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Research Needs and Priorities supporting *Sustainable Construction with Nature-based Materials* under the European Green Deal

There is a clear need to close scientific gaps in nature-based materials and building to accelerate the transformation of the construction sector. Nature-based materials, like wood, have a high potential for climate change mitigation, societal impact, and are prime candidates for greater research and innovation support in the construction sector. Areas of key importance are:

1. **NOVEL AND ENHANCED CONSTRUCTION SYSTEMS for carbon-positive, long-life nature-based materials and building products** to boost and move the market towards more diversity, higher circularity and affordable solutions. Key topics include: hybrid, modular and novel construction products and systems, maximizing lightweight and insulation properties, design for disassembly and conversion of the building stock to material storage banks, (engineer from buildings back to resources and novel uses: reversible joints and structures, fire safety, alternative and undervalued tree species, wood modification, industrial upscaling, interior uses, standardization (Eurocodes) and building regulations.
2. **CIRCULAR ECONOMY solutions fostering repair, reuse and recycling and tackling waste and environmental issues in the sector.** Key topics include: Circular Design, assessing the life span of construction materials, long-life products and enhanced durability, resource and material efficiency, fossil-free, reversible adhesives for load-bearing structures, reverse logistics, waste wood and urban mines, cascade use of materials, valorisation of by-products and side streams, life cycle of buildings, incorporating the Circular Economy of functionalities and new business models into the construction sector.
3. **DIGITALIZATION and Industry 4.0 as key lever** to overcome barriers faced by the SME-dominated sector and to support circularity. The goal is to connect entire value chains from resources to manufacturing, customers and users through end-of-life phases. Key topics include: material traceability, resource use optimization (from product to landscape and market level), digital twins/digital design (materials, systems), automation in prefabrication, biobased sensing, logistics, value chain networks, novel platforms and business models, building information models (BIM), intelligent buildings, digital hubs.



4. **INTERDISCIPLINARY research and co-creation to break down silos, achieve a holistic perspective and widen societal impacts.** Putting users in focus in all key topics: human health benefits through comfort, wellbeing and productivity enhancements, architecture and urban space, aesthetics, biomimetic/ biophilic design, recovery of traditional knowledge/skills and cultural heritage, the creative sector, open innovation testbeds, citizen science.
5. **FAIR AND INCLUSIVE European Research Area for the sustainable built environment** to overcome regional and rural-urban divides and unbalanced representation in research excellence and innovation capacity of nature-based materials. Key topics include: affordable solutions, proactivity for gender diversity in STEM, inclusive and participatory design, Teaming with Widening countries especially Central-Eastern Europe, mobility actions for capacity building, transdisciplinary higher education programmes, upskilling and Dual Learning of the sector workforce, internationalization of the R&I ecosystem.

We advocate for a **EUROPEAN JOINT COORDINATION GROUP** for our R&I ecosystem to gain critical mass and scale for joint action and overcome fragmentation of the stakeholder landscape. The main purpose is i) to engage the *industrial construction sector*, ii) to co-create with *Partners of the New European Bauhaus* especially in the areas of architecture, design and urban transformation, and iii) to link to *European Partnerships under Horizon Europe*. Although none cover the entire value chain in a comprehensive manner, these partnerships can strengthen the role of nature-based materials in the New European Bauhaus: [Build4People](#) (conventional construction sector), [Made In Europe](#) (manufacturing industries), [DUT Driving Urban Transitions](#), [CBE Circular Bio-based Europe](#) (biobased products/ biorefinery), [Rescuing Biodiversity](#). A first step has been made with the foundation of our Wood4Bauhaus Alliance. This group intends to partner up other European key actors and initiatives, such as the [Forest-based Sector Technology Platform \(FTP\)](#) and more industrial representatives.

It must be noted that we have excluded research needs regarding the supply side of nature-based materials, e.g., ecosystems, forestry, wood markets. They represent another important domain with its own major challenges but has strong links to the construction ecosystem.

We wish to highlight that the scientific community and the innovation system in the field of nature-based materials are very heterogeneous and include numerous groups and diverse domains. The disciplines involved range from genetics to ecology to material science and engineering, and related fields such as health, social sciences and ICT. The solutions studied address hundreds of species, materials, products, applications and end-uses. This creates a



structural disadvantage to compete successfully in European calls for proposals against large established sectors with greater political visibility.

We also note that many of the topics are underrepresented or are missing a clear focus on nature-based materials in construction in the Horizon Europe work programmes. While forests and forestry are well represented, construction with nature-based materials requires extra attention. Several relevant calls are included, yet the opportunities for nature-based materials in buildings appear to be too few to drive the research advances needed. Even if various call topics target the built environment, only a few projects on nature-based materials can be successful under these calls. It is questionable if these will be sufficient to deliver the desired impact necessary to trigger a decisive transformation within the construction sector.

This underrepresentation is also true for other funding lines: ERC grants have no domain appropriate for wood science/building science, thus limiting the incentive to pursue breakthrough basic science in the field; the EIC lacks a challenge focus to support sustainable construction, despite its relevance to climate mitigation.

In the following, we highlight a selection of relevant Horizon Europe calls that may be suitable for this R&I community and the NEB challenges. A more extensive and comprehensive review of the upcoming calls is under preparation. We have identified over 75 potential calls for our R&I community, where the role of nature-based materials for carbon storage and substitution of fossil materials is not emphasized sufficiently or barely referred to at all.

In conclusion, the Wood4Bauhaus Alliance advocates for a level playing field for nature-based materials in European research programs and policy. Nature-based materials can meet the urgent challenge posed by climate change, enhance the implementation of the EU Green Deal, and lead the way towards a more beautiful and sustainable built environment through the New European Bauhaus.



Relevant upcoming Horizon Europe Calls: a few examples with comments

[HORIZON-CL6-2022-CircBio-01-06. Strengthening the European forest-based research and innovation ecosystem](#) (4M€/project). *Keywords in call text:* forestry and forest-based sector, overcome fragmentation, biodiversity and bioeconomy issues, renewable building materials for healthier living, EU network of research funding and research policy organisations, assess potential flagship projects.

Comment: Important call for forest research to form a Horizon Europe Partnership. It could support partially the setup of the European Joint Coordination Group (see point 6). Renewable building materials and wood products are considered under “assessment of flagships”, however, the built environment is not specifically mentioned. Connecting with market actors is not explicit. This raises the question if the budget allows for significant tasks targeting the construction sector. Topic scope and budget could be enlarged to make sure of this.

[HORIZON-CL4-2021-TWIN-TRANSITION-01-05. Manufacturing technologies for biobased materials](#) (4-6M€/project). *Keywords in call text:* innovative biobased products to substitute traditional materials with high environmental footprint; multidisciplinary research field combining engineering, physics, chemistry, biology, material science; easy to reuse and recycle; construction, food, medical, packaging and textile industries, composite, circularity by design, EP Made in Europe.

Comment: Interesting call considering construction offering fair chances (4-5 projects to be funded). However, three different manufacturing chains need to be covered by one project. Nature-based materials are not referred to explicitly; biobased is not specific enough.

[HORIZON-CL4-2022-RESILIENCE-01-16. Building and renovating by exploiting advanced materials for energy and resources efficient](#) (5-7M€/project). *Keywords in call text:* Building envelopes and renovation materials, new materials, innovative retrofitting, new insulation materials, "green" construction, sustainable building materials, circular design, self-sustaining buildings, Open Innovation Testbeds, EP Built4People.

Comment: Clearly interesting call for high-end facades and advanced renovation solutions. Relevant for wood panels and hybrid solutions. Limited opportunity for solid wood products/ mass timber or affordable solutions.

[HORIZON-CL4-2021-RESILIENCE-01-04. Developing climate-neutral and circular raw materials](#) (12M€/project). *Keywords in call text:* raw materials recycling, urban mines, wood- and rubber-based, construction and forest-based raw materials, wood-based panels, Critical Raw Materials (CRM), waste electrical and electronic equipment (WEEE), multi-material paper packaging, industrially- and user-driven multidisciplinary consortia, exploitation and business plans.

Comment: Very interesting call for sizeable projects with industry. Explicit focus on waste wood recycling included, among others. High competition expected as only three projects can be funded.



[HORIZON-CL5-2022-D4-01-02 Renewable-intensive, energy positive homes](#) (4-6M€/project). *Keywords in call text:* new constructions and renovation of cost-effective energy positive, climate neutral residential buildings, affordable and efficient construction materials, BMS/BAS, Built4People

Comment: Strong focus on energy efficiency and cost-effectiveness mainly through smart technologies. Materials are mentioned as one bullet point out of nine. Doubtful that nature-based materials can play a larger role.

[HORIZON-CL6-2022-CIRCBIO-02-01-two-stage: Integrated solutions for circularity in buildings and the construction sector](#) (6-8M€/project). *Keywords in call:* waste prevention/ recovery, lifetime extension, lifecycle performance of buildings/ components, disassembly, digital logbooks, upgradability, durability, material efficiency, dismantling, recyclability, BIM, PEF, New European Bauhaus

Comment: Very relevant call that can demonstrate the performance of nature-based materials.

[HORIZON-CL4-2022-RESILIENCE-01-20: Climate Neutral and Circular Innovative Materials Technologies Open Innovation Test Beds](#) (10-12M€/project). *Keywords in the call text:* Green Deal Strategy, clean products and materials, large-scale deployment and demonstration across sectors and across the single market, SMEs, open innovation

Comment: Potentially suitable call to foster exploitation and uptake of R&D results and innovations from climate-friendly materials into the broader industrial sector. However, nature-based materials are not referred in any way.

[HORIZON-CL2-HERITAGE-2022-01-04. Traditional crafts for the future: a new approach](#) (3.5-4M€/project). *Keywords:* traditional craftsmen techniques, traditional artefacts encompassing the full range of materials (stone, ceramic, metal, wood, fabric, paper/papyrus, etc.), vocational training, curricula, entrepreneurship skills.

Comment: Interesting call to revalorize traditional craftsmanship knowledge. Only two projects can be funded and are asked to cover the whole range of materials. Limited possibility to create significant impacts with nature-based materials.



Background information

The [European Commission's New European Bauhaus](#) calls for a creative, interdisciplinary, novel movement embedded in society to imagine a **sustainable** future together and to engage on a transformative path towards **affordable** and **beautiful** living spaces in urban and rural environments. A key step is the transformation of the building sector into a circular model that can also counteract the escalating climate crisis. This transformation requires prioritised research in the use of nature-based materials in buildings.

The Wood4Bauhaus Alliance's main objective is to shape a better and sustainable future with beautiful, healthy and inclusive living, working, and learning spaces as part of a sustainable, low carbon-built environment. Our platform shall foster an open, long-term dialogue with all interested stakeholders and help share good practices related to the Circular Economy and Green Buildings. Our goal is to inspire as many actors as possible to co-create and develop contributions to the New European Bauhaus from European to regional and local level, all in the common interest to advance and exploit as much as possible nature-based materials, innovative building systems and smart solutions to mitigate climate harm and benefit European citizens. The Alliance will therefore:

- Encourage research and innovation for novel and innovative uses of wood in the built environment,
- Foster new collaborations and co-creation between different stakeholders across disciplines, sectors, and society, and
- Facilitate knowledge sharing and skills development especially towards future generations.

The Alliance comprises the following partners:

[InnovaWood](#) is the European network for wood science, research, innovation and education with 60+ member organisations in 28 countries, including RTOs, universities, VET centres and cluster organisations.

The [European Confederation of Woodworking Industries \(CEI-Bois\)](#) is an umbrella organisation of 21 European and national organisations from 15 countries backing the interests of the entire wood sector.

The [European Panel Federation \(EPF\)](#) represents 100,000 direct jobs and counts more than 5,000 wood-based panel manufacturing and furniture companies in 25 countries.

The [European Organisation of the Sawmill Industry \(EOS\)](#) represents 35,000 sawmills in 12 countries.

The [European Federation of Building and Woodworkers \(EFBWW\)](#) is the European Trade Union Federation grouping 76 national free trade unions from 34 countries with members in the building, building materials, woodworking, forestry and allied industries and trades.

The [InnoRenew CoE](#) is a new research centre in Slovenia focused on sustainable construction with renewable materials. It was founded with support from Horizon 2020 Widespread-2-Teaming grant no. 739574.

[BASAJAUN](#) and [WoodCircus](#) are R&D project consortia fostering sustainable wood supply chains from forest harvesting to final buildings and Circular Economy solutions in the sector. They have received funding from the EU Horizon 2020 research and innovation programme under grant agreements no. 820892 and 862942.

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