GROW/HARVEST CALL FOR PROPOSALS 2021

2. THE NATURE-BASED SOLUTIONS CHALLENGE FOR THE CONSTRUCTION SECTOR

Nature-Based Solutions (NBS) are technologies and concepts which are inspired and supported by nature and address societal challenges (e.g., climate change, food and water security, natural disasters, air pollution or loss of biodiversity), while simultaneously providing benefits to human well-being and the environment. Among others, important aims include maintaining biological and cultural diversity and the ability of ecosystems to evolve over time recognising the trade-offs between the production of a few immediate economic benefits, and future opportunities in line with a broader range of ecosystems services.[1] NBS include green roofs and walls, green and blue corridors, dedicated biodiversity areas, waste management practices like composting, urban food production and many more. Thinking in terms of NBS means supporting new approaches for the planning, construction and management of cities inspired and supported by nature and its harmonious, elegant and resource-efficient solutions.

Nature-Based Solutions and the Built Environment

The modern built environment generates CO2 emissions and various environmental impacts These environmental impacts are especially prevalent in cities and increasingly threaten the quality of life for many European citizens. Extensive ground sealing and the use of heat-absorbing materials like glass or asphalt prevent the natural cooling of urban environments and contribute to the "Urban Heat Island" effect. Climatic stress will aggravate this problem in the future, leading to an increase in heat-related health issues. Ground sealing caused by construction activities also leads to increased water runoff, which already brings the sewerage systems of many cities close to their capacities in the event of heavy rainfall. These heavy rainfalls are also expected to occur more often in the future. The field of Nature-Based Solutions looks at more natural ways of water retention and drainage (e.g., green roofs, green spaces) that allow more water to go through its natural cycles.

Further urban challenges include the loss of biodiversity and the disconnection of humanity from its natural origins, as we live in increasingly artificial and inanimate environments. Several studies have shown the effect of plants and green spaces on psychological and physical wellbeing, indicating what a lack of these imply for the majority of today's city dwellers. With NBS, the aim is to converge back to more natural environments, based on nature's solutions and ecosystem designs. The result should be buildings and cities that have high quality of life, are climate-resilient, require little resources to build and operate and allow a wide spectrum of flora and fauna to exist within and around it.

NBS challenges in METABUILDING

To tackle the above-mentioned issues, the European construction sector needs to challenge its usual practices and innovate at a higher pace than ever before. Considering the application of the NBS paradigm to the built environment, from buildings to urban space and cities, several challenges have emerged from the METABUILDING stakeholder workshops.

TOPICS OF THE NBS CHALLENGE:

2.1 NBS system for renovation

NBS system for renovation that can be easily implemented during the refurbishment of buildings. The proposed solutions shall increase the energy efficiency of the building and serve other building optimization functions (cooling, shading, insulation, building protection, etc.). Ideally, they are aesthetically pleasing at the same time.

[1] Cohen-Shacham, E., Walters, G., Janzen, C. and Maginnis, S. (eds.) (2016). Nature-based Solutions to address global societal challenges. Gland, Switzerland: IUCN. xiii + 97pp.

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Solutions could include prefabricated "plug & play" greening modules, green roof modules, "building botany" applications or other concepts that allow an easy integration of greening in the existing building structure during the renovation process. As an additional cross-sectoral challenge, such a solution could also include 3D-printed components for NBS (*greenable* surfaces, increased functionality, new kinds of solutions made possible by additive manufacturing, etc.). Multifunctionality of parts/systems is highly valued in this challenge, e.g., a combination of insulation and greening, the possibility to easily install and mount PV panels (solar green roof) or other energy generation technologies that are combined with greening modules. Frugal innovation approaches will likely be important in order to find scalable solutions.

All solutions regarding the *building envelope* will be of special importance for this call (NBS applications regarding façades, roofs like insulating or structural materials). The building envelope is a key area for the energy performance of buildings, new and refurbished, and one that is at the centre of particular public policy efforts to boost a massive and much needed "renovation wave" in order to effectively tackle climate change.

Expected Outcomes/Impacts:

- Development of "renovation packages" that include greening solutions and are (to a certain degree) standardised, scalable and therefore cost-efficient.
- Simplification of the greening process during refurbishment processes.
- Extension of building envelope lifespan.
- Increased energy efficiency and internal comfort of buildings and CO_2 reduction.
- Reduction of material consumption through multifunctionality.

2.2. Digitization of care, maintenance, and monitoring for NBS

The operating cost of green facades and roofs is an important factor for competitive future innovations in the greening industry. Maintenance and care can be expensive – depending on the type of greening solution – requiring adequate planning, equipment and personnel. Creating systems that minimize the necessity for maintenance and finding more cost-efficient ways to check and monitor this need are therefore crucial for the widespread greening of urban environments.

The challenge here is to develop digital technologies, tools and concepts for monitoring, maintenance and care of NBS. This can include sensors, AI, AR, VR, cameras, irrigation systems, robotics and other approaches. Ideally, these systems have a digital interface with existing building operation systems (heating, ventilation, cooling, sanitary, electrics) and can be part of the Building Information Modelling (BIM) as BIM Objects.

Moreover, an intelligent use of sensors can enable the measurement of data that is important for ecosystem functions. Ecosystem services are positive externalities, their overall usefulness is hard to quantify, as it reaches far beyond the utility of the building itself. Showing the positive financial impact of NBS in an ecosystem is very challenging and data that can be used to monitor, understand, visualize and communicate the effectiveness of a green building (presence of insects/birds, cooling, humification, reduction of air pollution, rating of aesthetics by urban walkers, etc.) to a wider pool of stakeholders, increasing general awareness and interest in NBS is of outmost importance for the acceptance and uptake of NBS.

Expected Outcomes/Impacts:

- Reducing operating cost of greening systems.
- Enabling more precise monitoring and care.
- Ensure longevity and quality of greening systems.
- Gathering data that can be used for demonstrating (financial) impact on ecosystem.
- Might include social acceptance, participation tools and/or gamification aspects to address and include local residents.

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