LLC.

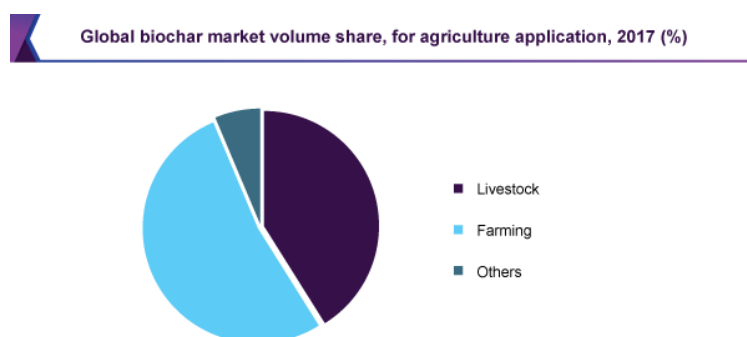
Source: <https://finance.yahoo.com/news/2020-biochar-market-study-global-154500115.html>

The global biochar market size was worth USD 1.3 billion in 2018, while demand was estimated at 395.3-kilo tons that year.

Application Insights

In 2018, the agriculture application segment accounted for 71.1% of the total biochar demand. Biochar helps to enhance water and fertilizer holding capacity and improve soil's biological productivity, which helps in providing crop nutrition and accelerating growth. However, a large number of farmers still lack knowledge about the product and its benefits.

In agricultural applications, general farming is a major segment that is expected to rise substantially and augment the demand of the overall market owing to increasing awareness among farmers by research groups and institutes.



Example figure 6: From source

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Livestock farming contributes to a large proportion of the overall consumption in agricultural applications. The ability of the product to provide essential nutrients and maintain the health of livestock has increased its consumption in livestock farming, including poultry farming, cattle farming, and meat production. Growing government support for organic farming is expected to create huge potential in forthcoming years.

Other major applications including water and waste treatment have witnessed rising demand in emerging economies, such as China and India, along with a growing need for advanced water infrastructure and hygiene awareness.

In organic farming, factors such as growing demand for organic food, health consciousness, and increasing consumer spending capacity are complementing this sector to grow exponentially over the coming years. Whereas, conventional farming is still used in several rural areas as it provides more yield. The use of biochar into mixed farming, zero tillage farming, and biodynamic agriculture would witness strong growth with supportive initiatives taken by the government and private institutions.

Regional Insights

North America has been the highest consumer of the product and it is expected to witness significant growth with increasing demand for organic food and high consumption of meat.

Awareness about biochar is very high in this region as compared to others, and the farming community has more knowledge about the product and its benefits. Moreover, low feed costs for livestock are expected to expand the consumption in this sector.

The U.S. has been generating the highest revenue in the world as a result of huge awareness about the product in the country. Numerous small and large scale manufacturers operating at domestic and international levels have contributed to the growth of the sector. Despite several companies exiting from the industry owing to lack of capital and expected growth, the overall growth prospects will be highly positive over the upcoming period.

The Asia Pacific is expected to witness extremely high growth owing to the presence of large and developing agriculture sector in growing economies, such as China and India. Various R&D activities and government initiatives are expected to contribute to spreading awareness about biochar and its benefits among the farming community and would result in increased demand.

China is the third-largest organic food-producing country in the world. The use of genetically modified crops has affected the soil and crop productivity in the agriculture fields of the country. An amalgamation of biochar in farming led by several research initiatives in the country is expected to increase awareness about the product and propel the consumption.

Biochar Market Share Insights

Key players involved in the manufacturing of Biochar are BSEI, Airex Energy Inc., and Diacarbon Energy. More than 80% of medium and large scale manufacturers are concentrated in North America while the Asia Pacific and Europe comprise lesser concentration. Aberystwyth University, Massey University, Federal Rural University of the Amazon, and the University of East Anglia are among the few of the research institutions engaged in the production and R&D activities of biochar.

Timber manufacturers such as Georgia-Pacific, West Fraser, and Weyerhaeuser supply wood pellets and waste wood to various manufacturers in North America. This industry has numerous small manufacturers including Cool Planet Energy Systems Inc., who have integrated their value chain at all levels. Companies such as Cool Planet Energy Systems Inc., 3R ENVIRO TECH Group, Phoenix Energy, and Pacific Pyrolysis deliver pyrolysis technology to manufacture the product and waste to energy solutions.

Source: <https://www.grandviewresearch.com/industry-analysis/biochar-market>

North America – United States – examples of US-based NBS



Table 1 Examples of GI elements, their purpose and case study implementation locations in the USA. (Reproduced with permission from Staddon et al. 2017)

GI element	Description	Cities/countries that have incentive programs
Downspout disconnection	Rerouting of rooftop drainage from going into the sewer to going into a rain garden, cistern or porous pavement	Los Angeles Downspout Disconnection Program Milwaukee Downspout Disconnection Portland Downspout Disconnection Program
Rainwater harvesting	Systems that slow and reduce stormwater runoff and collect rainwater for later use in rain barrels/cisterns	New York City Rain Giveaway Program
Rain garden/bioretention/biofiltration cells/infiltration trenches/settling ponds	Shallow vegetated basins that store and infiltrate runoff from rooftops, streets and sidewalks	Brunsville, Minnesota Rain Gardens in Puget Sound, Washington
Planter boxes	Rain gardens used in urban dense areas that have vertical walls and either closed or open bottoms	Michigan Ave. Streetscape Philadelphia Water Department
Bioswales/filter strips	Xeriscapes, mulched or vegetated channels that treat and retain stormwater as it moves by slowing, infiltrating and filtering the flow	Madison, Wisconsin
Permeable pavements	Surfaces that infiltrate, treat and collect stormwater where it falls. Materials include porous asphalt, pervious concrete or interlocking pavers	Sultan, Washington Shoreville, Minnesota Scotland
Green streets	Streets that integrate GI elements into their designs including permeable pavements, bioswales, planter boxes and trees	Seattle Public Utilities GSI Projects Syracuse Green Street Los Angeles Green Street Chicago Green Alley
Green parking	Parking lots that integrate GI elements including permeable pavements, rain gardens and bioswales in perimeter and medians	Ipswich River Watershed Demonstration Project
Green roofs/walls	Building roofs that are covered with growing media and vegetation	King County, Washington
Urban tree canopy	Trees intercept precipitation and slow stormwater runoff	Chicago Trees Initiative Philadelphia Stormwater Tree Trench
Land conservation	Protection of open space and sensitive natural areas (e.g. riparian areas, steep slopes, wetlands) within or adjacent to cities	Green Seams Flood Management in Milwaukee, Wisconsin GI Investment Program in Alachua County, Florida
Concrete inflow structures	Areas surrounding GI that are impermeable but have the necessary slope to direct stormwater to GI	Syracuse, New York
Curbside extensions/chicanes	GI that is located in areas extended into the road	Tucson, Arizona
Traffic circles	GI located in traffic circles that slow traffic and provide area for rain gardens	Tucson, Arizona

Example table 2: From source

Sources Staddon, C., Ward, S., De Vito, L., Zuniga-Teran, A., Gerlak, A. K., Schoeman, Y., ... & Booth, G. (2018). Contributions of green infrastructure to enhancing urban resilience. *Environment Systems and Decisions*, 38(3), 330-338.

EXAMPLE 4 GLOBAL – NATIONAL level for horticulture market

The global greenhouse horticulture market is poised to grow by USD 17.49 billion during 2020-2024, progressing at a CAGR of over 10% during the forecast period

Major Five Greenhouse Horticulture Market Companies:

Certhon

Certhon operates the business under various segments such as Greenhouse construction, Indoor farming, SuprimAir greenhouse, Heating & Cooling, Electrical engineering, Irrigation, Automation, and Others. The company offers Greenhouse construction, SuprimAir greenhouse, and more.

Dalsem

Dalsem offers products through the following business units: Dalsem Factory- Dutch Custom-Made, Greenhouse Glazing, Greenhouse Construction, Greenhouse Construction Trellis Girder,



Greenhouse Roof Construction, Assimilation Lighting System, and more. The company offers greenhouse construction, greenhouse glazing, and more.

Industries Harnois Inc.

Industries Harnois Inc. operates under various business segments, namely Greenhouses, Megadome, and Services. The company offers Fully enclosed systems, Environment control, Multiple equipment options, and more.

Netafim Ltd.

Netafim Ltd. offers products through the following business segments: Precision Irrigation, Products & Solutions, Crop Knowledge, Digital Farming, and End-To-End Projects. The company offers advanced engineering capabilities, greenhouse horticulture expertise, and more.

Priva Holding BV

Priva Holding BV offers products through the following business segments: Horticulture and Building automation. The company offers Efficient labor, Smart (re)use of water, Accurate greenhouse control, and more.

Source:

<https://www.businesswire.com/news/home/20200308005006/en/Global-Greenhouse-Horticulture-Market-2020-2024-Evolving-Opportunities>

Top global suppliers for horticulture

Richel

Hoogendoorn

Dalsem

HortiMaX

Harnois Greenhouses

Priva

Ceres greenhouse

Certhon

Van Der Hoeven

Beijing Kingpeng International Hi-Tech

Oritech

Rough Brothers

Trinog-xs (Xiamen) Greenhouse Tech

Netafim

Top Greenhouses

<https://khabarsouthasia.com/uncategorized/96033/horticulture-light-market-size-analysis-growth-trends-outlook-and-forecast-by-2027/>

Other examples to be included: Countries that have vegetation and NBS projects:



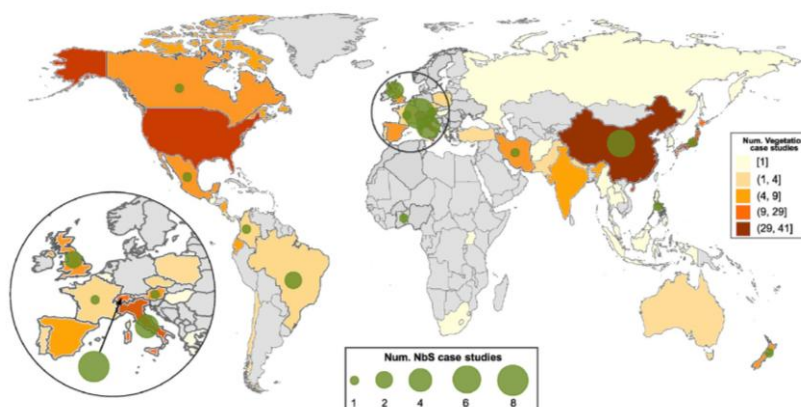


Fig. 8. Geographical priorities of vegetation and NBS case-based studies.

Example figure 7: From source

Source: de Jesús Arce-Mojica, T., Nehren, U., Sudmeier-Rieux, K., Miranda, P. J., & Anhuf, D. (2019). Nature-based solutions (Nbs) for reducing the risk of shallow landslides: Where do we stand?. *International Journal of Disaster Risk Reduction*, 41, 101293.

There will be an investigation of specific market studies from each sector aligned with each NBS from the catalogue:

UK Living roofs & Global Green Roofs:

Global Green-roofs Market 2018-2022 | Growth Analysis and Forecast | Technavio

The global green-roofs market research report by [Technavio](#) predicts the market to post a CAGR of more than **19%** during the period 2018-2022.

The global #greenroofs market research report by @Technavio predicts the market to post a CAGR of more than 19% during the period 2018-2022.

A key driver for the global green-roofs market is the reduction in global warming due to green roofs. Green-roofs assist in decreasing the ambient temperature and therefore, help in the reduction of greenhouse gas emissions from air conditioning. They also absorb most of the radiation from the sun, leading to a decrease in the urban heat island effect. Such benefits of green-roofs have been identified by several governments, which has led to the development of supportive policies for the adoption of these roofs.

Global green-roofs market: Integration of green-roof and solar photovoltaic systems

Green-roofs integrated with solar photovoltaic arrays are known as biosolar roofs. These roofs help in minimizing the emissions of greenhouse gases and ensure the sustainable development of buildings. The integration of green-roof and solar photovoltaic systems ensures enhanced functions and effectiveness through cooling and shading effects.

“The employment of solar photovoltaic arrays can result in areas of shade on roofs. Hence, only a certain category of plants called shade-loving plants can be placed in these areas. The installation of the biosolar roof is complex and only a few vendors such as ZinCo and Bauder offer green-roofs integrated with solar photovoltaic arrays,” says a senior research analyst at

Technavio.

Global green-roofs market: Segmentation analysis

This green-roofs market analysis report segments the market by product (extensive green-roofs and intensive green-roofs), application (residential properties and commercial properties), and geography (the Americas, APAC, and EMEA).

The extensive green-roofs segment held the largest green-roofs market share in 2017, accounting for more than 73% of the market. This product segment is expected to dominate the global market throughout the forecast period.

The EMEA region led the market in 2017 with approximately 37% of the market share, followed by the Americas and APAC respectively. EMEA is expected to dominate the market throughout the period 2018-2022.

Source <https://www.businesswire.com/news/home/20181127005936/en/Global-Green-roofs-Market-2018-2022-Growth-Analysis-Forecast>

The global green roof market size was worth USD 7.2 billion in the year 2018 and is predicted to grow at a CAGR of 17.1% for the period 2019 to 2025.

Source <https://www.millioninsights.com/industry-reports/green-roof-market>

Austria perspective: currently looking for English version, or may need to liaise with German partner for support with translation at a later stage in the report.

https://nachhaltigwirtschaften.at/resources/sdz_pdf/schriftenreihe-2020-27-green-market-report-kompakt.pdf

Can be based on NBS Catalogues and add elements from each specific exclusive sector e.g. living roofs, SUDs, smart soils/biochar, etc.

- **Example of NBS product description for green roofs:**

Green-roofs integrated with solar photovoltaic arrays are known as biosolar roofs. These roofs help in minimizing the emissions of greenhouse gases and ensure the sustainable development of buildings. The integration of green-roof and solar photovoltaic systems ensures enhanced functions and effectiveness through cooling and shading effects.

Source: <https://www.businesswire.com/news/home/20181127005936/en/Global-Green-roofs-Market-2018-2022-Growth-Analysis-Forecast>

- **Example for smart soils – biochar:**

Biochar is charcoal derived by controlled heating of waste materials, such as agricultural waste, wood waste, forest waste, and animal manure. Among all the end uses, it is widely used in a soil amendment to reduce pollutants and toxic elements and to prevent reducing moisture level, soil leaching, and fertilizer runoff. Environmental awareness, cheaper cost of raw material, and cohesive government policies for waste management are anticipated to create greater avenues for market expansion.

Source: <https://www.grandviewresearch.com/industry-analysis/biochar-market>



More NBS Case studies in Sweden, Berlin, Aarhus

Source:

https://www.researchgate.net/publication/344783901_Green_Infrastructure_for_the_city_of_the_future_Perspectives_from_Europe

The example figure below can be used as a model for all steps in the lifetime for green construction sector UAE- developer, consultant, mand and sub-contractor, suppliers:

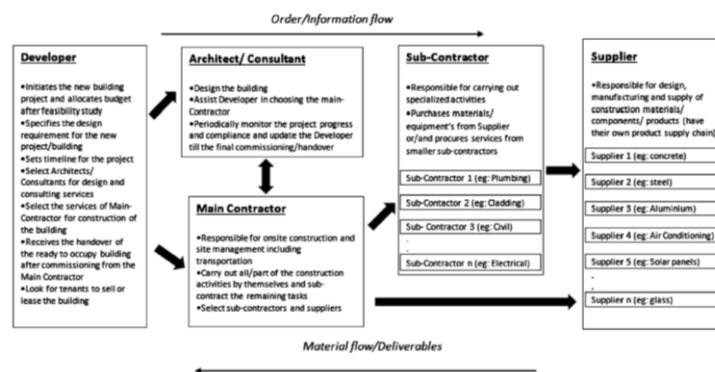


Figure 1. Construction supply chain.

Example figure 8: From source

Source: Balasubramanian, S., & Shukla, V. (2017). Green supply chain management: the case of the construction sector in the United Arab Emirates (UAE). *Production Planning & Control*, 28(14), 1116-1138.

Role of each player in green initiatives (green design, green purchasing, green construction, end of life management), example for Developer's role in green design:

- Emphasised in government regulations, LEED/ BREEAM
- certifications; practices applied vary across projects
- Aspects considered: Natural lighting and ventilation, use of
- water saving technologies, use of green materials, reduced
- use of hazardous materials and energy consumption based
- designing
- Additional aspects considered by large firms incl. use
- of photo-voltaic panels & more recyclable materials (to
- increase recovery at end-of-life), modular design (for ease of
- disassembly), pre-fabrication & waste water recycling

Table 3. Core green practices and their extent of implementation.

Core green practice	Developers	Architects/Consultants	Main/Sub-contractors	Suppliers
Environmental Impact Assessment	High • Done at the project concept stage and by most firms • Potential impact of project on natural habitat (flora & fauna) and air and water pollution assessed	High • Done at the actual assessment (alone or with the Developer)	Not relevant • No involvement with projects at this stage	Moderate • Potential impact of project on noise levels, air quality and water sources assessed; mostly done by large firms & foreign firms
Green design	High • Emphasised in government regulations, LEED/BREEAM certifications practices applied very across projects • Aspects considered: Natural lighting and ventilation, use of water saving technologies, use of green materials, reduced use of hazardous materials and energy consumption based designing • Additional aspects considered by large firms incl. use of photo-voltaic panels & more recyclable materials to increase recovery at end-of-life, modular design (for ease of disassembly), pre-fabrication & waste water recycling	High • Actually develop the designs incl. green related as required by the Developer • Better capabilities at foreign firms; are able to access the centrally (at HQ) available tools and expertise	Not relevant • No involvement in design incl. green related; enter after finalisation of design which they have little authority to change	Low • Relevant aspect is (green) material design • Green material offering is standard rather than customised to individual customer/project requirements; green material sales constitute only a small proportion of total sales
Green purchasing	Moderate • Essentially in relation to purchase of services (materials purchase is typically by Contractor, which are purchased from Architects/Consultants & Contractor, in whose selection, green-related criteria are applied as below • At pre-qualification stage: LEED certified staff in rolls + track record on LEED projects (for Architects/Consultants) and BMS and ISO 14001 certification (for Contractors) • At selection stage: 10-30% weight to green consideration in design (for Architects/Consultants) and to environment & waste management plan (for Contractors); small firms ~10% weightage, large ones ~30% weightage	Not relevant • No involvement in purchasing	Moderate • In relation to materials & service purchases from Suppliers & Sub-Contractors respectively • Smaller firms: purchase of green materials is entirely as per the contractual requirements (of the Developer) • Large local and all foreign firms exceed Developer's contract requirements such as on green material specifications, auditing suppliers (for green), considering LEED experience & No. of LEED certified staff in rolls for sub-contractor selection as well as making EMS and ISO 14001 mandatory for them	Low • The green in put material purchase is as per the green material demand, which constitutes only a small part of the total material demand
Green transportation	Low • No significant consideration from both material as well as employee (transportation) perspectives, and at own as well as downstream stakeholders	Low • Local firms: No significant consideration; foreign firms use video conferencing to minimise employee travel and thereby emissions	High • Preference for full truck load transportation, use of fuel efficient vehicles and employee accommodation near project sites • Large local and all foreign firms: additional practices such as choosing geographically closer suppliers (less material travel) and scheduling material deliveries during periods of less traffic congestion (lower fuel consumption, lesser emissions)	Moderate • Full truck-load transportation to minimise emissions is common • Use of other emission control practices varies; these incl. choosing geographically closer suppliers, choosing low-emitting transport modes, considering traffic congestion when planning deliveries, locating employees near manufacturing sites and sharing transportation
Green construction/manufacturing	Not relevant	Not relevant	High • Automated (and therefore less waste generating) & energy efficient machinery used • Waste segregated to enable its reuse/recycling • Pre-fabrication used (to reduce on site waste) Moderate • No specific regulations for this • Practices include use of energy efficient demolition equipment, selective dismantling of buildings, segregation of demolition waste and safe disposal of hazardous materials	High • State-of-the-art equipment that consumes less energy, causes less emissions and lower (manual related) wastage/errors used for manufacturing all materials in most firms Not relevant
End-of-life management	Moderate • No specific regulations for this • Not considered by small firms; large firms consider related design aspects like modular design (for easier disassembly), and use of more recyclable materials (to enable their reuse at end-of-life), though which varies across projects	Moderate • Actually develop the relevant end-of-life designs: Better tools, expertise with foreign firms		

Example table 3: From source

Source: Balasubramanian, S., & Shukla, V. (2017). Green supply chain management: the case of the construction sector in the United Arab Emirates (UAE). *Production Planning & Control*, 28(14), 1116-1138.

Example of jobs generated by NBS maintenance in South Africa:

- green jobs contribute up to 3-5% of total urban employment, employs 17,429 people receiving about US\$ 37 million

King, A., & Shackleton, C. M. (2020). Maintenance of public and private urban green infrastructure provides significant employment in Eastern Cape towns, South Africa. *Urban Forestry & Urban Greening*, 126740.

Partially, this section will be addressed together with 7A-7B, and refined with direct input from UGU partners based on their expertise and via additional data collected during the D 7.4 survey



Will be enhanced via extensive data collection both from industry reports and primary survey data.

Global data

Global level – The global market is currently estimated at €1.15 trillion a year. It could reach €2 trillion a year by 2020.

Source: https://ec.europa.eu/environment/nature/ecosystems/investing/index_en.htm

EU data

EU level – A 2014 study on the economic and social benefits of environmental protection looked at the economic impacts of 363 floods recorded across all EU Member States, with total damages estimated at €150 billion. The study showed that, while the cost per flood was €360 million, investing in flood protection typically returns benefits 6-8 times the costs, with green infrastructure projects potentially delivering significant environmental benefits as well as cost savings.

https://ec.europa.eu/environment/nature/ecosystems/investing/index_en.htm

Final estimates can be derived by aggregating data from each NBS

- total of all NBS at global level (e.g. global market value \$ of green roofs + global market value of smart soils/biochar + etc)
- similar aggregations at EU level, per continent
- similar aggregation at national level (per country)

After reviewing key concepts related to NBS, its market potential vis-à-vis grey/built infrastructure and opportunities for adoption in relevant sectors, the current section provides a country-level overview of NBS diffusion in EU and non-EU countries. For each URBAN selected country, NBS diffusion will be analysed based on multiple criteria, including examples of cities that have NBS within each country (or Green Infrastructure/green alternatives as a proxy for countries where there are no NBS), types of NBS (or Green Infrastructure/green alternatives) available, stakeholders relevant to NBS and their involvement, and an evaluation of how widely NBS are adopted currently or have potential for the future (or Green Infrastructure/green alternatives as a proxy for countries where there are no NBS). Due to limited information available in English at this interim stage, the current section will be completed at a later date with input from all partners. Further research will be undertaken in each country's respective language, e.g. it may be necessary to involve members of the local and national government in order to access country-level data on green initiatives. Additionally, some of the information needed will be collected via the public and private survey to be conducted for D 7.8.



Partially includes examples from some countries, to be developed with more extensive research at later stages of the report. Later, separation will be made between the various parts of the world.

- UK Association of SUDs Authorities <https://www.suds-authority.org.uk/knowledge-resources/>
- National Association of Landscape Professionals (USA): <https://www.landscapeprofessionals.org/>
- New Green Buildings Trade Association (USA) <https://www.buildinggreen.com/news-analysis/new-green-buildings-trade-association>
- University that offers Green Architecture Masters (Germany) [https://www.wings-university.com/green architecture](https://www.wings-university.com/green_architecture)

- Extensive environmental training is provided to employees at most firms; In a significant proportion of firms this training is also provided

international certifications. At local firms the training is more on waste minimization practices and is limited to onsite workers

Source: Balasubramanian, S., & Shukla, V. (2017). Green supply chain management: the case of the construction sector in the United Arab Emirates (UAE). *Production Planning & Control*, 28(14), 1116-1138.

Policy - to be further enhanced at later stages of the final report:

In 2019, the Commission published two guidance documents to help planners, policymakers and businesses solve socio-economic challenges, while also protecting and restoring Europe's nature:

The [EU Guidance document on a strategic framework for further supporting the deployment of EU-level green and blue infrastructure SWD\(2019\) 193 final](#) encourages a more strategic and integrated approach to scaling-up investments in EU-level GI projects. The aim is to improve the connectivity of Natura 2000 areas while also increasing the range and flow of multiple ecosystem services. The guidance document also provides information on existing funding sources. The accompanying Joint Science for Policy Report by the JRC, EEA, ETC on Urban, Land and Soil Systems, and DG Environment presents [Geospatial methods, data and tools to support strategic green infrastructure and ecosystem restoration](#).

The EU Guidance document on integrating ecosystems and their services in decision-making highlights the wide range of benefits that flow from nature to people, and possible ways to take better account of these benefits in policy, planning and business investment decisions.

[Part 1](#)

[Part 2](#)

[Part 3](#)

The new guidance document is complemented by an overview and progress report of [Natural Capital Accounting in the European Union](#) (May 2019).

- EU Funding for Green Infrastructure

Structural Funds ([European Regional Development Fund](#) (Chapter 4) and [European Social Fund](#))
[Cohesion Fund](#),

[European Maritime and Fisheries Fund](#)

[European Agricultural Fund for Rural Development](#),

[LIFE+](#)

[Research funding programmes](#)

[European Fund for Strategic Investment](#)

[Horizon 2020 and Nature based solutions](#)

https://ec.europa.eu/environment/nature/ecosystems/investing/index_en.htm

Green Infrastructure Projects in Latin America

<https://publications.iadb.org/publications/english/document/Principles-Practices-and-Challenges-for-Green-Infrastructure-Projects-in-Latin-America.pdf>

Poland green infrastructure policy

https://ec.europa.eu/environment/nature/ecosystems/pdf/Green%20Infrastructure/GI_PL.pdf

Germany green infrastructure policy

https://ec.europa.eu/environment/nature/ecosystems/pdf/Green%20Infrastructure/GI_DE.pdf#:~:text=Green%20Infrastructure%20in%20Germany%20Germany%20is%20a%20federal,and%20activities%20on%20Green%20Infrastructure%20and%20nature%20conservation

Romania green infrastructure policy

https://ec.europa.eu/environment/nature/ecosystems/pdf/Green%20Infrastructure/GI_RO.pdf

Brazil - Partnership for Action on Green Economy

<https://www.un-page.org/brazil-building-green-economy-infrastructure-whilst-maintaining-natural-resources-and-biodiversity>

Brazil policy for ecosystem-based disaster reduction

- This urgency has strong policy support, including the Millennium Ecosystem Assessment [25] within the framework of the Sustainable Development Goals [26], and the Strategic Plan for Biodiversity 2011–2020 under the Convention on Biological Diversity [27]. For this reason, ecosystem-based disaster risk reduction (Eco-DRR) has also gained



increasing attention [21].

Source

Young, A. F., Marengo, J. A., Coelho, J. O. M., Scofield, G. B., de Oliveira Silva, C. C., & Prieto, C. C. (2019). The role of nature-based solutions in disaster risk reduction: The decision maker's perspectives on urban resilience in São Paulo state. *International Journal of Disaster Risk Reduction*, 39, 101219.

Green infrastructure in Colombia – Amazon case study

<https://www.greengrowthknowledge.org/case-studies/sustainable-infrastructure-amazon-colombia-country-case-study>

Partially addressed with examples at preliminary stage for BREEAM, LEED and UGI plans, to be developed with more extensive research at later stages of the report:

BREEAM is the world's leading sustainability assessment method for masterplanning projects, infrastructure and buildings. It recognises and reflects the value in higher performing assets across the built environment lifecycle, from new construction to in-use and refurbishment.

<https://www.breeam.com/>

LEED certification provides independent, third-party verification that a building, home or community was designed and built using strategies aimed at achieving high performance in key areas of human and environmental health: location and transportation, sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality.

Source

https://www.cagbc.org/CAGBC/Programs/LEED/LEED_Certification_Process.aspx

Data will be collected regarding adoption of UGI plans in Europe regarding:

- GI Organisations
- Reports about policies
- GI Tools
- Research Papers

Source

<https://mainstreaminggreeninfrastructure.com/resources.php?urban-green-infrastructure-in-eu-is-it-policy-compliant>

UK – front runner

To be further developed with input from the city and relevant partners.

Spain – front runner

To be further developed with input from the city and relevant partners.



Example of secondary source suggested by VAL (only Spanish version available)

Source: NBS Report by National Environmental Congress of Spain, CONAMA:

http://www.conama.org/conama/download/files/conama2018//GTs%202018/10_final.pdf(only in Spanish).

Turkey – front runner

To be further developed with input from the city and relevant partners.

Italy – EU follower

To be further developed with input from the city and relevant partners.

Germany – EU follower

To be further developed with input from the city and relevant partners.

2.4.2 Non-EU countries

Vietnam – non-EU follower

This section will include elements from:

Report on Green Infrastructure Investment Opportunities (GIIO) in Vietnam, funded by European Climate Foundation

This report addressed Green infrastructure as an opportunity for growth Under the Vietnam Green Growth Strategy, approved by the Government for the 2011-2020 period, the capital market has been identified as being key to achieving the country's targets. Green bonds, for example, will be vital in raising funds specifically for green projects and assets, including green infrastructure, as well as tapping into private sector investment for sustainable development. So far, private investors have been limited by complicated legal and regulatory requirements and challenging risk sharing arrangements between the public and private sector.⁶ Fortunately, the Vietnamese government has begun implementing policies that improve the ease-of-doing business and are developing private public partnerships to attract private foreign investment. These efforts are already showing positive results. Adaptive and resilient infrastructure provision is also important, and it should become a core part of the national response to the coming climate emergency. Delayed action in transitioning to a low carbon economy increases the cost of change as well as the volatility and structural risks to the finance sector and underlying asset values. In this environment, major stakeholders in banking, finance and superannuation have a responsibility to act.

Vietnam's macroeconomic outlook was examined, focusing on maintenance of rapid economic growth compared to its ASEAN (Association of Southeast Asian Nation) counterparts. Vietnam's GDP growth rate accelerated to 7.31% in Q3 2019, surpassing the Government's GDP growth target of 6.8%. Therefore, whilst its economic outlook remains promising and its growth is projected to expand by 6.5% in 2020. President Nguyen Phu Trong assured that, "in 2020, [Vietnam] will continue to consolidate its macroeconomic stability, keep inflation under control and enhance the productivity, quality and competitiveness of the economy



Infrastructure spending in Vietnam was identified as having been central in Vietnam's impressive growth over the past two decades. According to the Global Competitiveness Report 2016-2017, Vietnam ranked 79th out of 138 countries in terms of overall infrastructure quality.¹⁹ Regionally, Vietnam is leading the way with electrification – 99% of the population has access to electricity. At the present rate of national infrastructure development, Vietnam remains on-track for continued growth. As estimated in the Global Infrastructure Outlook report 2017, if Vietnam continues on this impressive stride of infrastructure spending, the country will be able to meet 83% of its infrastructure needs by 2040. To reach 100%, Vietnam will need a future investment of USD 605bn via both public and private sector intervention, and according to current trends of government spending on infrastructure, this will leave an investment gap of USD 102bn by 2040.

Vietnam's climate policy was outlined detailing that Vietnam ratified the Paris Agreement in November 2016. In its Nationally Determined Contribution (NDC), Vietnam pledged to reduce 8% of carbon emissions by 2030, compared to business-as-usual, or 25% with international support. Prior to the Paris Agreement ratification, the Government aspired for low carbon growth. This was demonstrated by national climate policy frameworks introduced in 2011 and 2012: National Climate Strategy, outlining climate objectives, and the National Green Growth Strategy, including mitigation targets and measures, respectively

As part of its NDCs under the Paris Agreement, Vietnam has defined the following mitigation targets/GHG reduction targets: 8% reduction by 2030, compared to business-as-usual and 25% reduction with international support, by 2030, compared to business-as-usual

The report also addressed Green finance trends and opportunities were also discussed, which highlighted that in Vietnam the global demand for green and green finance is growing and that there is a brown to green transition.

Growth in Vietnam, is boosted by strong economic performance, and there is continued growth potential that could support the country in meeting its climate goals. So far Vietnam has been exploring green debt – including green bonds - as well as equity instruments, supported by credit enhancement mechanisms and other risk sharing approaches. This includes partial credit guarantees for green projects, concessional loans for solar energy projects and risk sharing facilities for energy efficiency projects. There has also been some 'greening' of the stock exchange and domestic banking. Asia-Pacific green bond issuance is rising, and the ten ASEAN countries have considerable growth potential. After the first green bond was issued in the Philippines, in February 2016, the next green bond issuances in ASEAN were two Vietnamese local government entities – Ho Chi Minh City and People's Committee of Ba Ria Vung Tau Province – issuing the first VND-denominated green bonds and listing them on Hanoi Stock Exchange.^{51,52} These issuances came out of a pilot program between the Ministry of Finance and the German International Cooperation Agency (GIZ), aiming to prepare the market for future issuance.

The Climate Bonds Initiative has been active in promoting a brown-to-green (BtG) transition strategy in GHG-emissions intensive industries around the world. BtG reflects the fact that, in the short- to medium-term, large companies in many sectors will inevitably straddle both brown and green assets, progressively reducing exposure to brown assets and practices as they increase capex towards, and adoption of, greener modes of operation.



It also embodies a recognition that, both globally and locally, the expectation of institutional investors is that progress towards low or zero-carbon business models, is increasingly indicative of corporate performance, hedging of climate risks and long-term value accretion.

The report has a summary outline of Green infrastructure investment opportunities in areas of Renewable energy; Low carbon transport; Sustainable water management and Sustainable waste management.

There are already green infrastructure projects and assets of many different sizes and technologies spread across Vietnam. These range from the USD 10bn national railway project through to a USD 30m water infrastructure project. A list of 40 projects have been compiled into a sample pipeline. Using the globally recognized Climate Bonds Taxonomy and Sector Criteria projects and assets have been assessed as to which are green. However, there are many other standards and schemes that can be used to measure the 'greenness' of projects in Vietnam, internationally, and in Southeast Asia. Most of these apply to either the development and retrofitting of buildings or a broad set of infrastructure projects and assets.

Investors currently have insufficient tools to ensure that their investments are making a positive impact. Having common definitions of 'green' across global markets, allows investors, potential issuers and policy makers to identify green assets and attract investment more easily.

A methodological approach was outlined, in the report, to enable exploration of green infrastructure investment opportunities across Vietnam in four key sectors: renewable energy, low carbon transport, sustainable water management and sustainable waste management. Although not included here, Vietnam has some green projects across other sectors, such as green buildings, agriculture/forestry, and tourism. There are various ways for an investor to gain exposure to a specific project, asset or portfolio. The possible investment pathways were said to vary depending on the asset ownership structure, the stage in the asset's financing lifecycle, and the investor's mandate. This can further vary between projects with public and private funding.

Accordingly, metrics have been used to classify the green infrastructure investment opportunities, by status: Completed projects: high profile, recently completed projects; Projects under construction: major projects that are under construction; and Planned projects: major projects that have not yet begun construction but have been announced and/or have undergone business case planning and/or have been allocated budget.

To grow green infrastructure the report concludes with a series of seven actions:

- Incorporate climate risk exposure to new infrastructure plans
- Improve the visibility of green investment opportunities
- Adjust regulatory requirements
- Issue a green sovereign bond
- Offer incentives



- Partner with development entities
- Promote climate-related financial risks disclosure

The development of this report was made possible by sponsorship from the European Climate Foundation (ECF).

The Climate Bonds GIIO series of reports aim to identify and highlight low carbon climate resilient and adaptive projects opportunities and to promote green finance investment by institutional investors and asset managers.

Source:

<https://www.climatebonds.net/resources/reports/green-infrastructure-investment-opportunities-giio-vietnam>

To be further developed with input from the city and relevant partners.

Colombia – non-EU follower

To be further developed with input from the city and relevant partners.

In conclusion, NBS have a variety of uses and benefits in addressing climate and other challenges; they can be seen as either stand-alone products or complex package solutions; they are an alternative to current grey solutions and can either substitute or replace existing grey infrastructure, and are relevant to the sectors of landscaping, construction of buildings, architecture, ecological restoration and others.



3 Characterization of each city

The following chapter provides an overview of existing/planned NBS in the URBAN GreenUP cities, as well as a summary of local stakeholders involved in NBS, with legal, economic, and social factors influencing NBS at the city level. Also, key barriers and enabling factors are discussed. The chapter is divided by European and non-European cities, with summaries of key features drawn for European cities first and then for non-European cities. Within the sections, some contributions are directly from partners, while others are based on past documentation submitted e.g. D 6.2 Characterization of front-runner and follower cities from the perspective of the implementation of NBS. <https://www.urbangreenup.eu/>, Source: D1.5 Barriers and Boundaries Identification, Source: D2.1 Report on the Diagnosis, and other materials.

Direct contributions from cities are noted whenever they were provided (LIV, VAL, MAN, IZM, BIN).

3.1 EU cities – Adoption of NBS: benefits, constraints, and barriers

This section provides an overview of existing/planned NBS in the URBAN GreenUP cities, as well as a summary of local stakeholders involved in NBS, with legal, economic, and social factors influencing NBS at the city level in European cities, followed by a summary of key barriers and enabling factors to overcome challenges and increase market opportunities for NBS.

Liverpool

3.1.1 Liverpool

Current/Planned NBS

Source: Direct contribution from LIV

Liverpool is a partner in the Horizon 2020 UGUP project and is in the process of retrofitting a number of different NBS to monitor and test their effectiveness and the associated multiple environmental, social and economic benefits.

Works in Liverpool comprise of completed and in-progress works such as:

- Complete tree planting, pollinator planting, green walls, pollinator roofs, mobile forests, floating island ecosystems, Tree SUDs and water retention ponds (SUDs);
- Other works to follow: which include container tree planting, green fences, additional pollinator planting, a rain garden, arts works and the promotion and use of a bio app for species identification;
- Some non-technical supporting works: Forest Schools, Forest Church and programmes around green infrastructure for physical and mental wellbeing.



The NBS have been located in positions where they can provide a natural service or function to directly tackle an environmental, social or economic issue:

- Examples: areas prone to local flooding have benefitted from installations of Tree SUDs, water retention ponds etc. and other areas in very urban environments have benefitted from the introduction of pollinator planting, pollinator roofs or floating ecosystem islands to help enhance biodiversity, trees have also been planted to provide shade and cooling.
- Benefits: The NBS help to provide a natural function that directly addresses an environmental issue of concern or a future predicted impact associated with climate change.

Local collaborations, regulatory, economic and social factors (LIV)

The table below provides a summary of local stakeholders involved in NBS, with legal, economic, and social factors influencing NBS at the city level.

Item related to NBS (local/city level)	Comment from city – direct contribution
Companies/Businesses	<p>Collaborations with utility providers - those with land holdings such as the water companies are more interested in NBS.</p> <p>City planners – supportive with land registry searches and planning permissions; interested in replicating.</p> <p>Green infrastructure companies – aware of the role and value of NBS, but use mainly existing UK experience and specialist knowledge for new NBS due to specialization.</p> <p>Examples: green walls by ANS global Ltd and Biotecture Ltd.; floating ecosystem by Biomatrix Water Solutions Ltd.; water retention ponds – local landscape and civils contractor Horticon Ltd; trees by preferred nurseries, e.g. Barchams; Pollinators - both local architects (reshaped) and larger landscaping contractors (nmcn); Tree SUDs – planting by BCA Landscaping under for Amey Ltd and Grahams contractors. The Friends of Parks Groups – help with installations, promoting, committing to longer term NBS maintenance.</p>
Examples of academia/R&D	<p>Collaboration with University of Liverpool and University of Manchester. Master and final year university students have undertaken research on the project, their work garnering support of businesses, key stakeholders, and the public in implementing NBS. The university - contributed to communication and public engagement, workshops, collaboration with a local community non-profit, PlacED, monitor the social impacts, academic publications, including URBAN GreenUP in the university curriculum, and the City Council and Mersey Forest have also been involved in giving lectures, project partners for masters students.</p>
Examples of international bodies	<p>Those reached in the context of URBAN GreenUP project</p>

Regulatory framework (local)	<p>No local government initiatives to specifically adopt NBS, but some legislation to consider and adopt SUDs. LIV has a procurement section to advise on tendering and procurement, lead local authority in the city region. The Metro Mayors manifesto - goal for a zero-carbon city region by 2040. Responsibility for green space: Regeneration and Economy: Planning issues for green space, Assets/disposals in the greenspace.</p> <p>Community Services: Capital projects and development of green space/NBS, Community engagement in green space/NBS, Small scale green space events. The Mersey Forest - a Community Forest Trust, which represents 6 local authorities.</p>
Economic (cost of NBS, economic instruments available)	<p>Currently no special taxes or grants to facilitate the adoption of NBS. Because of austerity & costs for pandemic response - no funding for NBS introduction. Capital funding that can be used via grant and awards - highest concern is the costs of longer-term ongoing maintenance.</p> <p>Solutions to overcome limitations:</p> <ul style="list-style-type: none"> o making a business case (e.g. the cost of the rain garden will over 5 years be less than the cost of the annual flooding); o placing NBS onto private buildings/land with a legal agreement that the owner maintains; o adding a dowry onto the costs to ensure there is some future maintenance budget available; o engaging local volunteers and groups to help maintain spaces.
Social (awareness/engagement of citizens/local communities)	<p>Awareness of citizens and local communities:</p> <ol style="list-style-type: none"> 1. Most citizens support green solutions, but limited awareness of the multiple environmental, social and economic benefits. 2. Before a consultation linked to the Pop-Up forest in Chavasse Park (2019), 75% of survey respondents did not know what the NBS concept was. However, after interacting with the Pop-Up forest itself – 57% of respondents had ‘some knowledge’. This suggests that the term is capable of being effectively transmitted and understood by local people. 3. Knowledge that green and blue interventions can lead to beneficial socio-economic and environmental outcomes, or solutions. Examples: Pop-Up Forest questionnaire, 88.9% of respondents stated that green space can improve well-being and mental health, and 83.3% stated that it can help to improve air quality, but not aware of new policy terms such as NBS. Introduction should capitalize on familiar terminology e.g. 68% of respondents know ‘green spaces’. <p>Engagement of citizens and local communities:</p> <p>Interest and some support in planting of areas etc. but affected by pandemic/social distancing.</p> <p>Southern zones - local people wish to be involved in localised green solutions: 1) connect URBAN GreenUP schemes to the work and expertise of pre-existing groups, such as ‘Friends of Sefton Park’ and 2) utilize URBAN GreenUP to catalyse greater local stewardship of new interventions as well as improved pre-existing ones.</p>

Table 4 NBS Situation in Liverpool. Source: LIV

As it can be seen, Liverpool has a variety of local specialized businesses for implementation and maintenance of NBS; University of Liverpool and University of Manchester have taken initiatives for collaboration and curriculum introduction of NBS; does not currently have specific legislation or economic incentives for NBS, but has some for SUDs. Economically, budgets have been limited due to the pandemic, but it is possible to build a business base based on long-term benefit, add a dowry to costs, engage volunteers for maintenance, etc. Citizen’s awareness of green spaces and their benefits is quite high, although may not be

familiar with new terminology such as NBS; some support and involvement but limited by the social distancing rules. Can benefit from connecting current projects to pre-existing groups (e.g. Friends of Sefton Park) and utilizing existing interventions to promote new ones.

3.1.2 Valladolid

Current/Planned NBS

Source: Direct contribution from VAL

Within the framework of the URBAN GreenUP project, the city of Valladolid is working on the implementation of a wide range of NBS adapted to the reality of the city, in order to evaluate their effectiveness and learn from the experience. The monitoring analysis factors are technical, economic and social.

Current efforts:

- Renaturing urbanization: Create a Green corridor, connected with a Cycle lane, green resting areas and SUDs; increasing the number of trees in the city, especially in the city center, along the green corridor and in the most degraded suburban areas such as the surroundings of the Zorrilla football Stadium car parking; implementing another Urban carbon sink in the city; implementing an Electro-wetland demonstrator at city level, and others).
- Singular green infrastructures: implementation of various types of Green coverages Green roof / green noise barrier/ Green façade in El Corte Inglés / Green canopies in Plaza España, vertical mobile gardens; Urban garden biofilter; various types of Pollinators' modules and using Smart soil for completing different NBS.
- Municipal urban orchards – for citizens with social purposes (unemployed people, social organizations, etc). Improving the infrastructure with drop irrigation, several systems for Community composting and an small henhouse.
- Water interventions (Grassed swales and Water Retention Pond, SUDs for several streets, Rain gardens and green parking pavements)
- Several non-technical interventions to improve the citizen awareness and engagement, such as the Tourist route for visiting Valladolid's NBS, local desk for providing information, organization of local contests, the “sponsor a tree” initiative, talks and attendance to national and international events, among others.

NBS under consideration:

- Natural wastewater treatment plant and the Green Filter area: The River Duero Basin did not give the permission for the implementation of the NWTP in the selected location. The alternative under study is a detention pond (SUDs) close to a storm tank in Santander Avenue.

NBS that will not be implemented:

- Floodable park: This intervention has been cancelled. An extensive report prepared by the Duero River Basin Authority (topography, geology, hydraulic and hydrological



studies) shows that the risk of flooding derived from the floodable park could outweigh the permissible. The alternatives are technically and economically not viable.

Local collaborations, regulatory, economic and social factors (VAL)

The table below provides a summary of local stakeholders involved in NBS, with legal, economic, and social factors influencing NBS at the city level.

Item related to NBS (local/city level)	Comment from city – direct contribution
Companies/Businesses	<ul style="list-style-type: none"> ▪ Nature-Base Solutions: Grupo EULEN S.A., Ecoemprendedores por el clima, Ferrovial Servicios S.A., ▪ Green Infrastructure: SingularGreen S.L., TIERRA Ingeniería y Paisajismo S.L., Evergreen S.L., Isla Verde obras y servicios S.L., Inforest Medio Ambiente S.L. ▪ Blue Infrastructure: Syntea S.L.
Examples of academia/R&D	CARTIF Technology Center, CENTA Technology center, LEITAT Technology center. BC3 (Basque Center for Climate Change www.bc3research.org), University of Málaga, Fundación Cristina Enea, COBCM - Colegio Oficial de Biólogos de la Comunidad de Madrid
Examples of international bodies	IUCN - Unión Internacional para la Conservación de la Naturaleza (Spain). Greenpeace association.
Regulatory framework (local)	No laws regarding NBS at local level (or any level), but NBS are frequently used by river basin organizations for sustainable water management (such as River Duero Basin, for Valladolid).
Economic (cost of NBS, economic instruments available)	<p>Examples of implementation costs: Green Infrastructure:</p> <p>VAc24-Green vertical mobile gardens: Different technical designs, average on 2,100 €/m²</p> <p>VAc27-Green covering shelter in Plaza España: horizontal green coverage, 200 €/m²</p> <p>VAc25-Green façade in El Corte Inglés building: vertical green garden, 550 €/m²</p> <p>VAc28-Green roof in El Campillo market: horizontal green coverage, 50 €/m²</p> <p>VAc29-Green canopies in Santa María Street: hanging GI, 2,400 €/m²</p> <p>VAc22-VAc23-Green noise barriers: 1,200 €/m² or 3,800 €/m linear</p> <p>VAc30-Urban Garden Bio-Filter: in Portugalete underground car parking 1,600 €/m²</p> <p>VAc26-Electro wetland: 2,000 €/m²</p> <p>Blue Infrastructure:</p> <p>VAc14-Parking green pavements: 100-150 €/m²</p> <p>VAc10-Rain gardens: 50 €/m²</p> <p>Examples of maintenance costs: Not yet available.</p> <p>No economic instruments specific for NBS. Public funding can be spent on NBS such as Horizon 2020, Interreg, EuropeAid, among other funds.</p>
Social (awareness/engagement of citizens/local communities)	The green infrastructure has high visibility and the population likes it. The inhabitants want to see their city greener, they want more trees, more green areas, more buildings with green infrastructure. However, the population is critical with the high cost of implementing and maintaining green infrastructure.

Table 5 NBS Situation in Valladolid. Source: VAL



As it can be seen, Valladolid has a variety of businesses to aid in blue and green NBS; some R&D centres available are CARTIF, CENTA and LEITAT; does not have any local legislation (nor regional/national) to encourage NBS, however NBS are often done by river basin organisations. There are no economic incentives for NBS, but public funding can be used for Horizon 2020, Interreg and other projects. Among citizens, there is enthusiasm for green spaces and buildings with green infrastructure, although they are critical of the high costs of implementation and maintenance.

3.1.3 Izmir

Current/Planned NBS

Source: Direct contribution from IZM

In İzmir, NBS production in demo sites still continues and achieved to some demonstrable results (i.e parklets). Renaturing Peynircioglu Stream and BioLab in Sasalı (covering various NBSs) will be completed in a few months. Social media releases, public bulletins and handouts are prepared and ready to deliver publicly. In order to widen the results, Izmir Metropolitan Municipality is preparing the Izmir Green Infrastructure implementation road map and Izmir Living Parks Implementations (covering peri-urban park network throughout the city). To this end, currently two national urban design competitions are arranged in the city.

Local collaborations, regulatory, economic and social factors

The table below provides a summary of local stakeholders involved in NBS, with legal, economic, and social factors influencing NBS at the city level.

Item related to NBS (local/city level)	Comment from city - direct contribution
Companies/Businesses/NGOs	Bio economy Cooperative and Izmir Foundation are the two emerging business cases in the city contributing NBS production. Bio economy Cooperative declares interest in the production of smart soil. Izmir Foundation develops a project called "IZMIRAS" aiming to reconnect Izmir's various heritage assets with the use of NBSs inherited from ancient practices. This culture-based approach to NBSs is one of the unique characteristics of Izmir that possibly adding up to mainstream NBS implementations.
Examples of academia/R&D	Landscape Research Society has provided research for Izmir: [https://direnclikent2019.izmir.bel.tr/en/ProjectScopePurpose/25/17]. Besides, in Izmir's academic circles, Izmir Institute of Technology's Energy Systems and City Planning Departments, Ege University's Landscape Architecture Department and Soil Science Department conducted research and provided capacity for further NBS implementations.
Examples of international bodies	For Izmir case, the city will implement more NBSs within the frame of Izmir Green City Action Plan (GCAP) granted by EBRD. Izmir's SECAP as requirements of Covenant of Mayors (CoM) also continues in line with GCAP.
Regulatory framework (local)	Source: from past documentation: Urban planning in the forms of urban master plans, implementation plans and plans for specific purposes, on the other hand, is considered at the local level. Izmir Green Infrastructure Strategy (IGS) is a recent document that outlines the strategies to tackle different issues such as preserving and improving biodiversity in a systematic way within the boundaries of the central city.

Economic (cost of NBS, economic instruments available)	<p>Parklets example: Parklets are on-street units with siting equipment and plant containers. They are designed to increase the amount of carbon sequestration as well as pollutant's removal with their plant cover. As some co-benefits, they are expected to increase spending time in green space on a busy and dense urban fabric. They may also serve as cool spots through shading. Parklet units of 4 will be installed in two different sites. It will provide approximately 12,5sqm (an area using for 1 on-street car parking slot) more green areas and 12sqm shadow areas for each parklet.</p> <p>Capital costs (euro): 21.000 €</p> <p>Average operational & maintenance cost (euro/year) 1.500-2.000 € / yr</p> <p>EU grant was used in this implementation and therefore it was exempted from the payment of 18% VAT.</p>
Social (awareness/engagement of citizens/local communities)	<p>Relatively low due to the lack of public information and community consultation on the issue. Therefore, more demonstrations and series of different NBS implementations should be more concrete in the public eye. Regarding to NBS measures people are more sensitive for arboreal interventions [please see: https://www.urbangreenup.eu/news--events/news/wildfires-in-izmir-a-green-plan-for-the-city-an-urban-plan-for-the-forests.kl].</p>

Table 6 NBS Situation in Izmir. Source: IZM

As it can be seen from the table, Izmir highlights Bio economy Cooperative (smart soils) and Izmir Foundation (IZMIRAS project to connect heritage assets – a unique culture-based approach); for academia/R&D, Landscape Research Society, Izmir Institute of Technology's Energy Systems, Ege and others are available; key local regulations include the urban master plan and Izmir Green Infrastructure Strategy; for economic facilitators, a EU grant was used and therefore exempted from 18% VAT tax; citizen's awareness and involvement is quite low due to limited public information, although there seems to be some preference for arboreal interventions.

3.1.4 Mantova

Source: some elements contributed by MAN, with added details from past documentation.

Current/Planned NBS

Source: direct contribution from MAN

MAN is working on NBS introduction; have already used NBS in new parking area; WE candidate NBS in Fondazione Cariplo Call for ideas "Climate strategy" - in order to introduce a Climate Strategy in territory planning.

Source: from past documentation

Existing efforts include:

- Local Water Plan, Tree planting and selection of coherent arboreal essences with the ground, New arboreal areas around urban areas, Mantova Hub project, Urban Orchards
- Sanitary pest control actions (pollinators, green spaces, etc.)



NBS under consideration:

- To address water management (Urban catchment forestry, Hard drainage-flood prevention, Unearth water courses, Channel re-naturing, Water treatment: Green Filter Area, Natural wastewater treatment, Electrowetland, Green pavements, Cycle-pedestrian Green Pavement)
- For climate mitigation and adaptation (Shade trees, Planting and renewal urban trees, Urban Carbon Sink, Trees re-naturing parking, Cool pavements, Green Covering Structures)
- For urban renewal (Planting and renewal of urban trees; Shade Trees; Cooling trees; Trees re-naturing parking, Arboreal areas around urban areas, Urban catchment forestry, Sustainable urban Drainage Systems (SUDs), Urban orchards)
- For public health and well-being (Trees re-naturing parking and Arboreal areas around urban areas, Green Façade, Cycle and pedestrian green routes, Pollinators)
- For air quality (Urban Garden Biofilter, Green Façade, Cycle and pedestrian green routes, Arboreal interventions)

Local collaborations, regulatory, economic and social factors

The table below provides a summary of local stakeholders involved in NBS, with legal, economic, and social factors influencing NBS at the city level.

Item related to NBS (local/city level)	Comment from city – some direct contribution, some past documentation
Companies/Businesses/NGOs	Mantova Ambiente S.R.L directly involved in Mantova. Some Consortia, e.g. Consorzio forestale Padano
Examples of academia/R&D	VENICE UNIVERSITY IUAV
Examples of international bodies	FAO – Tree Board - After first meeting about Urban Forestry Mantova signed The Mantova Challenge
Regulatory framework (local)	From past documentation: local Urban Green Plan; River Mincio Contract; Adaptation Plan Guidelines (climate change effects); UNESCO, etc.
Economic (cost of NBS, economic instruments available)	Municipality is working in definition of economic instruments to implement natural solutions for private owners. From past documentation: At the local level, Institutions can voluntarily finance NBS interventions. From past documentation: expect increases in economic costs.
Social (awareness/engagement of citizens/local communities)	Awareness is increasing, many local associations are working in matching their activities with greening and NBS (ex: Slowfood, ULG C-change – EU project, R84, Festivaletteratura, Interno Verde etc). From past documentation: one of the first Italian cities where the citizen participation started; initiative “Ci vediamo nei quartieri” (Let’s meet us in the quarters) with walks and surveys in the neighborhood

Table 7 NBS situation in Mantova. Source: MAN, supplemented from past documentation.

As it can be seen above, Mantova has several consortia involved in NBS and Venice University for Academia; key local legislation includes Urban Green Plan; River Mincio Contract, and others; local institutions can voluntarily finance NBS as the city is working on defining specific



economic instruments; in terms of citizen participation, Mantova is among the pioneers with neighbourhood walks and survey activities.

3.1.5 Ludwigsburg

Current/Planned NBS

Source: from past documentation

Notable NBS initiatives before URBAN GreenUP:

Inner city greening - Thanks to the Strategic Concept for Open Space and Green Areas the city has accomplished several inner city greening projects. For example, in the Alt-Württemberg-Allee, a boulevard with old tree stock, area was unsealed to improve water storage capacity and to enlarge the space for the rhizosphere in 2015.

“Hungerberg” biotope – In 2006 the city began with its city’s largest conversion project, turning the 64 hectare area of the stone quarry “Hungerberg” in cooperation with the former owner into a biotope.

Neckarbiotop “Zugwiesen” - The city renatured the Neckar riverside “Zugwiesen” from 1998-2013. The restoration of a natural riverine habitat, comprising 17 hectare, cost 8 M €, of which the largest part was provided by the city and another part from the EU Life+ programme.

Due to the renaturation, the amount of fish species rose significantly; also the amount of water bird species rose from formerly 4 to 18 in 2014 as well as the occurring plant species, which significantly multiplied from 213 species observed in 2007 to 396 in 2014.

Current efforts:

- Discussion about heavy rain prevention Plan; push the topic of green roofs
- Secure and improve green spaces and open spaces, open space design with water, climate adapted buildings
- Masterplan with several measures to improve air quality in Ludwigsburg (e.g. increased number of electric vehicles in the fleet of the City administration, expansion of charging infrastructure; digital parking facility management to reduce the parking search traffic)
- Open space development concept, climate adaptation concept; new approaches for green in the City e.g. Green Room in Ludwigsburg
- Internal guidelines “how to build municipal buildings” i.e. high energy efficiency and green roof
- Future conferences with citizens of Ludwigsburg every three years, City district development plans and City district committees

NBS under consideration:

- To address flooding (Raingardens, Floodable Parks, Green Pavements, SUDs)
- To address heat (and drought) (Pavements, Green Covering Structures)



- For air quality (Green Shady Structure, Green Facades, Green Noise Barrier)
- For green space management (Parklets, Pocket Parks)
- For urban regeneration (Green roofs, Green Facades, Green Noise Barrier)

Local collaborations, regulatory, economic and social factors

The table below provides a summary of local stakeholders involved in NBS, with legal, economic, and social factors influencing NBS at the city level.

Item related to NBS (local/city level)	Source: from past documentation
Companies/Businesses/NGOs	NGOs: local branches of "Friends of the Earth Germany (BUND)" and Nature And Biodiversity Conservation Union (NABU)
Examples of academia/R&D	To be added with input from the city and partners.
Examples of international bodies	To be added with input from the city and partners.
Regulatory framework (local)	Urban Plan; interdepartmental unit for sustainable urban development under the Lord Mayor; tendering process.
Economic (cost of NBS, economic instruments available)	The city provides funding to local farmers for measures contributing to the preservation and improvement of flora and fauna habitats; the city set up a nature- and environment programme for citizens/non-profit organizations that supports: <ul style="list-style-type: none"> - Roof top and facade greening - Nature protection measures - Installation of cisterns and use of geothermal energy. Example: funding of 76,659.12 € were paid out in 2015.
Social (awareness/engagement of citizens/local communities)	Environmental topic "Green City" gets a lot of support from the citizens, who are concerned about air pollution; Public participation initiatives: Future conference, STEP - District development plans; Climate Path map – guided tour (by foot, by bike) to selected energy/climate projects in the city; "Sustainability Guides".

Table 8 NBS situation in Ludwigsburg. Source: past documentation.

As it can be seen, Ludwigsburg city is a pioneer in providing funding for local farmers to contribute to biodiversity; also, there are notable initiatives for citizen awareness and engagement, such as climate path tours and sustainability guides.



3.1.6 Regulatory framework for EU cities – summary

After previously discussing each European city individually, this section is a summary of key notes from previous sections on regulatory framework for EU cities – to be developed with input from partners during regular project meetings:

- Very few city-level initiatives related to green/GI/sustainability – many of them voluntary or guidelines rather than compulsory; many do not mention NBS directly (Davis et al, 2018)
- Some cities see/have opportunities to insert NBS guidelines at the local level e.g. MAN, LUD
- Issues with land and property use, special legislation e.g. UNESCO/conservation
- Tendering/bidding process with strict quality requirements

3.1.7 Economic factors for EU cities – summary

As above, this section is a summary of key notes on economic framework for EU cities – to be developed with input from partners during regular project meetings:

- Some cities (e.g. IZM) can benefit from funds exempted from 18% VAT tax
- Some cities (LUD) provide funding to local farmers for measures contributing to the preservation and improvement of flora and fauna habitat and set up a nature- and environment programme for citizens/non-profit organizations, that supports:
 - Roof top and facade greening
 - Nature protection measures
 - Installation of cisterns and use of geothermal energy.
 - For both programmes 223 applications for funding were received and a total of 76,659.12 € were paid out in 2015.
- Some cities (e.g. MAN) are working on introducing economic incentives for NBS and allow voluntary sponsoring from companies
- Some cities expect increases in economic costs (e.g. MAN)

3.1.8 Social factors for EU cities – summary

As above, this section is a summary of key notes on social framework for EU cities – to be developed with input from partners during regular project meetings:

- Many cities have participatory system where citizens are invited to share their opinions regarding the city's future and NBS
- Many cities have quite high interest and some engagement from citizens and local communities in green solutions, with variety of competitions, actions, e.g. LIV, VAL, MAN, etc. (less from IZM)
- Some cities (IZM, VAL) highlight arboreal interventions as citizen's preference
- Most/all cities have NGOs and other organizations/associations that support green initiatives, environmental protection, nature/forests, etc.

3.1.9 Barriers and enabling factors for NBS implementation in EU cities – summary

After reviewing key highlights from the European cities above, this section summarizes key barriers and how to overcome them, based on the European cities characteristics above. To be further refined with input from partners at future meetings.

Barriers

It is important to analyse barriers to NBS adoption so that suitable solutions can be employed to overcome challenges and increase the market opportunities for NBS.

Common obstacles to NBS implementation in European cities:

- Few companies with sufficient technical competence for bidding/tendering
- Limited funding or funding re-allocated for pressing needs e.g. pandemic
- Lack of local regulations to facilitate NBS adoption
- Concerns about high costs, especially implementation and maintenance
- Less citizen awareness and engagement in some cities (e.g. IZM)

Enabling factors

It is important to become aware of enabling factors and other solutions to facilitate NBS adoption so that the market for NBS can be expanded.

To tackle citizen awareness and knowledge of NBS (LIV):

- Introduction of NBS should capitalize on familiar terminology e.g. 68% of respondents know 'green spaces'
- connect URBAN GreenUP schemes to the work and expertise of pre-existing groups
- utilize URBAN GreenUP to catalyse greater local stewardship of new interventions as well as improve pre-existing ones.

To overcome economic limitations (LIV):

- Use capital funding – grants, awards
- making a business case (e.g. the cost of the rain garden will over 5 years be less than the cost of the annual flooding);
- placing NBS onto private buildings/land with a legal agreement that the owner maintains;
- adding a dowry onto the costs to ensure there is some future maintenance budget available;
- engaging local volunteers and groups to help maintain spaces.

3.2 Non-EU cities – Adoption of NBS: benefits, constraints, and barriers

This section gives an overview of existing/planned NBS in the URBAN GreenUP non-European follower cities, as well as a summary of local stakeholders involved in NBS, with legal, economic, and social factors influencing NBS at the city level, followed by a summary of key



barriers and enabling factors to overcome challenges and increase market opportunities for NBS. Within the sections, some contributions are directly from partners (BIN), while others are based on past documentation (MED) e.g. D 6.2 Characterization of front-runner and follower cities from the perspective of the implementation of NBS. In some instances, the data available was too limited to draw conclusions and therefore partners will be involved in future meetings to provide more detail.

3.2.1 Quy Nhon City

Current/Planned NBS

Source: direct contribution from BIN

- Solutions for green trees in Quy Nhon city
 - **Street and park greenery:** climate control, limit environmental pollution, improve living environment, beautify the city, enrich cultural life of urban residents. Green areas create quiet rest areas for adults, places of sports and sports for teenagers, places of entertainment for children; create aesthetic landscape and character of the city.
 - **Green trees along the water surface (lagoons, lakes ...):** typically mangrove areas that help to keep land, contribute to preventing erosion and flooding for urban areas. Due to the specific geographical structure (forests, mountains, lakes, lagoons, seas, and rivers all exist in the overall urban plan), therefore, the greenery system along the water surface is one of the important features and is the precious capital to be protected and exploited of Quy Nhon city. Although most of them are of technical greenery, this greenery area not only contributes a significant part to the urban greenery area but also creates its own characteristics, enriching the species of trees. Planting as well as in terms of urban landscape value.
 - **Trees on the mountain:** Quy Nhon city has many mountains in the heart of the city (Mount Vung Chua, Ba Hoa) that is why green trees on the mountain are also an important green area of the city. Quy Nhon, makes an important contribution to the current greenery system, significantly increases greenery, contributes to perfecting urban techniques (protective greenery, landscape creation, microclimate improvement) It is also an important source of greenery development reserves in the future, when pressure on population and construction land is increasing.

Source: from past documentation:

Efforts include:

- Plan urban storm water drainage system taking into account climate change
- Arboreal Interventions: To conserve and restore the mangrove ecosystem along the lagoon in combination with tourism and services. Solution: Planting casuarina trees on



sand dunes and planting them on the strips on the axis of Nhon Hoi Economic Zone to create landscapes according to the approved planning

- Renovating and upgrading ecological lakes and regulating lakes, improving embankments in the direction of organizing green areas and approaching the water surface
- Planting green trees, flowers in the family garden yard, unit offices, memorial gardens, squares, dividers, traffic islands; planting flowers in roadside trees
- Creating public green spaces, including: shade green trees, lawns, sports equipment, benches, promenades
- Citizens awareness: organizing activities for people, tourists and public services in coastal green areas

NBS under consideration:

- To deal with urban flooding (SUDs, Green Infrastructure, Green parks, Renovation of regulating lakes)
- To aid with urbanization along the lagoon (Restore mangrove forests in combination with tourism and services)
- To aid with industrial development on the peninsula of Nhon Hoi Economic Zone - Planting casuarina trees on sand dunes and planting them on the strips on the axis of Nhon Hoi Economic Zone.

Local collaborations, regulatory, economic and social factors

The table below provides a summary of local stakeholders involved in NBS, with legal, economic, and social factors influencing NBS at the city level.

Item related to NBS (local/city level)	Comment from city – direct contribution, some from past documentation
Companies/Businesses/NGOs	Quy Nhon Urban Lighting and Green Park Joint Stock Company
Examples of academia/R&D	Limited information available - to be developed in future meetings.
Examples of international bodies	The Rockefeller Foundation, USAID and CRS
Regulatory framework (local)	From past documentation: Adjustment of the General Plan of Construction of Quy Nhon City and its vicinity to 2035; Binh Dinh Provincial People's Committee is the unit that directs the planning, design, construction and maintenance of NBS; The Office of Climate Change Coordination in Binh Dinh Province (CCCO Binh Dinh) is the assisting body

Economic (cost of NBS, economic instruments available)	From past documentation: Binh Dinh People's Committee share of public budget; Private budget: from people and private companies inside Vietnam; International sponsors: transfer to Binh Dinh People's Committee or directly transfer to Binh Dinh CCCO; in general, the local budget sources are limited and the budgets from individuals and organizations in Vietnam are not large; foreign funds are currently declining, making difficulties to implement NBS in the future.
Social (awareness/engagement of citizens/local communities)	In decision making for 02 NBS Arboreal Interventions - willingness to participate and support with dissemination from people in the ward through the community meetings. From past documentation: Focus on local participation: planned NBSs in an area where vulnerable populations live (fishermen). Modelled on co-management and protection of the forest, which promotes the ownership of local people. Overall, citizens are very supportive of NBS to for climate mitigation.

Table 9 NBS situation in Quy Nhon City. Source: BIN with some past documentation.

As it can be seen, Quy Nhon city has few businesses available to implement NBS, and limited local budgets but with possibility to apply for some private or international funding; there is some awareness and enthusiasm for NBS, especially arboreal interventions for underprivileged populations and climate mitigation initiatives in general.

3.2.2 Medellin

Sources consulted: D6.2 Characterization of front-runner and follower cities from the perspective of the implementation of NBS and WP6 Follower City Progress Report at Izmir Regular Meeting, 2020, but a bit unclear which information was city-level and which country-level, therefore this section will be further developed with input from the city and relevant partners in future meetings.

Current/Planned NBS

Source: from past documentation:

MED's early interventions consist of green corridors, ecoparks, gardens, green walls, and eco-gardens food.

NBS under consideration:

Cover a variety of NBS to address various issues, including some examples: For climate mitigation and adaptation (Green covering shelters, Green Roof, Green Shady Structures, Floodable Park, Smart Soil, Pollinator, Green Façade, Vertical Garden); To address Water management: (Climate Smart Greenhouses, SUDs, Grassed Swales and Water Retention Ponds, Rain Gardens); For green space management (Pollinators, Green Resting Areas, Urban Orchard, Urban Garden Biofilter), For air quality (Pollinators, Green noise barrier, Vertical mobile garden, Urban catchment forestry); To address urban regeneration (Green Resting Areas, Green Filter Area (water), Floating Garden). Also, To increase economic opportunities and green jobs (Urban Orchard, Community Composting, Parklets, Green Resting Areas)



Local collaborations, regulatory, economic and social factors

The table below provides a summary of local stakeholders involved in NBS, with legal, economic, and social factors influencing NBS at the city level.

Item related to NBS (local/city level)	Comment from city – all from past documentation
Companies/Businesses/NGOs	Limited information – to be completed with input from relevant partner.
Examples of academia/R&D	Limited information – to be completed with input from relevant partner.
Examples of international bodies	Limited information – to be completed with input from relevant partner.
Regulatory framework (local)	Municipal Territorial Ordinance Plan (POT); The Secretariat of the Environment of the Municipality of Medellin – the entity responsible for the maintenance of urban forestry and the landscaping of the city. Municipal Decree No. 883 of 2015; The City's Environmental Management System, SIGAM;
Economic (cost of NBS, economic instruments available)	Needs further input from partner to clarify which instruments are available at city level and which are regional/national.
Social (awareness/engagement of citizens/local communities)	Limited information – to be completed with input from relevant partner.

Table 10 NBS in Medellin. Source: past documentation (incomplete).

Due to the limited information available at the interim step, further input from partner will be collected at future meetings.

3.2.3 Regulatory framework for non-EU cities – summary

After discussing the detailed situation in non-European cities, section is a summary of key notes on the regulatory framework at city level from the non-EU cities above. To be completed with input from relevant partners during regular project meeting.

3.2.4 Economic conditions for non-EU cities – summary

As above, this section is a summary of key notes of economic conditions at city level from the non-EU cities above. To be completed with input from relevant partners during regular project meeting.

3.2.5 Social factors in non-EU cities – summary

As above, this section is a summary of key notes on social factors at city level from the non-EU cities above. To be completed with input from relevant partners during regular project meeting.



3.2.6 Barriers and enabling factors for NBS implementation in non-EU cities – summary

After reviewing key highlights from the non-European cities above, this section is a summary of key notes of barriers and enabling factors at city level from the non-EU cities. To be completed with input from relevant partners during regular project meeting.

Barriers

It is important to analyse barriers to NBS adoption so that suitable solutions can be employed to overcome challenges and increase the market opportunities for NBS.

Common obstacles to NBS implementation in non-European cities (based on direct contribution from BIN) echo some of those mentioned for European cities:

- Few companies with sufficient technical competence for bidding/tendering (BIN)
- Limited budgets (BIN)
- Concerns about high costs, especially implementation and maintenance (BIN)

Other barriers from past documentation (about BIN):

- Incomplete policies and guiding documents related to implementation
- Limited mechanism of sharing information between levels and branches in the city
- The solution is implemented in the city, but the decision-making level is at the central level or provincial level or with the participation of decision makers at many levels, sectors, and decision-making processes
- The technical standard promulgated to implement the solution is not suitable to the location of deployment (strong winds, storms)
- Limited awareness, capacity and sense of responsibility to participate in responding to climate change, environmental protection of all levels, branches and communities

Enabling factors

It is important to become aware of enabling factors and other solutions to facilitate NBS adoption so that the market for NBS can be expanded.

To tackle budget issues (BIN):

- Using central and / or local funds in afforestation programs and projects;
- Proposing programs and projects related to afforestation supported by international organizations

3.3 SWOT analysis and key characteristics of each city

While the previous section discussed the NBS situation, regulatory, economic, social barriers and enabling factors in the EU and non-EU cities in URBAN GreenUP project, the current section focuses more holistically on the Strengths, Weaknesses, Opportunities, and Threats in each city. For the purpose of the interim report, a sample SWOT analysis with examples of possible drivers and barriers was created for illustration purposes only and may differ from the



final result, especially due to the evolving legal, social, and economic situation in each city and the different stages of NBS consideration/implementation at which follower cities are.

Here is a sample SWOT Analysis for a fictitious City A, for illustration purposes only:



Figure 1 Sample SWOT for City A (not a real city)

An actual SWOT analyses for each city will be developed in collaboration with all relevant partners from each city during a brainstorming workshop at future project meetings in which different partners can comment on the latest market trends in specific NBS solutions, growing expertise of NBS companies/businesses in the area, new or improved legal and economic conditions for NBS, increased social participation and other key factors. As SWOT models are drafted, there will be a strategy-building session, in order to develop a strategic SWOT, in which partners are encouraged to consider:

- Which Strengths to focus on in order to mitigate Threats
- Which Strengths to take advantage of in order to capitalize on Opportunities
- What new skills/expertise and Strengths needs to be created or utilised in order to overcome Weaknesses, etc.

To conclude, NBS adoption is at varying stages throughout the URBAN GreenUP countries, with more advanced implementation in demo cities, and earlier preparation and planning steps being taken in the follower cities. The cities also vary in terms of local regulations, costs and budgets, the availability of tax incentives and other economic facilitators for NBS, as well as varying degrees of awareness, knowledge, and engagement of the citizens and local communities with NBS.

4 Market demographics

After understanding the city characterization in more depth in the previous part, the current chapter provides an overview of the stakeholder groups identified that can be the target markets for NBS, as well as factors to consider when assessing the market potential of the various NBS within and outside the EU when targeting these stakeholder groups. Finally, some notes are included about possible directions for how to position NBS when introducing them to the targets.

4.1 Stakeholder group identification

This section is based on D 7.11 Exploitation and market deployment plan (Interim) and details the key stakeholder groups to be involved in the D 7.8 survey with public/private and citizens.

The target audiences are entities and/or individuals that can benefit from project results; for URBAN GreenUP, the target audience has have been grouped into five different categories of stakeholders, namely:

1. PUBLIC GOVERNMENTS (municipalities, city council and city administration, national and regional governments, environmental protection agencies, standardized bodies)
 2. BUSINESSES (city services companies, utility providers, nurseries and green infrastructure companies, industry and SMEs, urban planners, architects)
 3. SOCIETY (citizens, trade unions and professional associations, NGOs, local communities)
 4. ACADEMIA/R&D (academic organizations, institutional research organizations, and industrial research organizations)
 5. INTERNATIONAL BODIES (EC, European institutions and agencies, and International, regional and multilateral organizations).
 6. FINANCIAL INSTITUTIONS (Insurance companies, Multilateral development banks. Banks, foundations, capital management bodies, and large private investors)
- OTHER (EU projects)

During the identification of the target audience, the market needs of each target group have been individuated as well. The market needs inform organizations about what products to develop, for what customers, at what cost, through which distribution channels, thus reducing the uncertainty that a new product/service development always brings with it. Among the identified market needs there are: standards for NBS adoption at the urban level, process standardization, product identification, knowledge networks, land use regulation, the achievement of higher energy standards, and several types of NBSs that the group might be more apt to focus on.

However, this is not comprehensive, and in order to obtain a more exhaustive list of the market needs of each stakeholder, focus groups will be held with the partners of URBAN GreenUP in the near future during the project meetings.



4.2 Factors to assess opportunities/high-potential NBS

From the point of view of market opportunities, some key elements to consider when evaluating the NBS within URBAN GreenUP could be:

- Which are the key segments and sectors with highest interest and willingness to invest in NBS (B2B, B2C, government, etc.)
- What (if any) are the key segment(s) interested in each NBS solution in particular
- Which specific NBS solutions best meet the needs of the respective segments
- Which specific NBS solutions are superior/well-integrated compared with grey solutions/traditional infrastructure
- Which NBS are being currently adopted (more easily) and in which cities/countries, by which customer segments
- Which NBS are easier to highlight the benefits to potential customers, etc.
- Which NBS are more easily promoted to citizens and local communities
- What benefits (economic, energy savings, etc.) can be provided to the sector installing a specific NBS
- Which NBS are easier to integrate into an existing infrastructure

However, this is not comprehensive, and in order to obtain a more exhaustive list, partners of URBAN GreenUP will be invited to provide their input during future project meetings.

4.3 Notes on possible positioning of NBS

Source: Based on Catalogue 1.1 and literature

Based on the knowledge and evidence accumulated throughout the project, as well as elements from D 1.1 NBS Catalogue and literature, the following positioning details are proposed to be further discussed, refined, and enriched with input from partners during regular project meeting discussions and further customized/tested in the survey for D 7.8 Report on the market opportunities in European and non-European countries for the implementation of NBS.

SAMPLE POSITIONING FOR NBS

NBS IS

A portfolio of off-the-shelf and customizable options for sustainability in nature-centric urban development (Pontee et al 2016) that employs renewable natural processes

WHICH ACTS AS

A bridge to complement the advantages of engineered/grey urban landscapes and green infrastructure/ecosystem-based planning (Liquete et al 2016)

UNLIKE TRADITIONAL APPROACHES, NBS DELIVERS

Multifunctional benefits both ecological (water, air, climate) and socio-economical (mental, physical health and well-being, economic inclusion, job creation, etc.)

AND CONTRIBUTES TO

Reverse negative impacts of previous development (p. 214, Van Wesenbeek et al. 2014) in a more self-sustainable, cost-competitive way (Maes n Jacobs, 2017) that is adapted to local conditions.

In summary, the chapter has covered the five stakeholder groups that will be surveyed in D 7.8, namely public agencies/government, businesses/companies, academic/R&D, society, and international bodies, has highlighted some features of high-potential NBS to target the various segments e.g. ease of implementation, attractiveness to citizens, etc, and has provided a possible positioning statement for bringing NBS to the market.

5 Definition of the methodology for the market analysis that will be conducted in D 7.8

According to EC reviewer feedback, propose to increase sample size for survey to N = 460-560, widened to include cluster countries & cities

- 360 from current UGU, for example = 60 respondents/city (30 public and private + 30 citizens) x 6 cities
- 100-200 from cluster cities with help from partners, for example SPI.

Process to reach stakeholders:

Within WP7 – dissemination by local partners

This will be addressed in more depth close to the final report when the survey link becomes available and is sent to partners for dissemination.

After the previous chapter individuated the key stakeholder groups to be approached for NBS, this chapter takes the discussion one step further to clarify who will be surveyed, how many of them, and how they will be accessed. In detail, the section gives an overview of the steps in the methodology for primary data collection of a survey with partners in preparation for D7.8 Report on the market opportunities in European and non-European countries for the implementation of NBS [M60], including steps in refining the survey questions, steps in translating and disseminating the survey, and the process of further refining findings to arrive at meaningful recommendations on the market opportunities available for NBS in European and non-European countries.

5.1 Refining the survey draft

The definition and further refinement of the survey for D7.8 has three proposed steps as below:

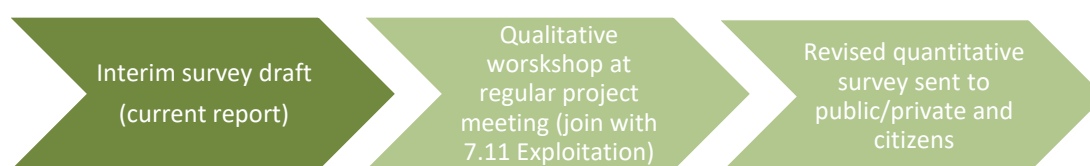


Figure 2 Steps in refining the current interim survey.

Interim survey step – developing the interim survey for public/private stakeholders and for citizens of current deliverable 7.12. The survey questions are in draft form only, based on interim data which is subject to change due to new developments in political, economic, legal, social, technological and other updates at EU and non-EU level, e.g. new legislation that may be passed or take effect, Covid-19 impact, some projects at front-runner cities are still in early stages to compare results to baseline, some follower cities are still in the process of developing/refining their RUP plan and/or have not started construction yet, etc.

To act as a bridge between the incomplete information at the interim stage and best prepare for the final survey in D7.8, a refinement step is proposed:

Qualitative step (serves as pre-test/refinement) join together with follow-up of D7.11 Exploitation and market deployment plan (Interim) to discuss how different stakeholders can exploit NBS (7.11) and the different market opportunities available for NBS (7.12)

– Joint workshop with representatives from all cities at regular project meeting early 2021 (March 2021?), during which:

- fill gaps in current knowledge and understanding of NBS diffusion, drivers, barriers, SWOT and market opportunities in all partner cities (e.g. update on changes in legislation/political/economic/social conditions, new developments in follower cities, collecting more success stories and caveats/lessons learnt, collecting more financial data, etc.)
- refine methodology of final quantitative survey e.g. regarding sample size, accessing stakeholders, translation into local language, timeline of data collection, etc.
- refine open questions by providing a wide spectrum of answer choices that reflects most stakeholders' views (e.g. so that most current open questions can be turned into quantitative)
- streamline to high-potential and medium-potential NBS solutions (out of all NBS options) and on the most promising directions for marketability (e.g. most promising/high-potential examples of NBS, high potential sectors to be approached about adopting NBS and to be included in the quantitative survey, etc.)
- refine positioning strategy, competitive advantage, and differentiation points of NBS (as an alternative to grey/traditional) to be tested through the wider survey in 7.8
- brainstorm exploitability cross-check questions e.g. input regarding business models/financing/exploitation/willingness to pay, etc.

Quantitative step [around April-May to mid- 2021?] – a quantitative survey with public and private stakeholders as well as citizens will be conducted, see details in the next section 6

5.2 Respondents, sample size and survey dissemination

This section details the recommended sample size from each stakeholder group including public, private, and citizens, the language and contact method for the survey, and some points about data analysis.

5.2.1 Stakeholders groups for the quantitative survey

As explained, the types of stakeholders included in the survey will correspond to the five stakeholder typologies highlighted in D7.11 Exploitation and market deployment plan (Interim):

1. PUBLIC GOVERNMENTS (municipalities, city council and city administration, national and regional governments, environmental protection agencies, standardized bodies)



2. BUSINESSES (city services companies, utility providers, nurseries and green infrastructure companies, industry and SMEs, urban planners, architects)
3. SOCIETY (citizens, trade unions and professional associations, NGOs, local communities)
4. ACADEMIA/R&D (academic organizations, institutional research organizations, and industrial research organizations)
5. INTERNATIONAL BODIES (EC, European institutions and agencies, and International, regional and multilateral organizations).
6. FINANCIAL INSTITUTIONS (Insurance companies, Multilateral development banks. Banks, foundations, capital management bodies, and large private investors)
7. OTHER (EU projects)

5.2.2 Sample size and respondents – to be updated

For each city, the proposed sample size is approximately 10 public/private respondents and approximately 5 citizens/local communities, with a mixed breakdown as follows:

Number of respondents from each group	Type of stakeholder group
Total 2-3 Example <ul style="list-style-type: none"> - 1 from municipality/city council/city administration - 1 from national/regional government - 1 from environmental protection agency 	<ul style="list-style-type: none"> - PUBLIC GOVERNMENTS (municipalities, city council and city administration, national and regional governments, environmental protection agencies, standardized bodies)
Total 5-6 Include SMEs Example <ul style="list-style-type: none"> - 3 industry and SMEs - 1 city service company/utility provider - 1 urban planner/architect - 1 nurseries and GI companies 	<ul style="list-style-type: none"> - BUSINESSES (city services companies, utility providers, nurseries and green infrastructure companies, industry and SMEs, urban planners, architects)
Total 2 Example <ul style="list-style-type: none"> - 1 from academic - 1 institutional research organization - AND/OR 1 from industrial research organizations 	<ul style="list-style-type: none"> - ACADEMIA/R&D (academic organizations, institutional research organizations, and industrial research organizations)
Total 4-5 Example <ul style="list-style-type: none"> - 3-4 citizens - 1-2 trade union and professional association - 1-2 local communities - 1-2 NGO - Citizens/local communities should have a mix of age groups and occupations - Citizens/local communities should not be rejecters of NBS 	<ul style="list-style-type: none"> - SOCIETY (citizens, trade unions and professional associations, NGOs, local communities)

Total 1-2 As relevant to local city/country Example <ul style="list-style-type: none"> - 1 from standardization body - 1 from international or regional/multilateral organization - OR 1 from EC/European institution and agency (for EU cities) 	- INTERNATIONAL BODIES (EC, European institutions and agencies, and International, regional and multilateral organizations)
Total 1-2 As relevant to local city/country Example <ul style="list-style-type: none"> - 1 bank - 1 insurance company 	- FINANCIAL INSTITUTIONS (Insurance companies, Multilateral development banks. Banks, foundations, capital management bodies, and large private investors)
Total 1-2 As relevant to local city/country	- OTHER (EU projects)

Table 11 Proposed Sample Size and Stakeholder Breakdown

After setting a possible list of respondents from each category, the next section will give more detail about how respondents will be accessed.

5.2.3 Language and contact method

Respondents will be surveyed via an online platform; the master survey will be online-based, available in 6 languages (from drop-down list), with both public/private and citizens option included (from drop-down list) – see sample figure below.

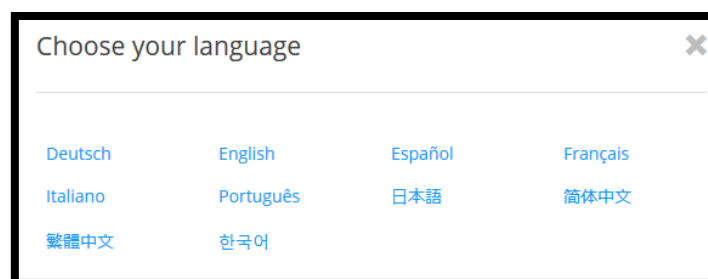


Figure 3 Sample screen of 'Choose your language' option. (Source: discussions.viki.com, 2020)

The software platform for the survey can be Qualtrics, Google Forms, Survey Monkey or similar, and will be forwarded via email by RMI as a link to all partners/cities, who will in turn distribute as link to any stakeholders that match the requirements. The answers will be automatically recorded and sent to RMI via the software.

To create the master list of all survey questions in all 6 languages, RMI needs the help of one key partner from each language (e.g. UBO for Italian, CAR for Spanish, etc.) to translate the survey questions in the local language, then send the translation back to RMI so that RMI can make the master survey link available in all languages, see sample process below:

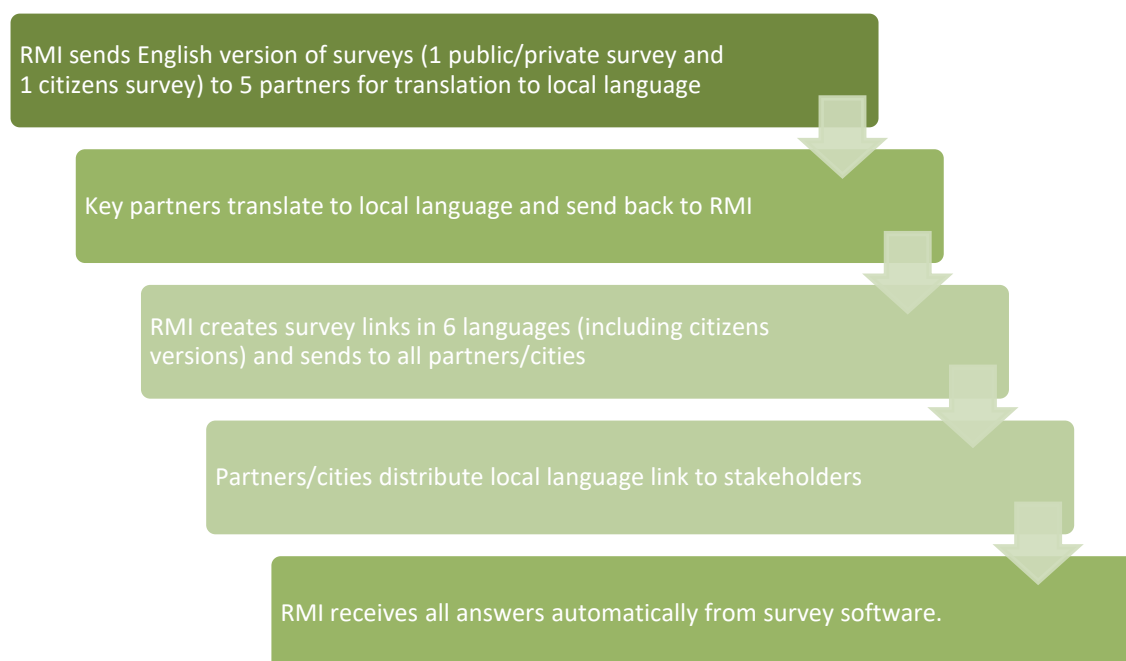


Figure 4 Steps for RMI to create survey links in 6 languages (including versions for citizens)

Data collection is expected to last around 2-3 months, e.g. April – May – June 2021, with a possible follow-up step in case some of the answers collected are incomplete.

5.2.4 Data analysis and further refinements

After collecting the information, data analysis will be conducted with visual representations suitable for quantitative surveys such as charts, graphs, mapping of stakeholders, positioning maps of high-potential NBS, opportunity maps of high-potential industries/sectors, etc.

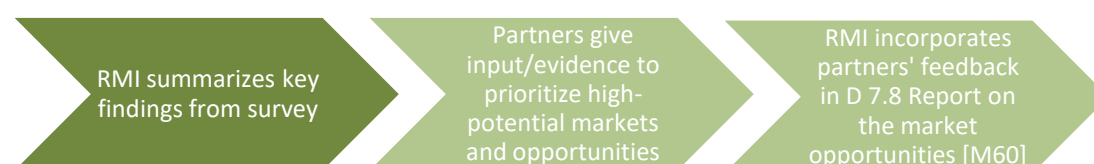


Figure 5 Survey results analysis and further enrichments.

As this is a cross-cutting task, all partners are expected to be involved in providing their input on how to use the survey results to identify and prioritize the high potential market opportunities, sectors, NBS types, and contribute to the final recommendations in D7.8 Report on the market opportunities in European and non-European countries for the implementation of NBS – M60.

In short, the chapter clarified who will be surveyed, the recommended sample size from each group, the research design and methodology, as well as language and platform for data collection.

6 Definition of a survey for the demand-side analysis to understand the most pressing needs of the target markets

While the previous chapters focused on who will be surveyed and how, the current chapter discusses the purpose of the survey and what (the topics) that the respondents will address. This section proposes two draft surveys, one for public/private and one for citizens, which will be refined through the qualitative step highlighted above - workshop at regular project meeting in early 2021.

6.1 Purpose of the survey

In preparation for the market opportunities report, the survey aims to collect data on the demand-side of NBS in order to inform strategic decisions about the following issues:

- Positioning of NBS to the market. How to define, position, and differentiate the NBS, e.g. as a product, service, sustainability solution, in what ways it is superior to grey/traditional infrastructure, etc.
- Market size and gaps. Which areas have the most pressing needs, how many NBS opportunities and how much scale/size there is, etc.
- High-potential NBS and growth opportunities – which specific NBS have more potential and in which cities/countries/sectors, etc.
- Customer segments. Further refine and identify customer segments for NBS by market demographics, geographic, behaviour, willingness to pay, possible challenges and solutions, etc.
- Opportunities for EU and non-EU companies to be involved in NBS, e.g. availability of local service providers, local contractors, needs for consulting, technical assistance, etc.

6.2 Draft questionnaire for public and private stakeholders

The sample survey questionnaire below was devised to encompass both public and private targets, including a special section/block of questions that is aimed mainly at the private sector:

PUBLIC & PRIVATE SURVEY QUESTIONNAIRE

Please choose your language from the list

- Flag/name of language in original e.g. “Español”

Are you a citizen/local community?

YES → will continue with citizen survey

NO → will continue with public/private survey (current survey)



Personal information of respondent and NBS introduction

1. Name _____
2. Email address _____
3. Phone number including country code _____
4. Affiliation _____
5. Which category does your affiliation belong to?

You are a member of	Please click the correct choice
PUBLIC GOVERNMENTS (municipalities, city council and city administration, national and regional governments, environmental protection agencies, standardized bodies)	
BUSINESSES (city services companies, utility providers, nurseries and green infrastructure companies, industry and SMEs, urban planners, architects)	
SOCIETY (citizens, trade unions and professional associations, NGOs, local communities)	
ACADEMIA/R&D (academic organizations, institutional research organizations, and industrial research organizations)	
INTERNATIONAL BODIES (EC, European institutions and agencies, and International, regional and multilateral organizations).	
FINANCIAL INSTITUTIONS (Insurance companies, Multilateral development banks. Banks, foundations, capital management bodies, and large private investors)	
OTHER (EU projects)	

6. What is your location?

Your Location	Please click the correct choice
EUROPEAN – Liverpool, UK	
EUROPEAN – Valladolid, Spain	



EUROPEAN – Izmir, Turkey	
EUROPEAN - Ludwigsburg, Germany	
EUROPEAN - Mantova, Italy	
NON-EUROPEAN Medellin, Colombia	
NON-EUROPEAN Quy Nhon, Vietnam	
Other _____	

7. What is your position and role in your affiliation? (open text field)

Please answer here (e.g. architect, urban planner, etc.) _____

ABOUT YOUR CITY'S SITUATION

8. Please tick the box to show how much you agree with each of the statements below:

Statement	very much disagree	disagree	neither agree nor disagree	agree	very much agree
The current investment in public and private infrastructures in my city is high and increasing.					
My city is currently developing new areas.					
My city is currently doing renovations in the Old Quarter.					
My city is currently offering incentives for public – private partnerships in city infrastructure projects.					
My city has adopted resolutions/decisions/guideline					



on green infrastructure or NBS to mitigate current and future challenges					
It is common in my city for the public to participate in NBS initiatives (e.g. private homes have green roof, green walls, etc.)					
It is common in my city to have green areas.					

9. Please provide a short overview of how your city defined the baseline analysis.

→ _____

CITY NEEDS/DRIVERS TO CONSIDER NBS

10. Please click to indicate if you agree that the following challenges/issues are relevant to your city:

Possible challenges/issues	Strongly disagree	Disagree	Uncertain to agree or disagree	Agree	Strongly agree
Climate change mitigation & adaptation					
Air quality					
Coastal resilience					
Green space management					
Participatory planning and governance					

Potential of economic opportunities and green jobs					
Public Health and Wellbeing					
Social justice and social cohesion					
Urban regeneration					
Water management					
Heat island					
Ecosystem connectivity					
Biodiversity					
Local food production					
Green Mobility					
Sustainable buildings					

Diffusion of NBS

11. From the options below, which NBS solutions have you already been involved with e.g. implemented (outside/inside URBAN GreenUP project) and which solutions are you considering (for URBAN GreenUP project)?

Out of all 42 examples, the shortlist of NBS will be prioritized based on input from partners during regular project meetings. Below list is based on comment by CAR reviewer:

Green route

Carbon capture



Resting area

Arboreal intervention

Smart soils

Pollinators

Vertical green infrastructure (green wall, green noise barriers...)

Horizontal green infrastructure (green roof)

Pollutant filters

Urban farming

Floating garden

Floodable park

Bio swale

SUDS

Water treatment

Green pavement

Educational activities

Rain garden

Please give more detail about current and considered NBS solutions:

12. Give examples of NBS that you are familiar with that have been adopted/applied (year adopted, for what purpose, public or private)?

Name/type of NBS already adopted	Year adopted	The main purpose/intention of this NBS	Is it Public or Private?

13. NBS has been considered for future project (for what purpose, public or private)



Name/type of NBS considered for future adoption	The main purpose/intention of this NBS	Is it Public or Private?
---	--	--------------------------

14. Below are some statements that can drive a city or country to adopt NBS. For each statement, please rate how much you agree with the statement.

Possible driver to adopt NBS	Strongly disagree	Disagree	Uncertain to agree or disagree	Agree	Strongly agree
Regulatory requirements related to NBS e.g. guideline for designing company or contractors to use green certificated materials, solutions.					
NBS show promises (environment, energy, health) to solve the problems of the city.					
NBS meets the needs of citizen for more environmental friendly infrastructure, green space, etc.					
Other_____					
Other_____					

15. Are these opportunities relevant to your city right now? For each statement, please rate how much you agree with the statement.

Opportunities for NBS	Strongly disagree	Disagree	Uncertain to agree or disagree	Agree	Strongly agree
Urban planning recommends using green materials					
Government incentive mechanism					
Serious climate change issues (heat island effect, inundation, etc.) that NBS can address					
Local citizen/organizations are well aware of the benefits of NBS to mitigate current city challenges					
There is already strong investment from public/private for environmental friendly solutions to buildings/infrastructure.					

16. Please describe the legal framework of NBS implementation. - See example here <https://climate-adapt.eea.europa.eu/metadata/case-studies/four-pillars-to-hamburg2019s-green-roof-strategy-financial-incentive-dialogue-regulation-and-science> Includes in the urban planning of the city regarding greening solutions or adopting new solutions for new urban development area (channel re-naturalization, SUDs, green pavements) – example from Ludwigsburg - channel re-naturalization.

Legal framework for NBS implementation	How NBS is implemented	How are private companies engaged	How are the incentives	How successful implementation has been	Reasons for success/lack of success

--	--	--	--	--	--

17. Please explain and give examples of some economic instruments used in your city/country to foster adoption of NBS (e.g. tax breaks, government grants, etc.)

18. Below is a list of possible stakeholders who may be the targets for adopting NBS in your city. In your view, please rate the importance of each stakeholder in adopting NBS.

Opportunities for NBS	Not important at all	Not too important	Neither important nor unimportant	Important	Very important
Public Authorities (Municipalities, etc.)					
Corporations and businesses					
Citizens					
NGOs/Associations					
Educational institutions					
Research institutions					

Others _____ (please specify) _____					
-------------------------------------	--	--	--	--	--

- Please give more detailed description to explain your answers.

19. From the list of possible stakeholders who may be involved in adopting NBS in your city, please rate how ENGAGED do you think each stakeholder may be in adopting NBS.

Opportunities for NBS	Not engaged at all	Not too engaged	Neither engaged nor unengaged	Engaged	Very engaged
Public Authorities (Municipalities, etc.)					
Corporations and businesses					
Citizens					
NGOs/Associations					
Educational institutions					
Research institutions					
Other _____ (please specify) _____					

- Please give more detailed description to explain your answer

20. From the list of NBS options below, which do you think have more potential for being adopted in your city/country?

Green route

Carbon capture

Resting area

Arboreal intervention

Smart soils

Pollinators

Vertical green infrastructure (green wall, green noise barriers...)

Horizontal green infrastructure (green roof)

Pollutant filters

Urban farming

Floating garden

Floodable park

Bio swale

SUDS

Water treatment

Green pavement

Educational activities

Rain garden

21. From the list of NBS, please select the possible stakeholders who may be involved in adopting NBS in your city, and how WILLING TO PAY do you think each stakeholder may be in adopting that particular NBS.

Green route

Carbon capture

Resting area

Arboreal intervention

Smart soils

Pollinators

Vertical green infrastructure (green wall, green noise barriers...)

Horizontal green infrastructure (green roof)



Pollutant filters

Urban farming

Floating garden

Floodable park

Bio swale

SUDS

Water treatment

Green pavement

Educational activities

Rain garden

Answer the question for each of the NBS in the list

Opportunities for NBS	Not willing to pay at all	Not too willing to pay	Neither willing nor unwilling to pay	Willing to pay	Very willing to pay
public agencies/government					
businesses/companies					
academia/R&D					
Society (citizens/local community)					
international bodies					

22. In your opinion, how high is the Awareness level of the citizen/organizations/business regarding the NBS to mitigate urban issues (climate, water management, regeneration, etc.)?

Please rate awareness level of each group related to each environmental problem below by clicking low awareness, medium awareness or high awareness.

Possible challenges/issues	Strongly disagree	Disagree	Uncertain to agree or disagree	Agree	Strongly agree
Climate change mitigation & adaptation					
Air quality					
Coastal resilience					
Green space management					
Participatory planning and governance					
Potential of economic opportunities and green jobs					
Public Health and Wellbeing					
Social justice and social cohesion					
Urban regeneration					
Water management					
Heat island					

Ecosystem connectivity					
Biodiversity					
Local food production					
Green Mobility					
Sustainable buildings					

- Please give more detailed description

BARRIERS/DIFFICULTIES FOR THE ADOPTION OF NBS

23. Below are some examples of barriers or difficulties that may be relevant to adopting NBS in your city. For each barrier, please rate your level of agreement about this barrier being very relevant to your city in adopting NBS: from strongly disagree (=barrier is not relevant to my city adopting NBS at all) to strongly agree (=barriers is very relevant to my city adopting NBS).

Barriers for NBS that are relevant to your city	Strongly disagree	Disagree	Uncertain to agree or disagree	Agree	Strongly agree
Technology readiness					
Guideline is not available					
High investment compared to other solution					
Difficulty regarding the management of the NBS					
Difficult for the implementation of NBS					
Cannot be implemented as it will alter whole or part of the structure which is under					

protected agreement (e.g. UNESCO site of Mantova)					
The initial acceptance of the market or the public					
Competitiveness of the NBS compares to traditional or grey infrastructure (new and innovative solutions take time to get used to)					
The perception of higher price of NBS solutions in investment and maintenance.					
Other (please specify) _____					

Please explain your answer in more detail:

24. 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 very 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)	Very high impact (may stop the NBS from happening)
Institutional – administrative					
Institutional – legislative					
Institutional – governance					
Social/cultural					

Financial/market					
Technological barriers (e.g. city maintenance workforce)					

Please explain your answer in more detail:

25. In terms of investment cost, please rate the following NBS by affordability considering your budget.

FOR GOVERNMENT: low cost for my budget – cost similar to my budget – cost is high for my budget.

Areas of NBS	Examples of solutions		
Re-naturing Urbanization	Green route		
	Carbon capture		
	Resting area		
	Arboreal intervention		
Singular Infrastructure green	Smart soils		
	Pollinators		
	Vertical infrastructure green		
	Horizontal infrastructure green		
	Pollutant filters		

	Urban farming		
Water Interventions	Floating garden		
	Floodable park		
	Bio swale		
	SUDS		
	Water treatment		
	Green pavement		
Non-technical interventions	Educational activities		
	Support activities		
	City coaching		
	Engagement		
Others _____ (please specify)			

26. Name and state how many local contractors/designer/technological companies are in your city/area that can offer NBS for public and private

Type of NBS service	Number of companies that can offer this NBS	Names of companies that can offer this NBS



Other (please specify) _____		

MARKETING AND THE FUTURE OF NBS – both public and private can answer

27. In your opinion, which ONE of the following answers describes NBS best (choose one answer):

- Product
- Service
- Package solution of product and service
- Investment option
- Sustainability solution
- Other _____

28. In your opinion, which ONE of the options below describes how NBS is different or better than traditional options (grey infrastructure, green infrastructure):

- NBS has nature as the centre
- NBS can help to reverse some negative effects of traditional infrastructure
- NBS can help to reduce some Climate Change effects
- NBS solutions are self-renewable
- NBS can get investment more easily
- Most NBS have low start-up capital
- NBS are favoured by legislation
- Other _____

29. In your opinion, which ONE of the options is the primary high potential buyer/client/industry for NBS:

- Urban planner
- Ecological manager
- Public authority
- Private developer
- Construction sector
- Corporation for Corporate Social Campaigns (CSR)
- NGOs and charities/associations
- Other _____

30. In your opinion, which ONE of the options is the most important secondary stakeholder or entity (not direct buyer/owner) that can benefit from NBS commercially/exploit NBS:

- Construction companies, contractors
- Developers e.g. real estate developer
- Consultants e.g. architect, landscape providers, exterior designers, etc.
- NGOs and charities/associations
- Citizens
- Private entities, give examples: _____

Questions focused on private company/business:

31. In your experience as a company (private), how important is NBS in your overall business?

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

32. Primarily, does your business deal mostly with

- Mostly simple, off-the-shelf solutions that are easy to implement/replicate?
- Mostly complex, customizable solutions that require extensive expertise and budget?
- A rather equal mix of both?

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

- Specialized e.g. in one or a few very similar NBS (e.g. only green roof)
- Multiple NBS solutions, somewhat similar to each other (e.g. all water-related)
- Wide variety of NBS solutions that require different skill/expertise

34. In your experience as a company (private), which of these services do you offer regarding NBS?

- Technical consulting (e.g. technical specifications of the NBS)
- Training
- Financial/commercial consulting (e.g. how to get revenue from NBS)
- Legal consulting (e.g. legal requirements, certifications, etc.)
- Design (e.g. technical design)
- Customizing large-scale NBS
- Supply materials needed for the NBS e.g. smart soil
- Installation /technical/implementation
- Maintenance
- Other _____?

35. In terms of customers, are your clients:

- Mostly Public (e.g. government or state-affiliated companies)
- Mostly Private (e.g. corporations, businesses)
- Mostly Individuals (e.g. home owner, local community)



- A mix of public and private
- A mix of private and individuals
- Other _____

36. In terms of origin and location, are most of your customers

- Local (e.g. from your city/area)
- Region/national (e.g. different parts of your country)
- From outside your country

37. Do you offer NBS services outside of your country?

Yes/no

If Yes – where? A. Close by, e.g. neighboring countries B. Quite far, e.g. different continents C. Online?

38. What are some key challenges regarding growing your business?

- 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 _____

39. From your experience, what are some of the steps you have taken to solve these issues/grow your business?

- Use examples/case studies of successful NBS
- Conduct workshops/training
- Submit proposals/tenders when there is a bidding opportunity
- Networking/join trade events
- Lobby regulators about favourable NBS legislation
- Other _____

40. From your knowledge/experience with NBS, what has worked well (and was surprising)?

41. From your knowledge/experience with NBS, what doesn't work well (that was initially thought to be an important element) and should be noted for the future?

42. Out of all the NBS that you know/have experience with from the list below, please mark which NBS you would recommend to other cities/countries for implementation and which NBS you would NOT recommend to other cities/countries for implementation.

Areas of NBS	Examples of	Would recommend to other	Would NOT recommend
--------------	-------------	--------------------------	---------------------



	solutions	cities/countries	to other cities/countries
Re-naturing Urbanization	Green route	Yes Because _____	No Because _____
	Carbon capture		
	Resting area		
	Arboreal intervention		
Singular green Infrastructure	Smart soils		
	Pollinators		
	Vertical green infrastructure		
	Horizontal green infrastructure		
	Pollutant filters		
	Urban farming		
Water Interventions	Floating garden		
	Floodable park		
	Bio swale		
	SUDS		
	Water treatment		
	Green pavement		

Non-technical interventions	Educational activities		
	Support activities		
	City coaching		
	Engagement		
Others _____			

Please explain your answer in more detail

43. Based on your experience, which elements make some NBS more popular/high-potential than others?

- 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 benefit (e.g. reduce air pollution, etc.)
- Have aesthetic benefit (e.g. attractive, beautiful surroundings)
- Other _____

44. Considering the overall current market in your city/country, which NBS are most used/popular?

Green route

Carbon capture

Resting area

Arboreal intervention

Smart soils

Pollinators

Vertical green infrastructure (green wall, green noise barriers...)

Horizontal green infrastructure (green roof)

Pollutant filters



Urban farming
Floating garden
Floodable park
Bio swale
SUDS
Water treatment
Green pavement
Educational activities
Rain garden

Please explain your answer in more detail

45. Considering the future market direction in your city/country, which NBS are likely to become more popular in the future? Why?

Green route
Carbon capture
Resting area
Arboreal intervention
Smart soils
Pollinators
Vertical green infrastructure (green wall, green noise barriers...)
Horizontal green infrastructure (green roof)
Pollutant filters
Urban farming
Floating garden
Floodable park
Bio swale
SUDS
Water treatment
Green pavement
Educational activities



Rain garden

Please explain your answer in more detail

46. Considering the overall market direction in the world, which NBS are likely to become more popular in the future?

Green route

Carbon capture

Resting area

Arboreal intervention

Smart soils

Pollinators

Vertical green infrastructure (green wall, green noise barriers...)

Horizontal green infrastructure (green roof)

Pollutant filters

Urban farming

Floating garden

Floodable park

Bio swale

SUDS

Water treatment

Green pavement

Educational activities

Rain garden

Please explain your answer in more detail

47. What should the EU, cities and stakeholders do to facilitate NBS adoption?

In Europe? _____



In the world? _____

Please explain your answer in more detail:

48. In what ways (if any) do you think that the Covid-19 situation can impact NBS adoption?

a. In your country?

b. Around the world?

Please explain your answer in more detail:

49. Is there anything else regarding potential market for NBS that has not been covered already in this survey and you wish to add?

6.3 Draft questionnaire for citizens and local communities

Below are some suggested questions to be included in the survey for citizens/local communities to give an indication of the stakeholder's group knowledge and interest in NBS, needs that NBS can satisfy and willingness to participate in NBS either financially or otherwise.

General information of the interviewee

Name and Surname (optional)

Age group

Job/ Occupation

City of residence

Area of the city (specify if you live close to one of the NBS implemented)

Are you aware of the URBAN GreenUP project?



YES/NO

If you are aware of URBAN GreenUP project, how do you rate the initiative?

Give a rating from 1 to 10

Are you familiar with the concept of NBS – Nature-Based Solutions?

- . yes – have heard before and understand well
- . yes – have heard before, but not know well
- . no – never heard

In your opinion, NBS refers to

- . A product
- . A service
- . A package of products and services
- . Other _____?

From the list below, which NBS examples are you familiar with?

[list will be prioritized based on the most relevant NBS for citizens' knowledge; terminology will be simple/non-technical; photos will accompany each NBS example for illustration]

- .
- .
- .
- .

In your opinion, NBS should be initiated by

- . National government e.g. country government
- . Local government e.g. city/municipality
- . Businesses/Companies e.g. green roof businesses, landscape businesses, real estate developers, etc.
- . Citizens and local communities



. NGOs

. Other _____?

From the NBS list below, is there any NBS that you would like to have in your city/area (but do not have yet)? Please give reason(s) why would you like to have this NBS in your city.

.
.
.
.

If there is an initiative in your city to set up NBS, your response to it would be:

. very positive

. somewhat positive

. neutral

. somewhat concerned _____ please explain.

. very concerned _____ please explain.

From the NBS list below, which NBS solutions would you like to become involved with if given the choice? Please give reasons for your choice.

.
.
.
.

. None

From the NBS that you would like to be involved with, how do you see your role in it?

. owner

. shared owner or sponsor

. volunteer

. promoting/creating awareness about the NBS to others

. Other _____



From the NBS that you would like to be involved with, what type of benefit do you expect to receive?

- . financial benefit e.g. product/result that I can sell for money
- . produce/product that I can use or consume myself e.g. pure water, fruits, etc.
- . ecological benefit e.g. fresh air, cooling/shading, reduced flood risk, etc.
- . aesthetic/attractiveness of the area e.g. beautiful surroundings, beautiful landscape
- . cultural preservation e.g. my effort helps to protect a place with historical or cultural importance
- . a place for recreation e.g. picnic, outdoor walks, etc.
- . Other _____?

From the NBS that you would like to be involved with, how do you see your financial contribution to it?

- . as tax payer
- . as partial financial contributor e.g. shared with the local municipality/government
- . as member of a co-operative with other local community members
- . as full financial contributor
- . Other _____

From the NBS that you would like to be involved with, what payment plan do you expect?

- . included in tax
- . one-time only fee
- . recurrent fee (e.g. monthly/yearly)
- . pay-per-result (e.g. only pay when visiting/accessing the NBS and its benefits; or buying its results e.g. fruits, pure water, etc.)
- Other _____

To conclude, the current chapter established the methodology for data collection, the sample size and steps in data collection and analysis, as well as proposed two survey versions – one for public and one for private.

7 Conclusion

As an interim step to *D 7.8 Report on the market opportunities in European and non-European countries for the implementation of NBS*, the current report has covered a number of areas. Initially, it has introduced the concept of NBS and its uses both from the point of view of public and private stakeholders, and has assessed NBS competitiveness against some grey/traditional solutions as well as which sectors would be most likely targets to be approached. Next, it has laid the foundation for future country-level analysis for the market for NBS in European and non-European countries, followed by a deep-dive into the city-level legal, economic, and social factors contributing to or impeding NBS adoption. In addition, it discussed market demographics of potential customers for NBS, as well as the methodology of data collection for the public and private survey of D 7.8. Finally, two survey drafts – one for public/private and one for citizens – were developed to be further refined before usage in D 7.8.



8 New chapter – Future directions for investment and upscaling

Most of these perspectives will be distilled from the whole report after in-depth analysis at global, EU, country, and national/city levels, from survey results and conversations with stakeholders. As more data is collected, we will be able to get a perspective on market potential for different NBS applications

Upscaling strategies/levels e.g. patches, landscapes, regions, globe

Table 2

Scales and levels for human-environment interactions.

Source: based on Cash et al. (2006).

Scale type	Scale description	Scale levels (from small to large)
Spatial	Areas	Patches, Landscapes, Regions, Globe
Temporal	Rates, durations, frequencies	Daily, Seasonal, Annual
Jurisdictional	Administrations	Localities, Provincial, National, International
Institutional	Rules	Operating Rules, Laws/Regulations, Constitution
Management	Plans	Tasks, Projects, Strategies
Networks	Links	Family, Kin, Society, Trans-Society
Knowledge	Truths	Specific/Contextual, General/Universal

Example table 4: From source

Upscaling example from Australia – Living Melbourne

Source: Fastenrath, S., Bush, J., & Coenen, L. (2020). Scaling-up nature-based solutions. Lessons from the Living Melbourne strategy. *Geoforum*, 116, 63-72.

Upscaling example from Germany – Edible City

- suggest that a bottom-up approach linked with a top-down perspective is needed for successful upscaling
- understood in terms of more supportive actors (Ehnert et al., 2018) but also in terms of connecting different sustainability contexts under the umbrella of one NBS
- Example for edible city – actors see it as a cross-cutting issue
- connected with the slow-food movement, fair-trade or soil protection
- network collaboration – Partnerships with other cities that have the same NBS

Source: Sartison, K., & Artmann, M. (2020). Edible cities—An innovative nature-based solution for urban sustainability transformation? An explorative study of urban food production in German cities. *Urban Forestry & Urban Greening*, 49, 126604.

Other opportunities:

Example – NBS for building owners (hotel)

- Presence of green spaces within and outside hotels increases guest loyalty by improving mental and physical wellbeing

Source Han, H., Jongsik, Y., & Hyun, S. S. (2020). Nature based solutions and customer retention strategy: Eliciting customer well-being experiences and self-rated mental health. *International Journal of Hospitality Management*, 86, 102446.



Example – tourism associations to encourage NBS

- Female millennials and Generation Z are interested in traveling to urban NBS sites

Source Giachino, C., Pattanaro, G., Bertoldi, B., Bollani, L., & Bonadonna, A. (2020). Nature-based solutions and their potential to attract the young generations. *Land Use Policy*, 105176.

Example – Poland (Poznan) – growing plants in balconies, green areas on social-modernist residences

- only 37.3–53.9% of balconies have been used for growing plants and, to a great extent, the ones that are used for growing include only single pots rather than a complex greenery.
- green areas occupy less than 20% of the investment area and in 26% of cases there was not a single tree on the complex.

Source Zwierzchowska, I., Haase, D., & Dushkova, D. Discovering the environmental potential of multi-family residential areas for nature-based solutions. A Central European cities perspective. *Landscape and Urban Planning*, 206, 103975.

Market Estimates will be given by local partners for their respective cities – to be collected at later stages of the report.

Estimates from partners each NBS will include:

- how much in volume in m2 or m3
- market/customers to take up
- players (suppliers, installation, maintenance, etc to deliver this)
- capital and maintenance cost,
- benefits
- financials that could provide leverage.



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10 Annex

D 7.12 Template summary from VAL

Name of city	Summary of current NBS situation in your country/city (existing/planned NBS, functions of NBS, applications of NBS)	Examples (names) of businesses/companies involved in NBS in your city/country	Examples of academia/R&D (research institutions) involved in NBS in your city/country	Examples of international bodies (EU institutions, agencies, etc.) involved in NBS in your city/country	Examples of economic conditions (cost to implement/maintenance of NBS), economic instruments available (e.g. special tax, grants, etc.)	Comment on how high is awareness and interest of citizens and local communities to be involved in NBS in your city/country
VALLADOLID	In Spain there is currently no specific legislation on Nature-based Solutions. There is no specific strategy at national level (Spain), nor regional (Castilla y León) nor local (Valladolid). The Ministry of the Environment (www.miteco.es) mentions NBS mainly in the application of solutions for sustainable water management (www.miteco.gob.es/es/agua/formacion/soluciones-basadas-en-la-naturaleza_tcm30-496389.pdf). NBS are frequently used by river basin organizations for sustainable water management (such as River Duero Basin, for Valladolid). The National Environmental Congress of Spain, CONAMA, created in 2018 a specific working group on NBS: (http://www.conama.org/conama/download/files/conama2018/GTs%202018/10_final.pdf)	<ul style="list-style-type: none"> Nature-Based Solutions: Grupo EULEN S.A., Ecoemprendedores por el clima, Ferrovial Servicios S.A., Green Infrastructure: SingularGreen S.L., TIERRA Ingeniería y Paisajismo S.L., Evergreen S.L., Isla Verde obras y servicios S.L., Inforest Medio Ambiente S.L. Blue Infrastructure: Syntea S.L. 	CARTIF Technology Center, CENTA Technology center, LEITAT Technology center, BC3 (Basque Center for Climate Change www.bc3research.org), University of Málaga, Fundación Cristina Enea, COBOM - Colegio Oficial de Biólogos de la Comunidad de Madrid	IUCN - Unión Internacional para la Conservación de la Naturaleza (Spain). Greenpeace association.	<p>Examples of implementation costs: Green Infrastructure:</p> <p>VAc24-Green vertical mobile gardens: Different technical designs, average on 2,100 €/m²</p> <p>VAc27-Green covering shelter in Plaza España: horizontal green coverage, 200 €/m²</p> <p>VAc25-Green façade in El Corte Inglés building: vertical green garden, 550 €/m²</p> <p>VAc28-Green roof in El Campiello market: horizontal green coverage, 50 €/m²</p> <p>VAc29-Green canopies in Santa Maria Street: hanging GI, 2,400 €/m²</p> <p>VAc22-VAc23-Green noise barriers: 1,200 €/m² or 3,800 €/m linear</p> <p>VAc30-Urban Garden Bio-Filter: in Portugalé underground car parking 1,600 €/m²</p> <p>VAc26-Electro wetland: 2,000 €/m²</p> <p>Blue Infrastructure:</p> <p>VAc14-Parking green pavements: 100-150 €/m²</p> <p>VAc10-Rain gardens: 50 €/m²</p> <p>Examples of maintenance costs: Not yet available.</p> <p>Economic instruments available (e.g. special tax, grants, etc.): In Spain there are not economic instruments specific for NBS. Public funding can be spent on NBS such as Horizon 2020, Interreg, EuropeAid, among other funds.</p>	The green infrastructure has high visibility and the population likes it. The inhabitants want to see their city greener, they want more trees, more green areas, more buildings with green infrastructure. However, the population is critical with the high cost of implementing and maintaining green infrastructure.

D 7.12 Template summary from IZM

Name of city	Summary of current NBS situation in your country/city (existing/planned NBS, functions of NBS, applications of NBS)	Examples (names) of businesses/companies involved in NBS in your city/country	Examples of academia/R&D (research institutions) involved in NBS in your city/country	Examples of international bodies (EU institutions, agencies, etc.) involved in NBS in your city/country	Examples of economic conditions (cost to implement/maintenance of NBS), economic instruments available (e.g. special tax, grants, etc.)	Comment on how high is awareness and interest of citizens and local communities to be involved in NBS in your city/country
IZMIR	In Turkey, Ministry of Environment and Urbanization has published "rain garden" guidelines to encourage implementations in gardens of public institutions. In Izmir, NBS production in demo sites still continue and achieved to some demonstrable results (i.e. parklets). Renaturing Peynircioglu Stream and BioLab in Sasalı (covering various NBS) will be completed in a few months. Social media releases, public bulletins and handouts are prepared and ready to deliver publicly. In order to widening the results, Izmir Metropolitan Municipality prepares Izmir Green Infrastructure implementation road map and Izmir Living Parks Implementations (covering peri-urban park network throughout the city). To this end, currently two national urban design competitions are arranged in the city.	Bio economy Cooperative and Izmir Foundation are the two emerging business cases in the city contributing NBS production. Bio economy Cooperative declares interest in the production of smart soil. Izmir Foundation develops a project called "IZMIRAS" aiming to reconnect Izmir's various heritage assets with the use of NBSs inherited from ancient practices. This culture-based approach to NBSs is one of the unique characteristics of	Ministry of Environment and Urbanisation Climate Change Department Adaptation to Climate Change Division provides national demonstration projects and guidelines. Within the scope of İklimin Project, Landscape Research Society has provided research for Izmir: (https://direndikent2019.izmir.bel.tr/en/ProjectScopePurpose/25/17). Besides, in Izmir's academic circles, Izmir Institute of Technology's Energy Systems and City Planning Departments, Ege University's Landscape Architecture Department and Soil Science Department conducted research and provided capacity for further NBS implementations.	İklimin project co-financed by the European Union and the Republic of Turkey and beneficiary institution is the Ministry of Environment and Urbanisation. (http://www.iklimin.org/en). For Izmir case, the city will implement more NBSs within the frame of Izmir Green City Action Plan (GCAP) granted by EBRD. Izmir's SECAP as requirements of Covenant of Mayors (CoM) also continues in line with GCAP.	<p>Parklets example: Parklets are on-street units with siting equipment and plant containers. They are designed to increase the amount of carbon sequestration as well as pollutant's removal with their plant cover. As some co-benefits, they are expected to increase spending time in green space on a busy and dense urban fabric. They may also serve as cool spots through shading. Parklet units of 4 will be installed in two different sites. It will provide approximately 12,5sqm (an area using for 1 on-street car parking slot) more green areas and 12sqm shadow areas for each parklet.</p> <p>Capital costs (euro): 21.000 €</p> <p>Average operational and maintenance cost (euro/year) 1.500-2.000 € / yr</p> <p>EU grant was used in this implementation and therefore it was exempted from the payment of 18% VAT.</p>	Relatively low due to the lack of public information and community consultation on the issue. Therefore, more demonstrations and series of different NBS implementations should be more concrete in the public eye. Regarding to NBS measures people are more sensitive for arboreal interventions [please see: https://www.urbangreenup.eu/news-events/news/wildfir]



D 7.12 Template summary from BIN

Name of city	Summary of current NBS situation in your country/city (existing/planned NBS, functions of NBS, applications of NBS)	Examples (names) of businesses/companies involved in NBS in your city/country	Examples of academia/R&D (research institutions) involved in NBS in your city/country	Examples of international bodies (EU institutions, agencies, etc.) involved in NBS in your city/country	Examples of economic conditions (cost to implement/maintenance of NBS), economic instruments available (e.g. special tax, grants, etc.)	Comment on how high is awareness and interest of citizens and local communities to be involved in NBS in your city/country
QUY NHON	1. Solution for green trees Quy Nhon city:					
	1.1. Street and park greenery: climate control, limit environmental pollution, improve living environment, beautify the city, enrich cultural life of urban residents. Green areas create quiet rest areas for adults, places of sports and sports for teenagers, places of entertainment for children; create aesthetic landscape and character of the city.	Quy Nhon Urban Lighting and Green Park Joint Stock Company			Local budget source	
	1.2. Green trees along the water surface (lagoons, lakes ...): typically mangrove areas that help to keep land, contribute to preventing erosion, erosion, and flooding for urban areas. Due to the specific geographical structure (forests, mountains, lakes, lagoons, seas, and rivers all exist in the overall urban plan), therefore, the greenery system along the water surface is one of the important features and is the precious capital to be protected and exploited of Quy Nhon city. Although most of them are of technical greenery, this greenery area not only contributes a significant part to the urban greenery area but also creates its own characteristics, enriching the species of trees, planting as well as in terms of urban landscape value.	Department of Agriculture and Rural Development		The Rockefeller Foundation, USAID and CRS	Funding from local budgets and non-governmental organizations	For the green tree solution, Quy Nhon city received high support from the people as well as the local community through its willingness to contribute efforts, costs and participate in propaganda to increase awareness of planting and urban greenery protection.
	1.3. Trees on the mountain: Quy Nhon city has many mountains in the heart of the city (Mount Vung Chua, Ba Hoa, ...) that is why green trees on the mountain are also an important green area of the city. Quy Nhon, makes an important contribution to the current greenery system, significantly increases greenery, contributes to perfecting urban techniques (protective greenery, landscape creation, microclimate improvement ...) It is also an important source of greenery development reserves in the future, when pressure on population and construction land is increasing.	Department of Construction, Department of Agriculture and Rural Development			Mobilize capital from local budgets	

D 7.12 Template summary from MAN

Name of city	Summary of current NBS situation in your country/city (existing/planned NBS, functions of NBS, applications of NBS)	Examples (names) of businesses/companies involved in NBS in your city/country	Examples of academia/R&D (research institutions) involved in NBS in your city/country	Examples of international bodies (EU institutions, agencies, etc.) involved in NBS in your city/country	Examples of economic conditions (cost to implement/maintenance of NBS), economic instruments available (e.g. special tax, grants, etc.)	Comment on how high is awareness and interest of citizens and local communities to be involved in NBS in your city/country
MANTOVA	We are working in NBS introduction. We already used NBS in new parking area. WE candidate NBS in Fondazione Cariplo Call for ideas "Climate strategy"- in order to introduce a Climate Strategy in territory planning	Mantova Ambiente S.R.L directly involved in Mantova. Consorzio forestale padano	VENICE UNIVERSITY IUAV	FAO – Tree Board - After first meeting about Urban Forestry Mantova signed The Mantova Challenge	Municipality is working in definition of economic instruments to implement natural solutions for private owners	Awareness is increasing ever more, many local associations are working in matching their activities with greening and NBS (ex: Slowfood, ULG C change – EU project, R84, Festaletteratura, Interno Verde etc)

Contribution as in-line answers from LIV

Question 1

Please give a summary of current NBS [Nature Based Solutions] diffusion in your country and city, focusing on

- Existing and/or planned NBS
- Functions of NBS
- Application of NBS

Liverpool is a partner in the Horizon 2020 UGUP project and is in the process of retrofitting a number of different NBS to monitor and test their effectiveness and the associated multiple environmental, social and economic benefits.

Works in Liverpool comprise of completed works such as tree planting, pollinator planting, green walls, pollinator roofs, mobile forests, floating island ecosystems, Tree SuDs and water retention ponds (SuDs) with other works to follow which include container tree planting, green fences, additional pollinator planting, a rain garden, arts works and the promotion and use of a bio app for species identification. A number of non technical supporting works have also been delivered such as Forest Schools, Forest Church and programmes around green infrastructure for physical and mental wellbeing.

The NBS have been located in positions where they can provide a natural service or function to directly tackle an environmental, social or economic issue e.g. areas prone to local flooding have benefitted from installations of Tree Suds, water retention ponds etc and other areas in very urban environments have benefitted from the introduction of pollinator planting, pollinator roofs or floating ecosystem islands to help enhance biodiversity. Trees have also been planted to provide shade and cooling. The NBS help to provide a natural function that directly addresses an environmental issue of concern or a future predicted impact associated with climate change.

Question 2

Please give examples (e.g. names of local city administration bodies, names of companies, names of research institutes etc.) and comment on the following stakeholders that are available in your city and country and how interested they are in adopting NBS solutions:

- **public agencies/government** (municipalities, city council and city administration, national and regional governments, and environmental protection agencies);

Liverpool is the lead local authority in the city region. NBS has been expanded beyond the UGUP project and some aspects have been incorporated into future city schemes. Smaller,



neighbouring authorities are likely to also implement similar works when Liverpool begins to publish some of its results and conclusions. Liverpool work to date has been encouraged and supported by the key environmental protection agencies (United Utilities, Environment Agency) and Liverpool staff have spoken about the UGUP project at a number of agency conferences and webinars. Nationally, prior to lockdown Liverpool, project staff have been invited to DEFRA and British Academy workshops in London to discuss and influence the future role of NBS and biodiversity. The importance of NBS has also been included and recognized in the city's emerging Spatial development frameworks and public open spaces strategy.

- **businesses/companies** (city services companies, utility providers, urban planners, architects, nurseries and green infrastructure companies, industry and SMEs, trade unions and professional associations, and NGOs)

As part of the UGUP works Liverpool has worked with some utility providers and shared information and presentations to their staff on the UGUP proposals. The degree of interest varies across providers with those that have land holdings such as the water companies more interested in NBS than those whose main function may be to lay communication cables. City planners have been supportive and helped with land registry searches and planning permissions etc and are keen to replicate the approach into new city regeneration schemes. Green infrastructure companies are aware of the role and value of NBS but many of the tenders and contracts have been specific in nature and we have used existing UK experience and specialist knowledge to deliver some of the more innovative or new NBS. Green walls have been provided by ANS global Ltd and Biotecture Ltd. The floating ecosystem providers were Biomatrix Water Solutions Ltd. The water retention ponds were delivered by a local landscape and civils contractor Horticon Ltd. Trees have been provided by the preferred nurseries, mainly Barchams. Pollinators work has been carried out by both local architects (reshaped) and larger landscaping contractors (nmcn). Tree planting for the Tree SuDs was carried out by BCA Landscaping working for Amey Ltd and Grahams contractors and elsewhere tree planting and smaller works have been undertaken by local authority staff. The Friends of Parks Groups have also been active in some locations, helping with installations and promoting the work of the NBS as well as committing to longer term NBS maintenance.

- **academia/R&D** (academic organizations, institutional research organizations, students and trainees, and industrial research organizations);

The Liverpool project is in partnership with the University of Liverpool and also collaborates with the University of Manchester. A number of MSc and final year university students have undertaken research on the project, and their work has helped to shape the project or add value to what we are doing, including gauging the support of businesses, key stakeholders, and the public in implementing NBS more broadly in Liverpool, even beyond the project. The university has also contributed to our work in communication and public engagement, including through research on community engagement and governance. We have also had a MPhil student who has recently completed her thesis, which looked at the engagement aspects. The University also has held a number of workshops as part of their research and



outreach activities, including in collaboration with a local community non-profit, PlacED, to engage the public and gauge support for NBS. The universities are also supporting our efforts to monitor the social impacts, perceptions, and support for NBS in the city. The University also has a number of academic publications in progress and we have several more planned, where we will be co-authoring all together as a team to describe the benefits of NBS and how to implement them. Urban GreenUP has also been included in university curriculum, and the City Council and Mersey Forest have also been involved in giving lectures and disseminating information about the project, as well as acting as project partners for masters students group projects.

- **international bodies** (standardization bodies, EC, European institutions and agencies, and international, regional and multilateral organizations).

Most international links have been established through the UGUP project and partners.

Question 3

Please give detail about the regulatory framework, names and requirements of

- national laws, local laws that can affect NBS

Liverpool and the UK have a plethora of national and local laws that can be used to encourage and promote NBS. These are detailed in the UGUP Deliverable 3.1 Diagnosis: Detailed assessment and prioritisation of environmental challenges – see Appendix 1.

- local government initiatives for adopting NBS in your country and city

At present there are no local government initiatives to specifically adopt NBS, but some legislation does promote the consideration and adoption of NBS through SuDs.

Question 4

Please give details about the economic conditions of adopting NBS in your country and city, including

- cost of implementation and maintenance of NBS

Due to austerity, and more lately the costs the city has incurred for the pandemic response, there is no funding for NBS introduction. Where there is capital funding that can be used via grant and awards the issue of most concern is often the costs of longer term ongoing maintenance. In many instances this is partly resolved by:

- making a business case (e.g. the cost of the rain garden will over 5 years be less than the cost of the annual flooding)
- placing NBS onto private buildings/land with a legal agreement that the owner maintains,



- adding a dowry onto the costs to ensure there is some future maintenance budget available,
- engaging local volunteers and groups to help maintain spaces.
 - current economic instruments that are available to facilitate the adoption of NBS (e.g. special taxes, grants, etc.)

Currently there are no special taxes or grants to facilitate the adoption of NBS.

Question 5

Please give details about the social context of adopting NBS in your country and city, including

awareness of citizens and local communities about green solutions and NBS

1. Most citizens support green solutions but would not be aware of the multiple environmental, social and economic benefits that NBS can provide.
2. Before a consultation linked to the Pop-Up forest in Chavasse Park (2019), 75% of survey respondents did not know what the NBS concept was. However, after interacting with a primer – in this case, the Pop-Up forest itself – 57% of respondents stated that they now had ‘some knowledge’ of what the NBS concept communicates. This suggests that the term is capable of being effectively transmitted and understood by local people.
3. However, despite not being familiar with the term prior to the primer, respondents in multiple surveys illustrated knowledge that green and blue interventions can lead to beneficial socio-economic and environmental outcomes, or solutions. For example, from the Pop-Up Forest questionnaire, 88.9% of respondents stated that green space can improve well-being and mental health, and 83.3% stated that it can help to improve air quality. Thus, local communities are already intimately aware that greening can lead to solutions, but are just not cognisant of new policy terms such as NBS. This raises the question as to how important it is that local communities are fluent in emerging policy terms that re-mobilize pre-existing concepts such as green space or green infrastructure, especially when 68% of respondents stated that they were familiar with the concept of ‘green spaces’ already.

interest of citizens and local communities in green solutions and NBS

There is a growing interest and support for green solutions and NBS.



Surveys tapped into a local desire for council to increase urban-greening efforts, especially with regard to tree planting and the effects this has on factors such as community cohesion, mental wellbeing and air quality.

Evidence/examples:

Otterspool:

1. "More trees for carbon and improving air quality".
2. "We need green areas with healthy animal and plant life for wellbeing and environmental reasons"
3. "Preservation of open (green) spaces i.e. retaining them for public use and not building on them".
4. "We need to ensure the soils are not polluted and the Mersey gets cleaner each year".
5. "More 'greening' of back alleys - hanging baskets, bee friendly planters etc."

Sefton Park:

1. [Need] "An encouragement to be constantly aware of the importance of green spaces to all aspects of society"
2. "Maybe vegetable boxes on street so we can grow local!"
3. [Locals want Council to "Keep making sure they [green spaces] are well maintained and respected"

Pop-up Forest:

1. "All urban spaces would benefit from edible plants and fruit trees."
2. "Plant more trees create a calm space" / "More trees and other plants would be ideal" / "Flower tubs and large trees."

willingness of citizens and local communities to be engaged/sponsor green solutions and NBS

The UGUP demonstrator projects attracted interest and some support with aspects like planting of areas etc although this was then reduced by the pandemic and the need for social distancing. The opportunity for future sponsorship of NBS is still being explored for the floating ecosystem at Wapping Dock and some other NBS initiatives that are still under consideration e.g. there has been a request from a business to potentially sponsor delivery of a leaky dam in one of the parks.



There is a tangible sentiment in both southern zones that local people wish to be involved in localised green solutions. There is a call to 1) connect URBAN GreenUP schemes to the work and expertise of pre-existing groups, such as 'Friends of Sefton Park' and 2) utilize URBAN GreenUP to catalyse greater local stewardship of new interventions as well as improved pre-existing ones.

Examples/Evidence:

Sefton Park:

"Funding to community centres, initiatives spaces for learning and community gatherings e.g. after school activities focused on environmental education/challenges"

"Create greater links with friends group to maintain and improve use [of green spaces]"

"Perhaps more community involvement to keep it [green spaces] clean and to tend it."

Otterspool:

"with increased community activities [based around greening], people could take part to increase a sense of community"

"I think the community could be engaged more. More 'greening' of back alleys - hanging baskets, bee friendly planters etc."