GROW/HARVEST CALL FOR PROPOSALS 2021

3. THE CIRCULAR ECONOMY & RECYCLING CHALLENGE FOR THE CONSTRUCTION SECTOR

An ambitious new *Circular Economy Package* - which is one of the main building blocks of Europe's new agenda for sustainable growth (*EU Green Deal*) - has been recently adopted by the European Commission (EC) with the objective of helping European businesses and consumers in their way to the necessary transition to a more circular economy. This is a policy response that puts circularity as a key framework that can contribute to address systemic crises such as climate change, pollution, waste generation, and the reduction of biodiversity. In a concerning landscape of increasing global consumption and ever-growing pressure on natural resources – due to population growth - it is widely accepted that one key solution is to decouple economic growth from the excessive exploitation of natural resources. This would pave the way to a fast transition to climate-neutral solutions and a circular use of resources. Another related position from the EC is that Europe needs to increase its resilience concerning the supply of critical raw materials and the security of its value chains.[1]

Circularity and the built environment [2]

The built environment[3] generates CO_2 emissions and is currently responsible for the use of many resources, many of which are produced or derived through processes which impact our natural world (biodiversity loss). It should be mentioned that the aforementioned impacts are generated during the whole life cycle of the built environment and not only during the construction and operation stages. Thus, impacts from "cradle to grave" (and even "cradle to cradle") must be accounted for, from the extraction of the raw materials to the end of life and re-use.

A Life Cycle Approach should systematically be implemented in order to assess and then reduce the environmental impact of any construction project, throughout all its phases. To that end, methods and tools to perform Life Cycle analyses in construction projects should be both reliable and replicable. Issues to be considered include, among others, the impact of design on future energy consumption, the embodied energy of material used, durability and reuse of materials (e.g., "circular by design"). Urban mining for instance should become a key component of the supply chain in order to privilege secondary raw materials and distress natural resources. Completing the scope of Circularity of the Built Environment, solutions for the revegetation, urban food production, water reuse and the provision of ecosystem services by buildings and infrastructure should also be integrated, contributing to climate resilient, re-natured cities[4].

Circularity challenges in METABUILDING

To tackle the above 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 Circularity paradigm to the built environment production, from buildings to urban space and cities, several challenges have emerged from the METABUILDING stakeholder workshops.

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[1] From EC, Horizon 2020 Work Programme 2018-2020, Climate & Energy Cross-cutting activities, 09/2020.

[2] From ECTP *Strategic Research & Innovation Agenda*, 2021-2027, 11/2019.

[3] The human-transformed environment for shelter and other human activities, as opposed to the "natural" environment, so mainly concerning cities, buildings and infrastructures.

[4] See other METABUILDING Grow & Harvest challenges launched in parallel with this one, *notably Nature-Based Solutions Challenges for the Construction Sector*.

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TOPICS OF THE CIRCULARITY CHALLENGE:

3.1. New recycled building and/or urban infrastructure materials,

products and building systems with high performances in terms of circularity (frugality in the use of resources, reusability/recyclability, clear *Design for Disassembling* (DfD) approach, *Building Information Modelling* (BIM) implementation). This includes, as well, an increased recycling, recovery and integration of secondary raw materials (SRM) from end-of-life products in new construction products or components. SRM to be integrated can come from all sectors (any kind of waste stream apart from hazardous waste). Recycled products can be totally new or existing products in which natural resources are in a significant proportion replaced by SRM.

Of particular interest for this call is the use of SRM in *materials or components for the building envelope* (façades, roofs, and insulating or structural materials used in the building envelope. Indeed, 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 urgently tackle climate change which is a result of environmental degradation.

Expected Outcomes/Impacts:

- New SRM-based materials.
- New fully SRM-based building components or building components integrating SRM (notably for the building envelope).
- New methods and tools that push the boundaries to achieve a generalised use of LCA for recycling materials/components in buildings.
- New methods and tools integrating DfD in BIM enabled design processes.

3.2. Digital solutions for the Circularity approach in the construction sector

They answer one or more of the following challenges:

- Develop and/or bring closer to the market concepts, tools and technologies to promote the use of *material passports* and *smart materials*. Projects on material passports should consider ongoing developments in Europe and ensure correspondence/synergy with other initiatives. As smart materials are considered materials that can provide components/tracing information (being installed) during the life span of the products/building, with active or passive solutions.
- Develop intelligent (AI for automatic identification and measures), easy to use, and cost-effective digitalization tools of existing buildings and products, associated to back-office programs (e.g., integrating Scan to BIM) to facilitate building technical audit works, selective deconstruction, value estimation of waste and scenarios, to finally improve reuse and recycling of deconstruction products/waste in new or existing buildings.

Expected Outcomes/Impacts:

- Material Passports data & structure propositions including relevant ICT tools and testing/implementation roadmaps for concrete application areas / target groups.
- Proof of concept for material passports in the building sector.
- Implementation of smart materials in the construction (new and/or refurbishment) value chain including supply chain, off-site manufacturing and on the construction site, handover, and lifespan of the building its components until and after deconstruction (from cradle to cradle).
- Digital tools and software developments to handle deconstruction/demolition works in existing buildings to enable circularity of components.

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