D²XCEL

Sustainable & Circular Construction

1. Short Description

Innovative materials, processes, and tools to make our built world more sustainable. Included are new construction, (energetic) renovation, re-purposing, and demolition, especially aimed at increasing circularity of buildings and infrastructures. Focus topics include reduced-CO2, renewable, re-cyclable, healthy, preferably locally sourced construction materials and modules which decrease environmental impact and raw material dependencies, material & waste reduction during construction, pre-fab / off-site construction, robotics & 3D printing, green building designs, building & material EPDs, passports and digital twins (BIM), tools for circular design, renovation, reporting and management.

2. The Problem

The European Real Estate and Construction sector is facing substantial challenges in the coming years, but also great opportunities for early adopters of change. Material availability, Regulations, CO2 pricing, investor expectations and market demand all require a rethinking of how we deal with our built world.

The construction industry is responsible for 30% of GHG generated (between 5% and 15% from construction materials such as cement and steel), 40-50% of raw materials extracted (such as sand for concrete and wood), 35% of waste generated (15% is construction waste).

This poses substantial challenges for all industry actors, while those that plan for change early will most benefit. New EU Green Public Procurement rules will stimulate demand for more sustainable buildings. Reduced availability and increased costs of key resources (including energy, sand, steel), whether due to CO2 pricing or geopolitical developments, drive demand for alternative and more efficient construction methods. Market awareness and increasing attention to building sustainability ratings urge real estate owners and project developers to take action to reduce the risk of ending up with “stranded assets”.

We face a number of challenges which require innovative solutions:

- Decarbonising this industry is a major and urgent challenge, esp. regarding the use of cement and steel. 40% decarbonisation in EU construction materials (excl. steel) from 2018 to 2030 is needed to meet Fit for 55.
- Construction materials, especially sand that is suitable for concrete is become scarce.
- Wood is a good alternative, but less “renewable” as often thought, due to the slow growth of trees, and thus has limits to its use.
- Construction sites and demolished buildings are creating huge waste streams, with so far limit recycling. The embodied carbon emissions can be “locked in” for decades, if building lifetimes are extended. However, often buildings are demolished to make space for new buildings, rather than being renovated or re-purposed.
- Construction processes are generally very traditional, with low productivity and causing high levels of waste and pollution.
- Design-for-circularity is not well developed and adopted yet by the industry.

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3. Sustainability and Sovereignty Impact Potential for Europe

Developing and deploying alternative construction materials and methods is essential for Europe to:

- Reduce GHG emissions from producing construction materials (notably cement), the construction process itself (incl. NOX emissions), and demolishing (instead of renovating) existing constructions;
- Limit the dependency on raw materials that are becoming scarce in Europe, notable construction sand and wood;
- Secure building material production in Europe, despite soaring energy costs
- Enable circularity in our built world, through building lifetime extension, renovation, re-purposing and material re-use at the end-of-life;
- Reduce the toxicity of construction materials and methods, in line with new building regulations;
- Assure rapid and affordable construction of new housing and infrastructure projects across Europe.

4. Deep tech and Digital Innovation Potential

A broad range of Deep tech and Digital innovations will be considered to address the challenges mentioned above. These include, but are not restricted to:

- Sustainable, renewable, re-cyclable, healthy, and locally sourced construction materials, for example more sustainable cement and alternatives for virgin wood (e.g. re-used wood, biobased materials);
- Sustainable and healthy materials for insulation, coating, waterproofing, kitting, etc.;
- Alternative foundation and soil stabilisation technologies;
- Green building designs, methods and tools, reducing material use, waste and time, such as prefab / off-site construction, robotics, 3D printing;
- Digital and AI tools to enable design for circularity and sustainably, such as material databases, building & material EPDs/passports and digital twins (BIM).

Key success factors to be addressed by innovative solutions include:

- Scalability of the solution
- Acceptance by construction industry stakeholders, esp. project developers
- Suitability for (upcoming) building regulations
- Manageable “green premium” costs versus less sustainable solutions (taking into account future CO2 pricing and green certification requirements)

5. European Market Potential

The construction sector plays a vital part in the European economy, with a total revenue of €1,7 Trillion and a gross value added of 5,5% of GDP, about €550 Billion value added. It has more than 3 million enterprise and a total direct workforce of over 13 million people.

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The European construction products market is estimated to be about $100B in 2023, with an expected CAGR of 2,3% until 2032. The European Precast Concrete Market was valued at $134 in 2021 and the Cement market was about $30 billion in 2023, with the Green Cement market about $8 Billion.
Europe has many global corporate leaders that can and should play a key role in the industry transition. On the other hand, the overall construction sector is very fragmented, with 99% of the companies having less than 250 employees.
European VC investment in sustainable construction has been developing only recently and should grow to €1 billion by 2030 according to the Cleantech Group.

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