LIST
Local Innovation Screening Tool

(Innovation Pathways – self assessment)

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Material refers to innovations in the specific type of physical NBS intervention (e.g.: green roofs, green corridors, urban farming), and its technical and place-based aspects (challenges, needs, status quo) (Source: PMGRID REPORT).

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MAT-A Interventions in buildings

Innovation in interventions related to building envelopes (roofs and façades).

MAT-A-1 Green / blue roofs

Improve spaces on top of buildings covered with vegetation planted in a growing substrate including the use of new systems that facilitate water management (storage and use), the promotion of biodiversity, or the generation of energy.

MAT-A-1-01 Count on the volume of storage capacity for water treatment

Storage of water is part of a runoff recycling system, after which it can be treated into ponds or storage layers on the roof. Green roofs can contribute to the overall urban rainwater runoff, having both a retention and detection function. The collected water could be used as potable water, for irrigation during the dry seasons, or for other uses.

EXAMPLE: Green Business Centre in Hyderabad (India) was constructed in 2003. LEED Platinum-certified building. Link to the project's complete description: https://www.greenroofs.com/projects/cii-sohrabji-godrej-green-business-centre-ciigbc/

MAT-A-1-02 Consider water retention

Drainage systems enable water to flow along a winding route from one chamber to another. During heavy rainfall, the chambers of the board are filled with water, and it passes from one chamber to the next diminishing and optimizing the discharge of excess water.

EXAMPLE: The refurbishment of Gomeznarro park in Madrid focused on stormwater retention. Link to the example: https://climate-adapt.eea.europa.eu/metadata/case-studies/the-refurbishment-of-gomeznarro-park-in-madrid-focused-on-storm-water-retention

MAT-A-1-03 Use of smart flow control through a weather app

A weather app activates a smart control to discharge the flow when rain is expected. The rainwater outlet can be open, so that stormwater volume is drained off, creating space in the retention box for the expected volume of new rainfall to be stored.

MAT-A-1-04 Use of smart drip irrigation systems in green roofs

Smart drip irrigation system is a precise technique based on determining the real-time irrigation needs of the green roof, that is activated when a threshold in the substrate water content is reached.

REMARK: Recent breakthroughs in open-source hardware components open the door to new ways of developing smart irrigation systems that can connect to transmission devices via the Internet, thus providing high space-time data coverage of substrate water and of other multiple sensors installed in the green roofs, measuring air temperature and humidity.

MAT-A-1-05 Qualify roof areas with wild bee and nesting aids

Recreation of natural habitats (for example, by mimicking the surrounding environment, using native plants) to support a variety of birds and other animals, including invertebrates (such as insects, worms, etc.) . Logs, sand, water bodies, and boulders provide habitats for various species of insects and birds providing food sources for local wildlife.

EXAMPLE: Berry Architecture/DRHF office building. The building's crowning glory is the green roof which features a stream, native plantings, vegetable gardens, and bird, butterfly, and bee habitats, designed to be a living ecosystem. Link to the project's complete description: https://www.greenroofs.com/projects/berry-architecture-office-building-green-roof/

MAT-A-1-06 Combine solar panels and green-blue roofs

Combination of biodiverse and extensive green/blue roofs with photovoltaic systems, in a synergy of technologies (e.g. bio-solar roofs) that could provide power to smart systems.

EXAMPLE: Bellême Hospital. Located in Normandy, France, the design intent of the extension of the Bellême Hospital was to provide a sustainable building, LEED certified (HQE). According to various research, the implementation of a green roof underneath solar panels can increase the productivity of electricity by up to 15% as the green roof is limiting temperature fluctuation on the roof as well as decreases the temperature in the summer. Combining a green roof with solar panels is becoming a more and more common approach to increase the benefits of the vegetated roof.

MAT-A-2 Green facades and living walls

Use facades, walls, and vertical structures to improve bioclimatic conditions and introduce biodiversity including the promotion of new irrigation systems.

MAT-A-2-01 Build a green wall trellis

Trellis solution for green wall usually separated from the building wall.

REFERENCE: Maria Manso. João P. Castro-Gomes (2015). Green wall systems: A review of their characteristics. Renewable and Sustainable Energy Reviews 41:863–871. DOI:10.1016/j.rser.2014.07.203. Link https://www.researchgate.net/publication/266078897_Green_wall_systems_A_review_of_their_characteristics

MAT-A-2-02 Grow edible plants in façades and walls

Vertical structures (for example trellis construction that aims for easy access to the building facade) that have vegetables, fruits, and herbs attached to them instead of plants in a different way of growing fresh produce. The structures can be installed either indoors or outdoors.

EXAMPLE: Atlanta Botanical Garden Edible Garden Green Wall. The Atlanta Botanical Garden opened its Edible Garden Green Wall and Outdoor Kitchen on May 1, 2010, showcasing the farm-to-table concept of cultivating and consuming fresh local and sustainably grown food. Link to the project's complete description: https://www.greenroofs.com/projects/atlanta-botanical-garden-edible-garden-green-wall/

MAT-A-2-03 Use of smart drip irrigation systems in green facades and living walls

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MAT-B Public spaces and community areas

Innovation in the design and conception of green areas including the promotion of biodiversity and/or the proactive participation of the community.

MAT-B-1 Vegetated areas

Use new criteria (multicriteria, accessibility, comfort, shades, etc.), tools (digital base of natives plants), and systems (new root connection system) to improve the design of vegetated areas by introducing new garden concepts (sensory garden, nature experience area, etc.).

MAT-B-1-01 Perform a multicriteria evaluation for plant choices, aiming at experimenting with plant mixes

Use decision-makers' preferences (shadow, colour, etc.) in multicriteria evaluation to choose different plants in public space areas.

EXAMPLE: Multi-criteria decision making for plant location selection: an integrated Delphi-AHP-PROMETHEE Methodology. Sana Mousavi, Reza Tavakkoli-Moghaddam, Mojtaba Heydar, Sadoullah Ebrahimnejad. Link to the reference: https://www.researchgate.net/publication/257803253_Multi-criteria_decision_making_for_plant_location_selection_an_integrated_Delphi-AHP-PROMETHEE_Methodology

MAT-B-1-02 Generate a digital database of native plants and related local providers

Create a digital database that includes the native plant species of each place so that their use is prioritized in NBS projects and a list of the local suppliers that have or work with each of the species, to promote local trade.

EXAMPLE: Native Plants Finder. Link to the project: https://www.nwf.org/nativeplantfinder/

RELATED TO: MET-B-3-06 Prioritize the use of native plants

MET-B-2-04 Prioritize local supply chains and suppliers

MAT-B-1-03 Create sensory gardens

Design comfortable and accessible gardens, considering the correlation between pedestrian mobility and patterns of use of space and the creation of shelters from sun, rain, and wind (for example, generated/delivered shadows).

REFERENCE: How to design a sensory garden - Sensory Trust. Link to reference: https://www.sensorytrust.org.uk/resources/guidance/sensory-gardens-design-guide

MAT-B-1-04 Develop a new root connection system for the trees

Promote the use of products that help to build a specific underground structure for the root of the trees, compatible with other underground networks (water, electricity, digital services).

MAT-B-1-05 Build a nature experience area

Build large natural and "wild" free spaces for children and adolescents, in which they can play independently and unattended. The nature experience possibilities in these spaces include all forms of play, physical activity, and tranquillity that rely neither on infrastructure nor on playground equipment (Source: HNEE).

EXAMPLE: Pearlmutter, David et alt. (2019). Enhancing the circular economy with nature-based solutions in the built urban environment: green building materials, systems, and sites. Blue-Green Systems. 2. 10.2166/bgs.2019.928. Link: https://www.researchgate.net/publication/337737446_Enhancing_the_circular_economy_with_nature-based_solutions_in_the_built_urban_environment_green_building_materials_systems_and_sites

MAT-B-2 Community garden (Public or private)

Promote the generation of different elements (vertical walls for cultivation, orchards, urban fruit areas, aquaponics, etc.) to enhance biodiversity, encourage active participation in the community and increase the sense of ownership.

MAT-B-2-01 Provide appropriated vertical walls for farming

Provide vertical walls for farming that are based on "*growing crops in controlled indoor environments, with precise light, nutrients, and temperatures"* (Brikby, 2016).

REFERENCE: Birkby (2016) Vertical Farming. ATTA Sustainable Agriculture. NCAT Link https://attra.ncat.org/product/vertical-farming/

EXAMPLE: Vertical farming is a summary of approaches to growing skywards. Link to ttps://www.researchgate.net/publication/331130061_Vertical_farming_a_summary_of_approaches_to_growing_skywards

MAT-B-2-02 Promote the development of kitchen gardens

Promote kitchen gardens that are areas where vegetables, fruit, or herbs are grown for domestic use in public spaces.

MAT-B-2-03 Create urban fruit tree areas to generate mini urban ecosystems

Creating urban fruit tree areas is a good way of growing in urban walls (vertical urban fruit trees) or soils to generate mini urban ecosystem.

REFERENCE: Grow Veg: 3 Ways to Train Fruit Trees (Link: https://www.growveg.co.uk/guides/3-ways-to-train-fruit-trees/)

EXAMPLES: Urban food forestry. Fruit Tree Initiatives. Link: http://urbanfoodforestry.org/initiatives/

MAT-B-2-04 Promote the installation of aquaponics, preferably using rainwater

Promote the installation of aquaponics which is a portmanteau that is a combination of aquaculture (a place for farming fish crustaceans, molluscs, and other aquatic organisms) and hydroponics (a place-growing plants in a soil-less environment). Rainwater is the best choice of water to use in it.

REFERENCE: Small-scale aquaponic food production Integrated fish and plant farming. Link: http://www.fao.org/3/i4021e/i4021e.pdf

MAT-B-2-05 Promote self-constructed high beds for gardening (under expert supervision)

Promote (by workshops, hackathons, etc.) people's self-construction of high beds for public spaces gardening. It is a "leaning-by-doing" approach for students and locals acting as co-carers.

EXAMPLE: Boulevard gardening guidelines. The city of Vancouver. Link: https://vancouver.ca/home-property-development/gardening-guidelines.aspx
Prinzessinengärten.DIY Integrated Approach: learning from Prinzessinengärten. https://urbact.eu/diy-integrated-approach-learning-prinzessineng%C3%A4rten

MAT-B-2-06 Instruct private owners and communities on how to enhance biodiversity in their pocket gardens

Offer expert support and training to private owners and communities on how to enhance biodiversity in their pocket gardens (use of native plants to recreate natural habitats, installation of elements that can provide foraging and nesting for birds and insects, etc.). Evidence-based support to motivate private owners on the benefits of such actions.

EXAMPLE: Hanging Gardens Oberlaa: "Pupils of the elementary school Oberlaa plant a 5sqm, free-standing wall construction with herbs. The children themselves sow herbs and they were involved in the implementation right from the start. They learn how to grow, nurture and harvest plants as well as how seasons and weather conditions affect the vegetation. In addition to a lot of fun, an exciting change in everyday school life, and a lesson in organic farming, it is a nice experience for children to be able to literally reap the rewards of their own work". Link to the project: http://implementation-models.nature4cities-platform.eu/NBS.php?sid=42

MAT-C Water bodies and urban drainage systems for water resilience

Innovation in methods and systems to improve rainwater and water bodies management and their quality.

MAT-C-1 Urban drainage systems (methods improving rainwater retention and infiltration)

Develop innovative urban drainage systems (considering retention and infiltration methods and systems).

MAT-C-1-01 Promote the integration of infiltration solutions

Promote solutions such as infiltration basins, which are facilities designed to capture and retain runoff and allow it to infiltrate rather than discharge directly to surface water. Infiltration basins may be integrated into private gardens, in basic street design, etc.

REFERENCE: Wsdot (Washington State Department of Transportation Technical Monitor) (2003). Implementation of Infiltration Ponds Research. A design manual for sizing infiltration ponds. Final Research Report. Research Project Agreement No. Y8265. Link to the reference: https://www.wsdot.wa.gov/research/reports/fullreports/578.2.pdf

MAT-C-1-02 Consider a rainwater retention system

Take into consideration solutions such as the transformation of the bike lanes into high-volume rainwater retention systems by incorporating water storage channels under or next to cycle tracks.

EXAMPLE: The Copenhagener Current (proposal). "It involves digging trenches under existing cycle tracks, implementing precast, concrete containers and covering them with pre-fab, concrete slabs". Link to the proposal: http://www.copenhagenize.com/2015/03/the-copenhagenize-current-stormwater.html

MAT-C-1-03 Combine multifunctional rain gardens

Combine different functions such as an area that combines a playscape and a rain garden, where kids have fun while the landscape's design helps control stormwater runoff.

EXAMPLE: The Promenade at the Metropolitan (Columbia). "A 40,000-square-foot park open space serving a mixed-use multifamily building: a hybrid playscape and rain garden intended to be a didactic showcase for stormwater retention and native plantings. The Promenade encourages kids to have some rambunctious fun while learning a thing or two about how these landscapes can shepherd rainwater from the sky to the ground".Link to the project: PLAYING IN THE RAIN (GARDEN) | Landscape Architecture Magazine: https://landscapearchitecturemagazine.org/2019/07/25/

MAT-C-2 Water bodies

Integrate innovative systems in small areas of water in city gardens, lakes, and wetlands (big areas of water in the rural and peri-urban areas).

MAT-C-2-01 Integrate helophyte filters into the multifunctional gardens

Integrate helophyte filters, that is sand filter that is generally planted with reeds, into the multifunctional gardens. The actual treatment of the water is done by bacteria living in the roots. The reeds serve principally to aerate the roots and to capture nitrates and phosphorous. (Ref: https://www.urbangreenbluegrids.com/measures/vertical-helophyte-filters/).

EXAMPLE: Helophyte filter on Erasmusgracht, Amsterdam. "Rainwater is discharged into a separate sedimentation reservoir in the canal, after which it passes through the helophyte filter. It is subsequently discharged into the canal.". Link to the project: https://www.urbangreenbluegrids.com/projects/helophyte-filter-on-erasmusgracht-amsterdam/

MAT-C-2-02 Promote multifunctional water reuse (irrigation, heating…)

Reuse of treated wastewater which is placed into a water body source such as a lake (natural or artificial) and then some of it retrieved for later uses: as agriculture and irrigation, potable water supply, groundwater replenishment, industrial processes, and environmental restoration.

REFERENCE: Guidelines on water reuse. Link to the reference:
https://ec.europa.eu/environment/water/pdf/Guidelines_on_water_reuse.pdf

MAT-C-2-03 Instal flooding beds for water retention

It refers to the renaturation of the riverbed and riverbanks using natural solutions to increase the roughness of the terrain and therefore reduce flooding in the surrounding low-lying areas. The main solutions include the restoration of the banks with riparian vegetation or the elimination of transversal infrastructures that hinder the natural flow of water.

METHODS

Methods refer to the knowledge and evidence generation supporting co-design and informing decision making. This tier considers the innovation in the spatial analysis informing decision-making, such as modelling, tailored cartography, ecosystems analysis, natural capital accounting, etc.

ATTENTION: Stakeholder engagement, financing strategies, and spatial management are addressed under the MANAGEMENT tier; and co-monitoring, is under the MONITORING tier.

A	Spatial analysis for urban planning	**1**	Definition and identification of urban challenges	**01**	Obtain spatial information on urban challenges and potential risks in terms of climate change
		2	Baseline and diagnosis	**01**	Undertake spatially vulnerability and risk assessment to detect climate change vulnerable areas at risk
				02	Identify potential adaptation options to cope with the urban challenges and threats, with an ecosystem-based approach.
		3	Supporting tools and mechanisms for improving planning and NBS integration	**01**	Use citizens science (via digital applications) and Citizen Observatory's Data to improve NBS integration
				02	Digital Urban Planning concepts (e- planning and digital planning tools)
				03	Use Adaptive planning based on objective and subjective data (including Citizen Observatory's Data)
B	Co-design urban regeneration (meso and micro-scale)	**1**	Supporting mechanisms to enable the co-design process	**01**	Use novel tools to support mainstream co-creation (Living labs)
				02	Use Digital tools for urban design
				03	Introduce Co-Design-formats on the spot
		2	Socioecological Urban design	**01**	Actively include vulnerable groups in urban Planning decision making and NBS design
				02	Integrate the different local social and citizen stakeholders' groups (e.g. citizens or social associations)
				03	Multidimensional and multilevel (Horizontal & vertical) integration of the different groups of local stakeholders taking into consideration (public or private) their sector (finance, mobility, building, etc.)
				04	Prioritize local supply chains and suppliers
		3	Technical design	**01**	Apply the Universal Design concept (Design for all)
				02	Design with bioclimatic criteria (Bioclimatic Urban Design) using NBS adapted to local micro-climatic
				03	Design adapting to climate change
				04	Prioritize de use of local and/or recycled nature-based materials
				05	Prioritize de use of renewable and local energy
				06	Prioritize the use of native plants
				07	Consider plant guilds
				08	Design including maintenance
				09	Apply modelling techniques, including environmental conditions
				10	Deploy NBS that supports air quality
				11	Design considering the joint integration of Grey, Green, and Blue in Cities

A MET-A Spatial analysis for urban planning

Innovation in spatial analysis to inform decision making (urban scale, macro-scale) considering diagnosis (baseline) and supporting tools.

MET-A-1 Definition and identification of urban challenges

Define and identify urban challenges and potential risks.

MET-A-1-01 Obtain spatial information on urban challenges and potential risks in terms of climate change

Spatial information and spatial analysis of urban challenges, climate threats and hazards, potential vulnerability, and risks. This would imply hazards and risk maps, and urban indicators on social, environmental, and economic dimensions. Better informed decision making and planning, anticipating future risks, and preventing impacts towards better adapted and resilient cities.

REFERENCE: IVAVIA Impact and Vulnerability Analysis of Vital Infrastructures and built-up Areas RESIN-CITIES Project: "The document offers a practical guideline for conducting a risk-based process for assessing impacts and vulnerabilities of urban areas and their infrastructure related to consequences of climate change (CC)". Link to the project: https://resin-cities.eu/fileadmin/user_upload/Resources/Design_IVAVIA/IVAVIA_Guideline_v3_final__web.compressed.pdf

MET-A-2 Baseline and diagnosis

Analyse and evaluate the current situation to identify areas vulnerable to climate change that can integrate NBS as adaptation measures.

MET-A-2-01 Undertake spatially vulnerability and risk assessment to detect climate change vulnerable areas at risk

Assess vulnerability and risk on the territory to detect areas vulnerable to climate change at risk, so that adaptation can be planned at the local level.

REFERENCE: Grow Green: Climate change, vulnerability, and risk in urban areas. Link to the reference: http://growgreenproject.eu/climate-change-vulnerability-and-risk-in-urban-areas/

MET-A-2-02 Identify potential adaptation options to cope with the urban challenges and threats, based on an ecosystem-based approach

"Spatial analysis for the identification of current and potential urban green assets, to cope with different urban challenges under climate change. This implies an analysis of accessibility, connectivity, and multifunctionality of urban green, and the use of different methods such as Natural Capital Accounting, Ecosystem Services Evaluation, and valorisation of urban green.

Acknowledging the existing adaptation assets, green areas, green infrastructure, and their values. Different methods are available (i.e. natural capital accounting, ecosystem services assessment, economic valorisation of green areas, the functionality of green spaces, etc).

REFERENCES: Natural Capital Accounting. Link to the project:
https://ec.europa.eu/environment/nature/capital_accounting/index_en.htm
Mapping and Assessment of Ecosystem and Their Services MAES. Link to the project:
https://ec.europa.eu/environment/nature/knowledge/ecosystem_assessment/index_en.htm
Integrated valuation of ecosystem services and trade-offs INVEST. Link to the project:
https://naturalcapitalproject.stanford.edu/invest/#invest-models
i-tree. Link to the project: www.itreetools.org

MET-A-3 Supporting tools and mechanisms for improving planning and NBS integration

Use supporting tools and mechanisms for improving planning and NBS integration.

MET-A-3-01 Use citizens science (via digital applications) and Citizen Observatory's Data to improving NBS integration

Using digital applications for example for finding and prioritizing urban spaces for the deployment of nature-based interventions (people feed in data for spatial analysis). Suitability of NBS based on people´s needs and expectations to guarantee acceptance.

RELATED TO:
MAN-A-1-09 Promote planning based on crowdsourced data
MON-B-1-05 Create a Citizen observatory: objective and subjective data

EXAMPLE: Cos4Cloud, a European Horizon 2020 project to boost citizen science technologies. Link:
https://cos4cloud-eosc.eu/

MET-A-3-02 Digital Urban Planning concepts (e-planning and digital planning tools)

Application of Urban e-Planning concepts: the use of IT-based systems such as geographical information system (GIS), database management system (DBMS), and planning support system (PSS) for managing urban planning and development processes (within the framework of a post-positivist planning theory). Improvement of Integrated Management System.

RELATED TO:
MET-B-1-02 Use Digital tools for urban design
MET-A-3-03 Use Adaptive planning based on objective and subjective data (including Citizen Observatory's Data)

MET-A-3-03 Use Adaptive planning based on objective and subjective data (including Citizen Observatory's Data)

Plan adapted to the different urban regeneration needs detected by continuous diagnostic monitoring (quantitative and qualitative analysis and assessments, monitoring objective and subjective data during the execution).

RELATED TO: MET-A-3-02 Digital Urban Planning concepts (e-planning and digital planning tools)
MON-B-1-05 Create a Citizen observatory: objective and subjective data

REFERENCE: Jack Ahern, Sarel Cilliers, Jari Niemelä (2014) The concept of ecosystem services in adaptive urban planning and design: A framework for supporting innovation, Landscape and Urban Planning, Volume 125, 2014, Pages 254-259,
ISSN 0169-2046,https://doi.org/10.1016/j.landurbplan.2014.01.020. Link to the reference: https://www.sciencedirect.com/science/article/pii/S0169204614000346

MET-B Co-design urban regeneration (meso and micro-scale)

Innovation in mechanisms, criteria, and approaches to improve the co-design of urban regeneration.

MET-B-1 Supporting mechanisms to enable the co-design process

Use supporting mechanisms to enable the co-design process (living labs, digital tools, etc.).

MET-B-1-01 Use novel tools to support mainstream co-creation (Living labs)

Application of novel tools (e.g. IT citizens' platform, serious – or app-lied gaming, etc.) to support mainstream co-creation / living lab approach using the quadruple helix model for innovation, that considers civil society and the media as components of the innovation process.

RELATED TO:
MAN-C-3-01 Facilitate the application of co-creation

REFERENCE: UNaLAB. Urban Nature Labs (2020) Living lab handbook for urban living labs developing nature-based solutions. Link to the reference: https://unalab.eu/system/files/2020-07/living-lab-handbook2020-07-09.pdf

MET-B-1-02 Use Digital tools for urban design

Use of digital tools, such as IT-based systems such as database management systems (DBMS), to make participation and design processes easier.

RELATED TO: MET-A-3-02 Digital Urban Planning concepts (e-planning and digital planning tools)

MET-B-1-03 Introduce Co-Design-formats on the spot

Introduce Co-Design-formats on spot at the location of intervention (outreach participation).

EXAMPLE: Joana Dabaj, Andrea Rigon, and Hanna Baumann, 2020, Participatory Spatial Intervention: How can participatory design and a diversity lens help address vulnerabilities in Bar Elias, Lebanon? Beirut: CatalyticAction & University College London. Link to the example: https://progireg.eu/fileadmin/user_upload/Deliverables/D2.10_Guidelines_for_co-designing_proGIreg_ICLEI_200804.pdf

MET-B-2 Socioecological Urban design

Design with an urban socio-ecological approach (integrating different groups of social actors and local citizens -as vulnerable groups- in a multidimensional and multilevel way).

MET-B-2-01 Integrate vulnerable groups in urban planning decision-making and NBS design

Real and effective integration of groups at risk of discrimination or exclusion in Spatial Planning procedures and participative NBS design: for example, people of colour, women, young and elderly, people with sensory and motor functional diversity, and people with low socioeconomic status (for example, using the Clever Inclusivity Index).

More inclusive decision-making process. Real or more active integration of these groups (not only consulted).

EXAMPLE: A case from Budapest: Teleki tér. Link: https://urbact.eu/participation-or-inclusion

MET-B-2-02 Integrate the different local social and citizen stakeholders' groups

Real and effective integration of the different stakeholders in urban planning procedures and participative NBS design: local associations especially related to the environment, neighbourhood, and culture (e.g. Citizens or social associations).

Improvement of the bottom-up approach in the decision-making process. Real or more active participation of these representative groups (not only consulted).

RELATED TO: MAN-E-2-04 Participation of local groups of stakeholders at all project stages

REFERENCE: Arlati, Alessandro & Rödl, Anne & Konjaria-Christian, Sopho & Knieling, Jörg. (2021). Stakeholder Participation in the Planning and Design of Nature-Based Solutions. Insights from CLEVER Cities Project in Hamburg. Sustainability. 13. 10.3390/su13052572. Link to the reference: https://www.researchgate.net/publication/349771954_Stakeholder_Participation_in_the_Planning_and_Design_of_Nature-Based_Solutions_Insights_from_CLEVER_Cities_Project_in_Hamburg

MET-B-2-03 Multidimensional and multilevel (horizontal & vertical) integration of the different groups of local stakeholders considering their nature (public or private) and their field of work (finance, mobility, building, etc.)

Real and effective integration of the different stakeholders in NBS design: public administration, professionals related to urban planning and design, participation and/or social sciences, academia, companies, etc.

Improvement of the multidimensional and multilevel integration of the different groups of local stakeholders.

RELATED TO: MAN-E-2-04 Participation of local groups of stakeholders at all project stages

MAN-E-3-02 Improve vertical and horizontal coordination
MAN-C-2-02 Promote Horizontal governance
MAN-C-2-03 Promote Vertical governance

REFERENCE: European Commission (2020) Handbook of Sustainable Urban Development Strategies. Link to the reference: https://urban.jrc.ec.europa.eu/urbanstrategies/cross-sectoral-integration#the-chapter

MET-B-2-04 Prioritize local supply chains and suppliers

Prioritise local supply chains and local suppliers, boosting local development, saving energy, and reducing greenhouse gas emissions.

RELATED TO:
MET-B-3-06 Prioritize the use of native plants
MAT-B-1-02 Generate a digital database of native plants and related local providers

MET-B-3 Technical design

Design NBS including and prioritizing environmental criteria and considering bioclimatic criteria and universal design.

MET-B-3-01 Apply the Universal Design concept (Design for all Application the concept of Universal)

Design through the principles of Equitable Use, Simple and Intuitive Use, Flexibility in Use, Perceptible Information, Tolerance for Error, Low Physical Effort, and Size and Space for Approach and Use (The Centre for Universal Design, 1997). Raise the standard of its environments and services by making them more and more suited to the diversity of its citizens.

EXAMPLE: Acquire the "Flag of Towns and Cities for All". Better level of implementation of Design for All in the city. Design for all foundations. Link to the foundation http://designforall.org/index.php

MET-B-3-02 Design with bioclimatic criteria (Bioclimatic Urban Design) using NBS adapted to local micro-climatic

Design of NBS considering the real micro-climatic, taking into account the relation between the natural environment (hydrography, geomorphology, topography, wind, climate, and vegetation) and the built environment (orientation of the structure and urban fabric, adaptation or not to the topography, geometric conditions of the built environment, size, shape, location, orientation, building density, maximum occupancy of plots and patios, buildable area, formal building conditions, construction characteristics and conditions of use). For example, differentiating the vegetation at the bottom and upper parts of a green facade to consider wind and sun exposure differences.

REFERENCE: Design with Climate: Bioclimatic Approach to Architectural Regionalism. Link to the document: https://www.researchgate.net/publication/285610217_Design_with_climate_Bioclimatic_approach_to_architectural_regionalism_New_and_expanded_edition

MET-B-3-03 Design adapting to climate change

Consider adaptation to climate change in the design and choice of NBS.

REFERENCE: IHOBE (2016) Klimatek Project 2016 'Soluciones Naturales' para la adaptación al cambio climático en el ámbito local de la Comunidad Autónoma del País Vasco. Link: https://www.euskadi.eus/documentacion/2017/klimatek-soluciones-naturales-para-la-adaptacion-al-cambio-climatico-en-el-ambito-local-de-la-comunidad-autonoma-del-pais-vasco/web01-a2ingkli/es/

MET-B-3-04 Prioritize the use of local and/or recycled nature-based materials

Design prioritizing 100% local materials. Support sustainable production by building a nature experience area using recycled nature-based materials.

MET-B-3-05 Prioritize the use of renewable and local energy

Design that prioritizes the use of 100% renewable energy and is produced locally.

MET-B-3-06 Prioritize the use of native plants

Design prioritizing 100% autochthonous vegetation.

RELATED TO: MAT-B-1-02 Generate a digital database of native plants and related local providers
MET-B-2-04 Prioritize local supply chains and suppliers

MET-B-3-07 Consider plant guilds

Design that considers the application of plant guilds. A plant guild is "a beneficial grouping of plants that support one another in all their many functions" (Halsey, Ruddock, Weiseman 2014).

REFERENCE: Halsey, Daniel; Ruddock, Bryce; Weiseman, Wayne (2014) Integrated Forest Gardening. The Complete Guide to Polycultures and Plant Guilds in Permaculture Systems

MET-B-3-08 Design including maintenance

Design viable solutions from the point of view of maintenance and ongoing maintenance costs.

RELATED TO: MAT-B-1-02 Generate a digital database of native plants and related local providers

MET-B-3-09 Use modelling techniques, including environmental conditions

Use modelling techniques, including environmental conditions for benchmarking design alternatives. Use of visual simulation applications and/or dashboards for rendering.

MET-B-3-10 NBS that prioritize air quality

Green roofs and walls prioritizing the improvement of the (outside) air quality.

MET-B-3-11 Design considering the joint integration of the Grey, Green, and Blue in Cities

"Comparative analysis of green/blue versus grey infrastructures in urban areas that includes a documented analysis of interdependence between technological solutions (advancement of

existing products used in applied ecology and bioengineering) and social benefits (job creation via e.g. urban farming, entrepreneurial opportunities linked to food ecosystems, social inclusion of vulnerable groups, improvement of public health)".

A better understanding of urban functions and services being delivered by grey and by green/blue solutions and their benefits towards better integration.

REFERENCE: Integrating the Grey, Green, and Blue in Cities: Nature-Based Solutions for Climate Change Adaptation and Risk Reduction. Link to the document: https://www.researchgate.net/publication/317236775_Integrating_the_Grey_Green_and_Blue_in_Cities_Nature-Based_Solutions_for_Climate_Change_Adaptation_and_Risk_Reduction/link/59a954200f7e9b279011ef11/download Exploring trade-offs among the multiple benefits of green-blue-grey infrastructure for urban flood mitigation. Link: https://www.sciencedirect.com/science/article/pii/S0048969719349721"

MANAGEMENT

Management refers to the overall governance of NBS. Primarily this includes how NBS are integrated and consolidated in existing governance, legislative, business, and financing frameworks. It also considers formalized or non-formalized roles and responsibilities in place for NBS; procedures and protocols that regulate design; the implementation and monitoring of NBS; and the management and maintenance arrangements in the long run, such as city plans and strategies. Policy and governance innovation are included within this tier.

A	Public policies, regulations, and planning instruments	**1**	Policy framework	**01**	Integrate NBS into a global eco systemic planification at a city scale
				02	Incorporate NBS in land-use classification
				03	Promote and implement urban ordinances for NBS design and management
				04	Put in place regulations that set mandatory ecological standards for urban planning
				05	Have regulation in place that acknowledges the natural capital value of green spaces
				06	Design innovative urban redistribution instruments for NBS development
				07	Put in place regulation that stimulates business to implement NBS to reduce charges
				08	Develop and implement a gentrification mitigation mechanism
				09	Promote planning based on Citizen Observatory
		2	NBS and planning interaction	**01**	Mainstream NBS in urban planning and alignment with other public policies
				02	Deploy digital devices for planning connecting NBS with smart city
				03	Beware of small-scale infrastructure projects
				04	Integrate into planning the social benefits of ecosystem and biodiversity values
				05	Consider the NBS as a tool for social integration
				06	Generate scientific findings in social, digital, and environmental science
B	Delivery of NBS	**1**	Maintenance	**01**	Develop an innovative maintenance
		2	Procurement	**01**	Promote outcome-based procurement
				02	Integrate technical support for NBSs in the procurement procedure
				03	Use procurement models that include maintenance
				04	Reduce bureaucracy in procurement procedures.
				05	Introduce as a procurement criterium consider the carbon footprint and life cycle and circular economy concepts (Circularity and carbon footprint)
		3	Resources	**01**	Develop digital management and Maintenance guidelines
C	Governance	**1**	Policy-making	**01**	Drive policy considering outcomes (Outcomes driven policy)
				02	Implement evidence-based policy
				03	Join up in urban planning and environmental policy
				04	Make use of an Integrated Management System (IMS)
		2	Institutional Governance	**01**	Develop a transparent governance
				02	Promote Horizontal governance
				03	Promote Vertical governance
				04	Open government data

		3	Collaborative governance	**01**	Facilitate the application of co-creation
D	Business models and financing	**1**	Resource mobilizing and co-financing	**01**	Co-finance NBS projects through public-private-partnerships
				02	Use Revenue-generating instruments
				03	Use Green Debt
				04	Use Grant funding and donations
				05	Promote investment standards
				06	Finance NBS projects through Environmental or Social impact bonds
				07	Consider market-based financing instruments
		2	Value generation	**01**	Use a natural capital account
				02	Base finance in outcomes (Outcomes-based finance)
				03	Identify monetary value from monitoring data
				04	Identify commercial value derived from "private" business models of public green space
				05	Boost employment
		3	Innovative partnership to deliver NBS	**01**	Set up an ecosystem, stakeholders' community (Shared platform)
				02	Drive local initiatives forward, NGOs are included in the delivery of NBS
				03	Find allies that support the delivery phase of NBS: Close interaction between NBS firms and city representatives
				04	Use Instruments for NBS start-ups
				05	Promote crowdsourcing for implementing and monitoring the project
				06	Use green barters
		4	Socioeconomic impact valorisation & monitoring	**01**	Assess socio-economic impact
				02	Evaluate the economic and financial performance of NBS
				03	Conduct cost-benefit analysis and monetisation of NBS considering the entire process
E	Stakeholder engagement	**1**	Capacity building	**01**	Promote individual capacity building during the project
				02	Promote community capacity building
		2	During project development and implementation	**01**	Define and implement a long-term vision
				02	Define and implement a co-maintenance plan
				03	Contract maintenance responsibilities to professional stakeholders
				04	Foster the participation of local groups of stakeholders at all project stages
				05	Develop a strategy to intensification participation
				06	Use of incentives for motivation and engagement activities
				07	Establish a network of projects with shared goals
				08	Use ICT to improve citizen engagement during project
				09	Involve citizens in the project development
		3	Post-project	**01**	Work for the continuity of the created network
				02	Improve vertical and horizontal relations
		4	Awareness-raising on the value of NBS	**01**	Integrate learning and training on NBS at different educational levels and involve schools /universities in the design of an awareness campaign on NBS
				02	Involve senior centres participants in the design of an awareness campaign on NBS
				03	Implement events and campaigns for awareness-raising (such as competitions or gamification campaigns)
				04	Visualize NBS projects' actions and results on digital platforms to raise awareness
				05	Promote participation of off-topic groups (e.g. business networks) in on-topic forums

MAN-A Public policies, regulations, and planning instruments

Innovation in the set of principles that frame the development of public policies and regulatory instruments or tools, including the use of indicators and new criteria in urban plans; improvements in the implementation of territorial adaptation strategies, promotion of sustainability; improved coordination at the regional level, etc. For instance: Building Regulations, Public Procurement, Urban Planning Regulations, Certification Schemes, Strategies, and Action Plans and the potential interactions between them.

MAN-A-1 Policy framework

Develop an integrated framework and coherent narrative of the main planning instruments and regulations to promote and coordinate the implementation of NBS.

MAN-A-1-01 Integrate NBS into a citywide strategy and plan

Integrating NBS into the economic and development principles that underpin the city's economic strategy and development plan, to protect and enhance existing natural areas and to expand and reinforce an urban ecological network.

MAN-A-1-02 Incorporate NBS in land-use classification

Classify land by NBS function, and/or potential NBS function, as well as of typology. To include land suitable for climate adaptation techniques (such as flood storage or sustainable drainage, for example) as well as new typologies such as green roofs. NBS classification to be applied in masterplans.

REMARK: For example, including new types of green land-uses of including green roofs in building codes in cities

MAN-A-1-03 Promote and implement urban ordinances for NBS design and management

Planning policies and building regulations are in place, that are explicitly directed toward NBS integration.

EXAMPLE: Policy measures for green roofs, Basel. Reference Unalab Project (link to reference: https://unalab.eu/en/node/156)

REFERENCE: Higueras, Ester (2013) Las ordenanzas ambientales como instrumento para la eficiencia energética de los barrios residenciales

MAN-A-1-04 Put in place regulation that sets mandatory ecological standards for urban planning

Regulation that set mandatory ecological standards for urban planning, such as the biotope area factor green standards improvement, including green infrastructure as a structural element.

EXAMPLE: The biotope area factor, for example, Berlin Biotope Area Factor. More information on the Implementation of guidelines helping to control temperature and runoff. Link to example: https://climate-adapt.eea.europa.eu/metadata/case-studies/berlin-biotope-area-factor-2013-implementation-of-guidelines-helping-to-control-temperature-and-runoff

MAN-A-1-05 Have protocols in place that recognise natural capital values

Ensure that the economic value of NBS is understood and factored into decisions about design and management.

EXAMPLE: Stormwater fee or charge.

REFERENCE: Silvennoinen, Sveta & Taka, Maija & Yli-Pelkonen, Vesa & Koivusalo, Harri & Ollikainen, Markku & Setälä, Heikki. (2017). Monetary value of urban green space as an ecosystem service provider: A case study of urban runoff management in Finland. Ecosystem Services. 28. 17-27. 10.1016/j.ecoser.2017.09.013. Link: https://www.researchgate.net/publication/320264327_Monetary_value_of_urban_green_space_as_an_ecosystem_service_provider_A_case_study_of_urban_runoff_management_in_Finland

MAN-A-1-06 Design innovative urban redistribution instruments for NBS development

Design innovative urban planning instruments so that, based on the rainfall generated by new developments, it is possible to obtain public land or facilities for the development of NBS.

MAN-A-1-07 Put in place regulation or plans that stimulate business to implement NBS

Regulation or plans that stimulate business to implement NBS, indirectly through regulation such as planning policy, building regulations, or urban taxation, or directly by stimulating apprenticeship schemes or other training or R&D programmes.

RELATED TO:
MAN-D-3-04 Use Instruments for NBS start-ups

MAN-A-1-08 Develop and implement a green gentrification mitigation mechanism

Development of equity-driven policy that considers access to nature as a fundamental human right for urban residents, attuning the attention on relevant incentives or support. Mitigation of the negative green gentrification consequences (rise in housing prices, expulsion of the native population) by introducing mechanism as real estate market control, high public participation, etc.

REFERENCE: Contested Cities project. Link to the project: http://contested-cities.net/ ; https://www.mdpi.com/2071-1050/12/23/10020/htm
BCNUEJ Barcelona Lab for Urban Environmental Justice and Sustainability. Critical Sustainability Studies.Green Gentrification. Link: http://www.bcnuej.org/green-gentrification/

MAN-A-1-09 Promote planning based on crowdsourced data

Promote the consideration of crowdsourced data to inform the planning process (e.g., citizens observatories, citizens science, big data, etc...).

REFERENCE: We Observe. Link to the project: https://www.weobserve.eu/about/citizen-observatories/

RELATED TO: MET-A-3-01 Use citizens science (via digital applications) and Citizen Observatory's Data to improving NBS integration (e.g. finding suitable urban spaces to deploy nature-based interventions)
MON-B-1-05 Create a Citizen observatory: objective and subjective data

MAN-A-2 NBS and planning interaction

Identify and understand the interaction of NBS policy and planning with other public policies (using digital devices and platforms, considering social benefits or scientific findings, etc.).

MAN-A-2-01 Mainstream NBS in urban planning and alignment with other public policies

Identify and promote synergies between NBS in urban planning with practical outcomes of other public policy objectives. (e.g. adaptation to climate change, disaster risk reduction; health equity).

EXAMPLE: Valencia NBS Strategy in Grow Green project. Link to the reference: http://growgreenproject.eu/

MAN-A-2-02 Deploy digital devices for planning, connecting NBS with smart city platforms

Deployment of digital devices for engagement, consultation, and informing planning decisions. (e.g. dynamic reporting, data visualisation, virtual reality) and connect NBS projects with ICT data (e.g. from existing smart city projects).

RELATED TO:
MAN-E-4-04 Visualize NBS projects' actions and results on digital platforms to raise awareness
MON-B-2-02 Integrate data into city data and smart city platforms

MAN-A-2-03 Recognise the potential of multiple small-scale infrastructure projects

Pay attention to small-scale infrastructure projects (small-scale interventions might have a significant influence on urban areas).

MAN-A-2-04 Integrate into planning the ecosystem services perspective.

Using the ecosystem services to improve social welfare and social cohesion, as well as documenting the achieved benefits.

RELATED TO:
MAN-D-4-01 Assess socio-economic impact
MAN-D-4-03 Conduct cost-benefit analysis and monetisation of NBS considering the entire process

MAN-A-2-05 Consider the NBS as a tool for social integration

Using newly built infrastructure as a tool for social integration (connecting poor and wealthy neighbourhoods, for example).

EXAMPLE: Connecting poor and wealthy neighbourhoods, as Integrated Sustainable Urban Development Strategies (ISUDS) Eix Besòs with the Sarajevo Bridge. Link to the reference: https://www.youtube.com/watch?v=5Y7RY4Y-X1Q

MAN-A-2-06 Generate findings in social, digital, and environmental science

Incorporation and/or consideration of scientific findings in social, digital, and environmental science.

MAN-B Implementation of NBS

Innovation in obtaining resources through procurement and funding models and mobilising expertise.

MAN-B-1 Maintenance

Promote innovative maintenance.

MAN-B-1-01 Develop an innovative maintenance

Develop innovative maintenance that identifies the impact of maintenance changes and secondary benefits found through analysis of the operation of the NBS and associated systems.

RELATED TO: MAN-B-3-01 Develop digital management and Maintenance guidelines

MAN-B-2 Procurement

Promote procurement models based on new criteria that ensure environmental, social, and economic outcomes that can be delivered through NBS.

MAN-B-2-01 Promote outcome-based procurement

Outcome-based procurement "seeks innovation from the supply market by focusing on the agency outcome required rather than defining how the outcome should be achieved."

REFERENCE: Innovation Procurement. Link: https://ec.europa.eu/digital-single-market/en/innovation-procurement

MAN-B-202 Ensure NBS expertise is embedded in the procurement procedure

Procurement procedures to include NBS multidimensional expert criteria to guarantee the environmental, social, and economic multifunctionality outcomes. and facilitate co-design and the co-implementation processes.

REFERENCE: Innovation Procurement. Link: https://ec.europa.eu/digital-single-market/en/innovation-procurement

MAN-B-2-03 Ensure procurement of NBS projects includes a consideration of maintenance requirements at all stages of design and delivery

Procurement models are used that include maintenance or provision of training for maintenance.

REFERENCE: Innovation Procurement. Link: https://ec.europa.eu/digital-single-market/en/innovation-procurement

MAN-B-2-04 Simplify and digitalise procurement procedures

Reduction of bureaucracy (less paper and energy) in procurement procedures.

REFERENCE: OECD digital government toolkit. Link: https://www.oecd.org/governance/digital-government/toolkit/

MAN-B-2-05 Introduce in NBS procurement criterium considerations about the carbon footprint and life cycle and circular economy concepts (Circularity and carbon footprint)

Procurement criterium valuate the carbon footprint and the life cycle and circular economy concepts.

REFERENCE: Buying green. A handbook on green public procurement, 3rd Edition. Link: https://ec.europa.eu/environment/gpp/pdf/Buying-Green-Handbook-3rd-Edition.pdf

MAN-B-3 Resources

Mobilizing expertise.

MAN-B-3-01 Develop digital management and Maintenance guidelines

Digital tools for green infrastructure management and maintenance are available based on public-private local experience and needs.

REFERENCE: I-Tree tools for management and assessment. Link: https://www.itreetools.org/

RELATED TO: MAN-B-1-01 Develop an innovative maintenance

C MAN-C Governance

Innovation in institutional and collaborative governance.

MAN-C-1 Policymaking

Implement innovative policies (based on evidences and outcomes, that join urban planning and environmental issues, integrated in an IMS, etc.).

MAN-C-1-01 Drive policy considering outcomes (Outcomes driven policy)

Implement an outcome driven policy i.e. setting measurable objectives for policies to work towards and measure success.

RELATED TO: MET-B-1-03 Introduce Co-Design-formats on the spot

MAN-C-1-02 Implement evidence-based policy

Implement evidence-based policy, i.e. policy decisions are informed by rigorously established objective evidence. Project-oriented thinking, or project-oriented mindset towards effective governance [each agent is disciplined (constrained by resources), flexible (to adapt to progress),

focused (responsibilities distributed within a scope) and in action (follow clear milestones and schedule)].

REFERENCE: Big Policy Canvas project. Link to the project: https://www.bigpolicycanvas.eu/

RELATED TO
MET-B-1-03 Introduce Co-Design-formats on the spot
MAN-C-1-01 Drive policy considering outcomes (Outcomes driven policy)

MAN-C-1-03 Join up urban planning and environmental policy

Develop a joined up urban planning and environmental policy. E.g. building levies on new developments that are ringfenced for development of NBS.

REFERENCE: Integrated Sustainable Urban Development. COHESION POLICY 2014-2020 Link: https://ec.europa.eu/regional_policy/sources/docgener/informat/2014/urban_en.pdf

RELATED TO
MAN-A-1-06 Design innovative urban redistribution instruments for NBS development

MAN-C-1-04 Make use of an Integrated Management System (IMS)

Making use of an Integrated Management System (IMS), integrating all an organization´s systems and processes into one complete framework Multilevel/sectoral.

REFERENCE: Guidance paper on Overview of the IMS. Link: https://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=CHAMP_guide_1.pdf

MAN-C-2 Institutional Governance

Promote a transparent and multilevel (horizontal and vertical) institutional governance in the implementation and development of the NBS.

MAN-C-2-01 Develop a transparent governance

Transparent governance with frequent updating of transparent data.

MAN-C-2-02 Promote Horizontal governance

Cross-sectorial governance, between disciplines, cross departmental policy.

RELATED TO:
MET-B-2-03 Multidimensional and multilevel (horizontal & vertical) integration of the different groups of local stakeholders considering their nature (public or private) and their field of work (finance, mobility, building, etc.)
MAN-E-3-02 Improve vertical and horizontal coordination

MAN-C-2-03 Promote Vertical governance

Multi-level governance, between administration and their responsibilities.

RELATED TO
MET-B-2-03 Multidimensional and multilevel (horizontal & vertical) integration of the different groups of local stakeholders considering their nature (public or private) and their field of work (finance, mobility, building, etc.)
MAN-E-3-02 Improve vertical and horizontal coordination

MAN-C-2-04 Open government data

Open Government Data promotes transparency, accountability, and value creation by making data available to all (Open government data. Data shared with citizens).

REFERENCE:
OCDE Open Government Data. Link to reference: https://www.oecd.org/gov/digital-government/open-government-data.htm

MAN-C-3 Collaborative governance

Promote collaborative governance that improves the co-creation process.

MAN-C-3-01 Facilitate the application of co-creation

Guidance to facilitate the application of co-creation methodology / shared governance (responsive, equitable & inclusive, consensus oriented) and tools to follow-up its implementation.

RELATED TO:
MET-B-1-01 Use novel tools to support mainstream co-creation (Living labs)

MAN-D Business models and financing

Innovation in business models and financing (resource mobilizing and co-financing including innovative partnership to deliver NBS and value generation).

MAN-D-1 Resource mobilizing and co-financing

Use resource mobilizing and co-financing instruments in NBS projects.

MAN-D-1-01 Use resource mobilizing in NBS projects

Use resource mobilizing in NBS projects, such as (i) Revenue-generating instruments (e.g.: taxation, inter or intra municipal ecological fiscal transfers, sponsorships, private company co-financing and co-operating in the process)**,** (ii) Green Debt (long term funding for projects: loans, concessional financing, green bonds, crowdfunding-debt, Natural Capital Financing Facility/NCFF), , (iii) Environmental or Social impact bonds, where NBS projects are embedded in and financed through EIB's Natural Capital Financing Facility (EIB and SIB refer to the same scheme of an outcome-based contract: Private investment is put in upfront to fund the NBS and is then repaid by public bodies on achievement of pre-specified outcomes), (iv) market-based financing instruments (reduction of user charges of grey infrastructures-property owners are encouraged to install NBS to reduce their charges).

EXAMPLE: Public bid integrating a co-financing scheme from different mechanisms: European Structural and Investment Funds (ESIF), Program for the Environment and Climate Action (LIFE), Horizon 2020, Regional & national government grants, Philanthropic contributions, Crowdfunding donation or investment, Endowment funds

MAN-D-1-02 Co- financing / blended finance

Blended finance resulting a mix of grants, charges, and investments and promote investment standards (e.g. the environmental, social and governance business case evaluator), financial alternatives, co-finance NBS projects through public-private-partnerships (e.g. grant funding and donations (public bid integrating a co-financing scheme from different mechanisms)

EXAMPLE: Environment, social and governance (ESG) investing. Link:
https://www.oecd.org/finance/esg-investing.htm

MAN-D-2 Value generation

Identify and improve the generation of value (the value proposition, the generated and delivered value and the value capture are not considered).

MAN-D-2-01 Use a natural capital account

A natural capital account is prepared and used to inform future decision-making.

EXAMPLE: "Natural Capital Accounting (https://ec.europa.eu/environment/nature/capital_accounting/index_en.htm)
The INCA project. Link:
https://ec.europa.eu/eurostat/documents/1798247/6079569/Leaflet+2019+%E2%80%93+The+INCA+project/
The framework: https://seea.un.org/ecosystem-accounting "

MAN-D-2-02 Promote outcomes-based finance

Outcome-based can drive value generation.

MAN-D-2-03 Identify monetary value from monitoring data

Monetary value from data monitoring. NBS project provides additional revenues from data monitoring.

MAN-D-2-04 Identify commercial value derived from "private" business models of public green space

Create commercial value when green space is not publicly used (renting out for events).

RELATED TO:
MAN-D-3-06 Use green barters

MAN-D-2-05 Boost employment through NBS projects and outcomes

NBS project generating new jobs (e.g. teachers are employed for gardening lessons).

MAN-D-3 Innovative partnership to deliver NBS

Promote innovative partnership to deliver NBS.

MAN-D-3-01 Set-up an ecosystem, stakeholder's community (Shared platform)

Setting-up an ecosystem or stakeholders' platform for bringing about the supply and demand alignment for NBS design. Creation of an appropriate ecosystem to create synergies and accelerate the NBS launch process.

MAN-D-3-02 Drive local initiatives forward, NGOs are included in the delivery of NBS

Local initiatives, NGOs are included in the delivery of NBS. NGOs as stakeholders which will provide social benefits with the delivery of NBS.

MAN-D-3-03 Find allies that support delivery phase of NBS

Healthy interaction between city representatives and NBS businesses to ensure that city policy nurtures innovation and investment (e.g. through repeated workshops or roundtables).

REFERENCE: Clever Deliverable 5.3 Business, Financial and Governance Models. Link: https://clevercities.eu/fileadmin/user_upload/Resources/D5.3_Governance_business_and_finance_models.pdf

MAN-D-3-04 Use Instruments for NBS start-ups

Instruments for NBS start-ups as policy instruments (public incentives) or financial instruments (public-private procurement), etc.

REFERENCE: MAN-A-1-07 Put in place regulation that stimulates business to implement NBS

MAN-D-3-05 Use green barters

Green barters are used (maintenance or development obligation in exchange for commercial profit from green space).

RELATED TO:
MAN-D-2-04 Identify commercial value derived from "private" business models of public green space

MAN-D-4 Socioeconomic impact valorisation and monitoring

Measure, monitor and consider the socioeconomic impact in the different stages of the process, facilitating the cost / benefit analysis.

MAN-D-4-01 Assess socio-economic impact

Carry out a socio-economic impact assessment (SEIA). It could help quantify the impacts at different stages of the process and understand the potential impacts of proposed changes and the likely responses of those affected if the change occurs. (Reference: Australian Government. Department of Natural Heritage 2005).

MAN-D-4-02 Evaluate the economic and financial performance of NBS

Evaluate the economic and financial performance of NBS, which would contribute to a greater promotion of investments in NBS and to an acceleration of market uptake.

MAN-D-4-03 Conduct cost-benefit analysis and monetisation of NBS considering the entire process
Conduct cost-benefit analysis, taking into account the economic, social and environmental benefits and integrate, and consider it throughout the entire process.

MAN-E Stakeholder engagement

Innovation in the stakeholders` engagement process and strategies (during and after the project), including the promotion of individual and community capacity building and awareness raising on value of NBS.

MAN-E-1 Capacity building

Focus efforts on the building capacity of community groups and active citizens to participate in the NBS project (co-design, production, or implementation).

MAN-E-1-01 Promote individual capacity building during the project
Individual capacity building during the project: including the provision of training opportunities, access to materials and support services (including students, older people, vulnerable people, professional stakeholders, etc.).

MAN-E-1-02 Promote community capacity building
Community capacity building: as above, but also including proposals to strengthen the expertise of small businesses and/or local grassroots movements.

EXAMPLE: Green guerrilla. Link: https://www.greenguerillas.org/

MAN-E-2 During project development and implementation

Use innovative strategies, instruments, or methods to create, intensify and maintain citizen participation during the project.

MAN-E-2-01 Define and implement a long-term vision
Define and implement a plan to promote sustainable actions with the participation of all local stakeholders and vulnerable groups.

MAN-E-2-02 Define and implement a co-maintenance plan
Define and implement a co-maintenance plan with the involvement of all local stakeholders and vulnerable groups. Target commission.

MAN-E-2-03 Contract maintenance responsibilities to professional stakeholders
Contracting maintenance responsibilities to professional stakeholders.

MAN-E-2-04 Participation of local groups of stakeholders at all project stages

Involve citizens from the earliest opportunity e.g. in developing the concept and the project brief. Maintain involvement throughout the project development stages.

RELATED TO
MET-B-2-03 Multidimensional and multilevel (horizontal & vertical) integration of the different groups of local stakeholders considering their nature (public or private) and their field of work (finance, mobility, building, etc.)

MAN-E-2-05 Develop a strategy to maximise civic participation

Recruitment strategies adapted to the different needs of interest groups; considering different requirements to ensure an inclusive approach (e.g. varying time of meetings, creating accessible communication materials, in person and on street recruitment).

MAN-E-2-06 Use of incentives for motivation and engagement activities

Use of incentives for motivation and engagement activities. Incentives can include, but are not limited to, paying an agreed hourly rate for work done, one off payments, vouchers for food shopping, free food and entertainment, and access to training and mentoring opportunities.

MAN-E-2-07 Establish a network of projects with shared goals

Focus efforts and resources to create networks that connects different groups of stakeholders (ECHO Effect) with different capacities, facilitating exchange and interaction between them.

MAN-E-2-08 Use ICT to improve citizen engagement during project

Citizen engagement is done with the help of ICT: Putting ICTs at the service of citizens (and not the other way around).

RELATED TO
MET-A-3-01 Use citizens science (via digital applications) and Citizen Observatory's Data for improve NBS integration
MET-B-1-01 Use novel tools to support mainstream co-creation (Living labs)
MAN-A-2-02 Deploy digital devices for planning, connecting NBS with smart city platforms
MAN-E-2-06 Use of incentives for motivation and engagement activities
MON-B-1-05 Create a Citizen observatory: objective and subjective data

MAN-E-2-09 Involve citizens in the project development

Use creative methods to Involve citizens in the project development as guided tours visiting NBS targeted to citizens (first) and professionals (e.g. Designer/company involved shows their benefits), oral history, community wealth mapping, etc.

MAN-E-3 Post-project

Use innovative strategies, instruments, or methods to maintain citizen participation when the project has finished.

MAN-E-3-01 Work for the continuity of the created network

Continuity of the network created during the development of the project, allowing mutual support and exchange of ideas to be maintained.

MAN-E-3-02 Improve vertical and horizontal coordination

Improve vertical (municipal x resident) or/and horizontal coordination (community x community) created.

RELATED TO
MET-B-2-03 Multidimensional and multilevel (horizontal & vertical) integration of the different groups of local stakeholders considering their nature (public or private) and their field of work (finance, mobility, building, etc.)

MAN-E-4 Awareness raising on value of NBS

Develop different methods to raise awareness on value of NBS.

MAN-E-4-01 Integrate learning and training on NBS in different educational levels and involve schools/university in the design of an NBS awareness campaign

Inclusion in different levels of the educational curriculum (free credits in university, extra curricula activities, etc.) and involve schools in the design of an awareness campaign on NBS: Students as active agents that disseminate the value of the NBS.

RELATED TO:
MAN-E-1-01 Promote individual capacity building during the project

MAN-E-4-02 Involve senior centres´ participants in the design of an awareness campaign on NBS

Involve people from senior centres in the design of campaigns in social networks about the value and co-benefits of NBS.

MAN-E-4-03 Implement events and campaigns for awareness raising (as competitions or gamification campaigns)

Design of competitions and/or activities with a diverse range of participants: a) school, b) university, c) older people, d) small businesses, Gamification campaigns to invite citizens finding, experiencing, and learning facts about NBS.

EXAMPLE: Geocaching (link to the example: https://www.geocaching.com/play)
Second Green Roof Competition (link to the reference: https://ajuntament.barcelona.cat/ecologiaurbana/es/concurso-cubiertas-verdes

MAN-E-4-04 Visualize NBS projects' actions and results on digital platforms to raise awareness

Presence of NBS projects on digital platforms (smart platforms, GIS databases, Augmented Reality, etc.).

EXAMPLE: i tree. Link: https://www.itreetools.org/

RELATED TO
MON-B-2-02 Integrate data into city data and smart city platforms
MAN-A-2-02 Deploy digital devices for planning, connecting NBS with smart city platforms

MAN-E-4-05 Promote participation of off-topic groups (e.g. business networks) in on-topic forums

Promote participation of off-topic groups (e.g. business networks) in on-topic forums (nature forum, blue-green forums).

MONITORING

Monitoring implies the indicators, devices and local data collection and management tools used for co-monitoring and citizen based NBS impact assessment, (open data) platforms employed to support co-monitoring, dissemination, and presentation of results.

A	Evaluation framework	**1**	Goals, objectives & indicators defined in collaborative way	**01**	Develop /Use a Co-Monitoring or Reflexive monitoring approach
				02	Deploy Monitoring Infrastructure
		2	Integration of different knowledge & information dimensions	**01**	Consider different spatial levels in the Local Monitoring Plan (LMP)
				02	Consider economic, social and environmental dimensions and/or ecosystem services and biodiversity in the LMP
				03	Consider future urban regeneration scenarios in the LMP
				04	Consider future climate, social and economic scenarios in the LMP
				05	Consider monitoring un-wanted impacts and trade-offs and interdependencies
				06	Develop a sustainable monitoring
		3	Selection of KPIs	**01**	Monitor the impact and performance of the processes
				02	Propose and use new social KPIs
				03	Integrate temporal and spatial dimensions
				04	Use of composite indicators to assess the impact
B	Data gathering	**1**	Monitoring devices	**01**	Use new sensors for real time
				02	Use sensors integrated into the NBS
				03	Integrate real time and simulations data with other data techniques
				04	Use of remote sensing
				05	Create a Citizen observatory: objective and subjective data
		2	Data management	**01**	Use Standardized Data Models and AI
				02	Integrate data into city data and smart city platforms
C	Results and decision-making	**1**	Impact evaluation	**01**	Integrate data in decision support system
				02	Introduce an economic approach to evaluate societal, health and environmental impacts
				03	Integrate social dimension to evaluate societal, health and environmental impacts
				04	Include impact assessment that accounts for gender equality and /or environmental justice
				05	Develop modelling exercises and simulations
				06	Use virtual and/or augmented reality
				07	Reporting decision-making

MON-A Evaluation framework

Collaborative definition of an evaluation framework that establishes goals, objectives and KPIs and integrates different knowledge, information, and dimensions.

MON-A-1 Goals, objectives and indicators defined in collaborative way

Include the definition of goals, objectives and indicators through collaborative processes that allow continuous reflection and adaptation and the deployment of monitoring infrastructures.

MON-A-1-01 Develop /Use a Co-Monitoring or Reflexive monitoring approach

Definition of Monitoring and Evaluation goals, objectives, indicators, and variables in a collaborative way, involving different stakeholders to define the Monitoring Framework in different steps and cycles using participatory and co-designing methodologies such us Theory of Change.

EXAMPLE: Reflexive Monitoring Guidebook (2020) Connecting nature. Link: https://connectingnature.eu/sites/default/files/images/inline/Reflexive%20Monitoring.pdf

MON-A-1-02 Deploy Monitoring Infrastructure

Definition of the data management will contribute to the City´s monitoring strategy and includes different methods for monitoring as digital sensors (model, location, metrics.), questionnaires and Interviews experimental measures, observations or laboratory (when, where and who?) and other data sources (earth observations, Copernicus, big data, documents, links).

MON-A-2 Integration of different knowledge and information dimensions

Consider and Integrate in the Local Monitoring Plan (LMP) different knowledge and information (future scenarios, un-wanted impacts, etc..) dimensions (economic, social, and environmental variables and/or ecosystem services and biodiversity) and spatial levels.

MON-A-2-01 Consider different spatial levels in the Local Monitoring Plan (LMP)

The Monitoring and Evaluation Plan considers different spatial levels (building, district, city-level). Upscaling possibilities for monitoring has been explored.

MON-A-2-02 Consider economic, social, and environmental dimensions and/or ecosystem services and biodiversity in the LMP

The Monitoring and Evaluation Plan recognises co-benefits (social, economic, and environmental), such as ecosystem services. Assessing all the dimensions will provide the holistic impact identifying potential synergies across the topics.

MON-A-2-03 Consider future urban regeneration scenarios in the LMP

The Monitoring and Evaluation Plan considers future alternative urban regeneration scenarios (depending on the type of interventions - integrated, partial, or sectoral -, their intensity or degree of action, and their development over time).

MON-A-2-04 Consider future climate, social and economic scenarios in the LMP

The Monitoring and Evaluation Plan considers future climate (i.e. the four scenarios – RCP 2.6, 4.5, 6.0 or 8.5 – established by the IPCC to assess climate change), social (i.e., demographic developments, and social changes, such as those brought about by gentrification) and economic scenarios (i.e., the possibilities for economic recovery or possible impacts at global and local levels).

MON-A-2-05 Consider monitoring unwanted impacts and trade-offs and interdependencies

Monitoring captures unintended consequences, trade-offs and, unwanted or negative aspects.

MON-A-2-06 Develop a sustainable monitoring

Specifics opportunities are identified and established in long-term monitoring plans such as: identification of meaningful KPIs, considering of reference areas, replicating or upscaling devices or monitoring techniques.

MON-A-3 Selection of KPIs

Include KPIs that consider different impacts (environmental, economic, and social) and integrate the different dimensions (spatial, temporal, and thematic-sectoral).

MON-A-3-01 Monitor the impact and performance of the processes

Define impact assessment evaluation through KPIs to monitor the progress or the process (co-design, co-implementation, and co-management activities of the intervention).

MON-A-3-02 Propose and use new social KPIs

Incorporation of new indicators or variables that measure key issues related to health, social issues, etc.

MON-A-3-03 Integrate temporal and spatial dimensions

Consideration of temporal and spatial dimensions in the selection of parameters and in the definition of the methodology to monitor NBS performance (e.g: Digital twin approach, monitor an area with similar conditions as a refence area, etc.).

EXAMPLE: #DigitalTwin in #Cities. Tecnalia. Link: https://www.youtube.com/watch?v=mWdEYWYxhpc

MON-A-3-04 Use of composite indicators to assess the impact

Establish a scheme of composite indicators (combination of indicators forming an index) to assess the NBS impact assessment.

EXAMPLE: Use Thermal stress as indicator. Link: https://research.usu.edu/ehs/thermal-stress/ ; Combining thermal stress with vulnerable groups prevalence to define a composite KPIs about the health risk

MON-B Data gathering

Process of collecting (deploy of monitoring devices), measuring and managing information.

MON-B-1 Monitoring devices

Use different sensors (integrated in NBS, remote control, in real time, etc.) or citizen's data collection systems and integrate them with other data collection techniques.

MON-B-1-01 Use new sensors for real time data gathering

Use new, innovative or prototype sensors and devices for real time data gathering.

MON-B-1-02 Use sensors integrated into the NBS

Monitoring devices are integrated (physically included out of the box) into the NBS implemented.

MON-B-1-03 Integrate real time and simulation data with other data techniques

Use real time data and simulations (are being used) jointly as complementary techniques to obtain data (as big data platforms, city science observatory, Copernicus services, complex modelling, etc.).

MON-B-1-04 Use of remote sensing

Use of remote sensing to do the monitoring of green interventions and infrastructures (urban forestation and tree canopy monitoring). Map and plan the greening evolution in cities.

MON-B-1-05 Create a Citizen observatory: objective and subjective data

Use Citizens engagement for objective and subjective data gathering (i.e. citizens observatories to gather real time data by means of specific portable sensor/device/APPs, respecting data privacy issues, subjective/perception throughout surveys, APPs, etc.).

RELATED TO:
MAN-A-1-09 Promote planning based on crowd sourced data
MET-A-3-01 Use citizens science (via digital applications) and Citizen Observatory's Data for improve NBS integration (e.g. finding suitable urban spaces to deploy nature-based interventions).

MON-B-2 Data management

Develop a process of collecting, organizing, and maintaining the data (using new techniques as Standardized Data Models, AI, etc.) and integrate them into city/smart city platforms.

MON-B-2-01 Use Standardized Data Models and Artificial intelligence (AI)

The use of Standardized Data Models harmonizes the data structures for measurements, indicators, real time, and context data in alignment with INSPIRE Directive (i.e. FIREWIRE, ISO8601). Use of Artificial intelligence for data capturing and management.

MON-B-2-02 Integrate data into city data and smart city platforms

Integrate data are integrated into the smart city's platforms/ city existing data platforms.

RELATED TO:
MAN-E-4-04 Visualize NBS projects' actions and results on digital platforms to raise awareness
MAN-A-2-02 Deploy digital devices for planning, connecting NBS with smart city platforms

MON-C Results and decision-making

Analysis and information process on present and future impacts to support decision-making considering the monitored data.

MON-C-1 Impact evaluation

Assess the present and future changes that can be attributed to an intervention, integrating different approaches (economic, social, environmental) to evaluate societal, health and environmental impacts, and use them to report decision-making.

MON-C-1-01 Integrate data in decision support system

The analysis of data is (will be) supported by the same tool used to support the whole monitoring and evaluation framework (i.e. decision support system).

MON-C-1-02 Introduce an economic approach to evaluate societal, health and environmental impacts

Inclusion of Social Return of Investment (SROI) and/or similar economic techniques to evaluate societal, health impacts, as well as environmental. (cost-benefit and cost-effectiveness).

MON-C-1-03 Integrate social dimension to evaluate societal, health and environmental impacts

The impact assessment integrates analysis of data of social acceptance and perception and changes in well-being and social justice, pre and post project.

MON-C-1-04 Include impact assessment that accounts for gender equality and /or environmental justice

Targeted analysis of monitoring data about environmental/health/cultural factors in vulnerable areas or population.

MON-C-1-05 Modelling exercises and simulations

The monitoring activities are (will be) supported by modelling exercises and simulations.

MON-C-1-06 Use virtual and/or augmented reality

Use virtual and/ or augmented reality to assess impact.

MON-C-1-07 Reporting decision-making

Use the results of the monitoring and evaluation for informing decision making in planning processes. Urban network concept - developing a network for citizens to inform and get information (feedback system). The Urban e-Planning concepts (digital participation and other participatory tools) are also supporting the reporting. Reporting within the communication strategy of the City involving the community manager via i.e. website, press, radio/tv, social media.

RELATED TO
MET-A-3-02 Digital Urban Planning concepts (e-planning and digital planning tools)
MET-B-1-03 Introduce Co-Design-formats on the spot
MAN-C-1-01 Drive policy considering outcomes (Outcomes driven policy)