



Redefining Construction

The Role of Nordic Innovation in
achieving a Planetary Boundaries
compliant construction sector



Nordic
Innovation

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Preface

This project is part of the Nordic Sustainable Construction program initiated by the Nordic ministers for construction and housing and funded by Nordic Innovation. The program contributes to the Nordic Council of Ministers' Vision 2030 by supporting the Nordic region in becoming a leader in sustainable and competitive construction and housing with minimal impact on the environment and climate. The program supports the green transition of the Nordic construction sector by creating and sharing new knowledge, initiating debates within the sector, establishing networks, workshops, and best practice cases, and helping to harmonize Nordic regulations on the climate impact of buildings.

The programme runs from 2021–2024 and consists of the following focus areas:

- Work package 1 – Nordic Harmonisation of Life Cycle Assessment
- Work package 2 – Circular Business Models and Procurement
- Work package 3 – Sustainable Construction Materials and Architecture
- Work package 4 – Emission-free Construction Sites
- Work package 5 – Programme Secretariat and Capacity-Building Activities for Increased Reuse of Construction Materials

This text is connected to the Work Package 3, and Work Package 2.

The work has been conducted by Form/Design Center and Climate-KIC in collaboration with 42 experts and practitioners connected to the value chains related to construction and housing in the Nordics. The main interest has been on small and medium sized enterprises working with nature-based and circular alternatives to conventional construction materials.

The wealth of data collected has been carefully processed, observations clustered and analysed, and classified by topic, type of challenge, opportunity or tendency. All recommendations found in this report are based on repeated statements from several voices representing the many angles around the building industry.

The knowledge base for this report has been harvested through 3 events with more than a hundred participants, 17 interviews with small and medium sized enterprises in Nordic construction, as well as numerous conversations with experts connected to the Nordic Sustainable Construction program. A list of all the involved direct and indirect contributors can be found at the end of this report.

All recommendations represent the views and interpretation of the authors.

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Nordic Sustainable Construction

For more information on Nordic Sustainable Construction, visit our website here: www.nordicsustainableconstruction.com

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Eelgrass being picked up. Photo: Søuld

Introduction

The construction and real estate sectors in the Nordic region, while crucial to the economy and employment, significantly contribute to environmental issues, accounting for 39% of global energy-related CO₂ emissions with additional environmental impacts including resource depletion, pollution, and biodiversity loss.

Addressing the challenges connected to the modern construction industry is a question that takes more than a dialogue between the authorities and the industry. It is a societal activity of great importance impacting the whole of society. Hence, it is needed to say, that if we want to change something and form a path for the construction industry to become more sustainable, including a significant reduction of the negative impact of construction and a promotion and development of a practice that respects planetary boundaries and contribute positively to a better tomorrow, then we need to do something different.

Although there has been a growing focus and ambition in these areas—evidenced by initiatives such as the New European Bauhaus, the recent passing of the EU Nature Restoration Law, the establishment of environmental councils and committees, and the integration of sustainable development goals—economic considerations often overshadow these concerns. In many cases, the drive for GDP growth and specific industry interests has led to a disproportionate emphasis on short-term gains, at the expense of long-term sustainability.

Like in many countries, the construction sector in the Nordics is cyclical and sensitive to economic fluctuations. It typically expands during periods of economic growth and contracts during downturns. However, public infrastructure investments often help stabilize the sector during economic slowdowns. The public sector has also been recognized as one of the most important barriers- and therefore also opportunities - for driving the needed paradigm shift in the the construction sector by the stakeholders consulted throughout the Nordic Sustainable Construction program.

In close collaboration with the sector, legislation and regulation hold a central key in moving the sector towards operating safely within planetary boundaries.

Beginning around 2010 the Nordic countries have been collaborating to reduce the climate and environmental impact of construction with the aim of making the region the most sustainable in the world.

As the construction industry stands at a critical juncture, traditional practices reliant on CO₂-intensive materials will have to be replaced for the sector to be able to operate within planetary boundaries.

Small and medium-sized enterprises (SMEs) make up 99% of the European construction sector and employ over 18 million people and 83% of the workforce in the construction sector. Therefore, they play a central role in the sustainable transition and the EU's ambition to achieve a climate-neutral economy by 2050.

This report identifies the framework conditions that can support the transformative potential of small, innovative companies in the Nordic region, whose efforts to (re)introduce sustainable, place-based materials and circular practices offer a pathway toward a greener future.

Through this investigation, we highlight the opportunities and challenges for scaling these solutions within a sector still heavily dominated by conventional methods and influential industry players.

Eco Cocon's straw-based building system uses 89% renewable straw and minimal wood, sourced locally and produced with low energy consumption, ensuring a sustainable and eco-friendly construction solution. Since forests play an important role in protecting our climate, elements are designed to use as little wood as possible—just enough to ensure the system's structural integrity. This photo was taken in Hyllie, Sweden, where ETC bygg are currently erecting a low-emission house with 65 apartments and 12 floors.



Photo: Pernille Martiny Modvig

Key Observations and Areas of Focus

1. Nature-Based and Circular Solutions Are Ready to Scale and ready for market

We already possess the knowledge and resources necessary to transform construction practices to align with environmental limits. The use of sustainable, natural,- and renewable materials, gentle demolition techniques, and redistribution of surplus materials are proven approaches that need broader adoption.

2. The Role of Ambitious Legislation

Regulatory frameworks are both the primary obstacle and the greatest opportunity for driving change. Policymakers must create conditions that support innovative practices while addressing systemic barriers that hinder small companies from operating in a financially sustainable way.

3. Rethinking Construction Needs

In the Nordic region, there is no need to add more square meters to the existing building stock to meet housing demands. Instead, the focus should shift toward maximizing the efficiency and sustainability of existing structures.

The transformation of Gjuteriet in Malmö, designed by Kjellander Sjöberg for Varvsstaden, focuses on the intensive re-use of repurposed materials, the project demonstrates how existing buildings can be reimagined based on circular principles.

The abandoned old building has been given new life as an innovative and open new meeting place and a new company headquarters for Oatly.

Throughout its radical transformation the building still tells the story about the port's rich maritime heritage. This is achieved through a composition where new and old elements integrate into a whole, while still retaining their distinct and separate layer.

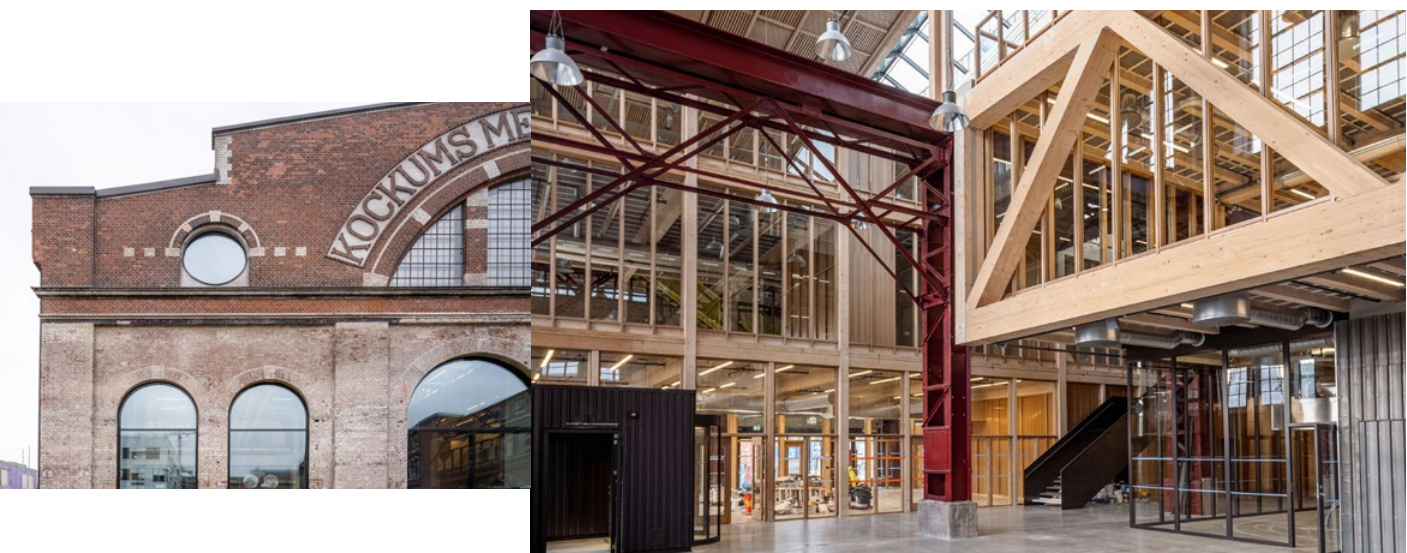


Photo: Rasmus Hjortshøj

Scope of the Report

This report explores the barriers and opportunities for integrating sustainable practices into mainstream construction, with a focus on enterprises that operate within the following areas:

- 1. Promoting Nature-Based, Circular, and Local Materials:** Encouraging the adoption of renewable, sustainable materials that are tailored to local contexts.
- 2. Gentle Demolition for Recycling:** Advancing demolition techniques that prioritize material reuse and support circular economy principles.
- 3. Redistribution of Used Materials:** Facilitating the reuse of surplus resources to extend product lifecycles and enhance resource efficiency.

This report reflects the collective knowledge and perspectives of a diverse group of stakeholders, including small business innovators, industry experts, and sustainability advocates. A detailed list of contributors can be found at the end of the report. It is important to note that all recommendations represent the interpretations and conclusions of the authors, informed by the input of these contributors.

The findings presented here culminate in actionable policy recommendations aimed at supporting Nordic Ministers of Urban and Housing in fostering a regulatory landscape that accelerates sustainable transformation.

Ekolution's hemp fiber insulation is a natural, recyclable, and renewable material that sequesters more CO₂ than its production emits, regulates temperature and humidity for energy efficiency, is free from harmful emissions, and provides excellent thermal and acoustic performance.



Photo: Ekolution

The report contains eleven policy- and leadership recommendations to pave the way for small, innovative companies working with sustainable, place-based materials and circular practices to contribute to the transformation of the construction sector towards operating within the safe operating space. The overarching focus areas for these recommendations are the following:

- **Strengthen Regulations and Frameworks:** Develop robust regulations, standards, and legal frameworks to support sustainability, incorporating carbon budgets, lifecycle assessments, and the use of sustainable materials.
- **Provide Economic Incentives:** Offer financial support through grants, subsidies, and tax incentives to make sustainable practices accessible and economically viable.
- **Foster Collaboration and Innovation:** Encourage cross-industry collaboration and simplify market entry for new sustainable solutions, with particular support for small businesses and startups.
- **Promote Renovation and Local Supply Chains:** Prioritize renovation over demolition, encourage the use of local supply chains, and drive circular economy practices to minimize waste and maximize resource efficiency
- **Enhance Education and Awareness:** Invest in education, awareness campaigns, and the development of practical tools and guidelines to ensure widespread adoption of sustainable practices across the construction sector.

Together, we hope this report will inspire the creation of policies that empower small players to lead the way in building a construction industry that respects planetary boundaries and prioritizes sufficiency over growth.

Recommendations

The following recommendations have been extracted from more than 250 pages of interview transcripts from interviews with material innovators and practitioners of sustainable practices in construction.

1. Strengthen Regulations, Standards, and Legal Frameworks

- **Climate and Sustainability Laws:** Establish carbon budgets, enforceable targets, and expand climate laws (e.g., LCA limit values) to include lifecycle and durability assessments for materials and practices. Implement stricter waste legislation, such as material reuse mandates, and raise landfill costs to incentivize recycling.
- **Building Codes and Zoning:** Update building regulations to incorporate sustainable materials and practices, shorten and support approval processes, and implement stricter sustainability requirements in zoning laws and municipal land allocations.
- **Public Procurement Reform:** Revise procurement laws to prioritize sustainability, incentivize green suppliers, and ease criteria to allow small firms access. Introduce inclusive procurement processes that encourage sustainability and innovation.
- **Certification and Standardization:** Develop National, - or Nordic standards and certifications for sustainable materials and practices to enhance market acceptance and trust.

2. Limit Undue Influence of Established Industry Players

- **Reduce Barriers for Small, Innovative Firms:** Create pathways for small firms to enter recognized material catalogues or official technical guides (such as "Byg Erfa" in Denmark). Revise procurement policies to simplify entry requirements for new materials, and increase transparency in decision-making processes.
- **Strengthen Independent Industry Voices:** Ensure a broader range of voices in policy discussions to encourage a more competitive and innovative market, benefiting from diverse solutions and sustainable practices.
- **Limit Undue Influence of Established Industry Players:** Remove pathways for influence on shaping building regulation for old, well established industry players. Instead, reward the conventional players to diversify, redefine and renew their business models to become fit for a future-proof market space.

3. Economic Incentives and Market Shifts

- **Financial Incentives:** Provide grants, tax credits, and subsidies for sustainable projects and materials. Implement resource and CO2 taxes to link resource extraction and emissions to economic costs. Create financial incentives for community-based and local projects that engage residents and use sustainable materials.
- **Life Cycle Cost Analysis (LCCA):** Mandate LCCA in project planning to demonstrate the long-term economic benefits of sustainable investments and make cost-neutral sustainable solutions more accessible to stakeholders.
- **Market Neutrality:** Encourage cost-neutral sustainable solutions to promote accessibility and adoption of eco-friendly practices across various market players.
- **Taxation or Penalties on all Energy Use:** To nudge towards a culture of "sufficiency" throughout all consumption and all scopes along the life cycle of products, introduce penalties or taxation on energy use regardless of the source of energy.

4. Facilitate Market Entry for Sustainable Solutions

- **Reduce Barriers for New Products:** Support approval processes for innovative materials to encourage competition with conventional products.
- **Public Procurement Policies:** Mandate sustainable materials in public construction projects to stimulate demand.

For over a decade Søuld has collaborated with ecologists, manufacturers and designers to develop acoustics from eelgrass—an abundant, renewable local sea plant with deep roots in Danish culture—to offer the industry a high performing alternative to synthetic options. Søuld's work has led to the revitalization of the 400-year-old eelgrass tradition, to the protection of the eelgrass ecosystem and to the material's optimization for sustainable 21st Century building.



Photo: Stine Heilmann, Jasper Benjamin Gren Riis-Hansen and Søuld

5. Foster Collaboration, Innovation, and Knowledge Sharing

- **Cross-Sector Collaboration:** Facilitate collaboration among construction firms, material suppliers, agricultural sectors, research institutions, and other industries (e.g., automotive). Establish eco-building hubs where small firms can collaborate with experts and consultants to reduce costs and inefficiencies due to duplicated insurance and risk management practices.
- **Support Collaborative Networks:** Facilitate partnerships between small producers for comprehensive sustainable solutions, such as prefabricated modules to provide turn-key solutions and manage risk through common quality assurance.
- **Promote End-User Participation in Construction Projects for Greater Sustainability and Community Impact:** Encourage the adoption of “built community” models that actively involve end-users in design, construction, and long-term management to enhance the social and environmental outcomes of construction projects to facilitate the adoption of more sustainable solutions because end-user-involvement enables addressing or bypassing potential legislative and stakeholder barriers.

Sjællandsk Muld is the first of six planned cohousing communities in the upcoming Hyllegård Høje district near Hvalsø, Denmark which will be home to a total of approximately 175–200 households. The vision is a sustainable collective community with shared meals, car-sharing, and livestock co-ops. The old farm and its 11 hectares of farmland will provide the setting for shared facilities, with sustainability as the key focus. The community will also become self-sufficient in electricity and heating and have Denmark’s largest privately-owned geothermal heating system.

Almenr, which creates housing and building communities, has, together with future residents, acted as the developer for the project, enabling a greater use of recycled materials in their new houses by taking on the associated risks themselves.



Foto: Jonas Halfter, Almenr

6. Promote Transformation or Renovation Over Demolition and Sustainable Construction

- **Incentivize Renovation:** Provide financial, regulatory, and educational incentives for renovating/transforming existing buildings instead of demolishing them. Develop renovation/transformation feasibility tools and guidelines to incorporate sustainable materials into renovation projects.
- **Support Local Supply Chains:** Encourage the use of local materials, including agricultural byproducts and biogenic materials, to reduce dependency on imports and support local economies.
- **All Buildings as Carbon Storage:** Mandate that all buildings should fulfil a requirement to function as carbon storage solutions. This could be done by implementing certification standards for materials based on their carbon storage capacity over time.
- **Limit Use of CO2-Heavy Materials to an Absolute Minimum:** Carbon heavy materials such as concrete or steel should be limited for use only in projects where they are absolutely necessary: This could be for bridges, tunnels and other central infrastructure



Photo: Rasmus Hjortshøj

Fabers Fabrikker - A former factory in the small town of Ryslinge now contains four affordable dwellings built using an all-wood modular system. The house-in-house method is a new housing typology that makes it economically viable to reuse the cultural heritage in rural areas. The Faber's Factories project was done for Faaborg-Midtfyn Municipality by Arcgency in collaboration with Ekolab (engineer) and Aarhus School of Architecture

7. Support Small Firms and Scalable Solutions

- **Access to Public Procurement:** Revise public procurement criteria to encompass more assessment parameters than just price to enable small firms with new, innovative products to participate. These criteria could be material health, offsite biodiversity or renewability.
- **Support for Small Firms:** Provide funding, insurance pools, and incubators to help small firms overcome market barriers such as obtaining certifications, obtaining a spot in official construction legislation guides, ensuring quality assurance, reducing perceived risks, and accessing resources for innovation in sustainability. Support test buildings allowing testing of the validity of construction requirements and testing alternative solutions.
- **Scalable Solutions:** Foster initiatives that create scalable sustainable solutions, especially those that involve small firms or community-based models.



Demolished buildings hold valuable bricks that can be recycled, prized for their patina and quality. With sustainability demands rising in construction, recycled bricks are key. Lolle og Nielsen, with technology partners and major demolition firms such as Søndergaard, aim to make used bricks cheaper than new ones for the benefit of cost, aesthetics, and the environment. The innovation is supported by MUDP - a public program that supports new, innovative technologies that promote a greener world and create jobs.

8. Encourage Systemic Market Shifts and Circular Economy Practices

- **Circular Economy Practices:** Support the adoption of circular business models, streamline material flows, and reduce barriers to reuse. Promote standardization of prefabrication practices and circular processes across the construction sector.
- **Municipal Sustainability Standards:** Increase the adoption of sustainability criteria in municipal projects and land allocation competitions, driving broader industry-wide change by incentivizing large construction firms to adopt green practices.
- **Encourage Innovation and Remove Barriers to New Products:** Support approval processes for innovative materials and products to reduce market entry barriers and increase competition with traditional construction materials.

Photo: Kasper Sørensen and Loudliving



These high-quality Douglas planks were saved by Søndergaard A/S from a demolition project in Copenhagen for ATP Ejendomme. The planks were reused for new inventory through a collaboration with Loudliving. To the right you can see the result.

9. Address Health and Safety Risks in relation to Long-Term Sustainability

- **Review Safety Standards in relation to overarching climate-change related risks:** Review individual pieces of legislation in connection to each other considering all interdependent consequences to screen for unintended barriers towards a primary focus on planetary Boundaries. Update safety regulations to smoothen the path to certification for new, nature based or circular materials.
- **Align Policies with Sustainability Goals:** Introduce policies requiring carbon impact reporting and mandates for carbon neutrality in construction projects, with penalties for non-compliance, to align with long-term sustainability goals.

10. Develop and Disseminate Guidelines and Tools

- **Comprehensive Guidelines:** Create tailored roadmaps for municipalities to implement sustainable practices, including assessments for climate impacts of construction versus renovation.
- **Renovation Feasibility Tools:** Develop practical tools and guidelines for incorporating sustainable materials into renovation projects.

11. Enhance Knowledge, Education, and Awareness

- **Education for Decision-Makers:** Provide training and educational programs for municipal officials and industry decision-makers on sustainability assessments, environmental impacts, and the benefits of sustainable practices.
- **Showcase Successful Projects:** Use case studies and successful projects to demonstrate the practicality, economic viability, and aesthetic appeal of sustainable materials and designs. Promote the shift from quantity (larger homes) to quality (better living experiences) to advocate for shared living and renovation.
- **Encourage Public Awareness:** Launch campaigns and knowledge-sharing initiatives to address knowledge gaps and misconceptions about sustainable practices, materials, and renovation versus demolition benefits.



Photo: Johan Jönsson

On September 14, 2024, we had the pleasure of co-organizing a workshop at Palmgatan's Kollektivverkstad, where we explored sustainable construction techniques using natural materials like clay and wood. The workshop was part of the exhibition The Great Repair Moves North. Throughout the day, participants engaged in practical tasks like timber framing and clay wall plastering, alternating with thought-provoking lectures on how architecture can act as a reparative force in today's world.

The Background of the Recommendations

About Nordic Sustainable Construction

The Nordic countries have set a joint ambition for creating a sustainable and competitive construction sector by 2030. As a contribution to the Nordic action plan under the Nordic Council of Ministers' Vision for 2030, the project Nordic Sustainable Construction, has been established as an investment in innovative and green solutions, where the goal for the Nordic region is to be a leader in sustainable and competitive housing and construction with a lower environmental and climate impact.

The project consists of 4 focus areas addressed through the work packages of the project:

- **WP1** Life Cycle Assessment – Lead: Ministry of the Environment of Finland
- **WP2** Circular Business Models – Lead: Nordic Innovation
- **WP3** SUSTAINORDIC – Sustainable Construction Materials and Architecture – Lead: Form/Design Center, Sweden
- **WP4** Emission Free Construction Sites – Lead: Ministry of Social Affairs, Iceland
- **WP5** Project Coordination – Lead: The Danish Planning and Housing Agency

This report is delivered by Form/Design Center in collaboration with work package 2 – Circular Business Models.

Purpose and Methodology

With this report, we have sought to identify the framework conditions that hinder or support the transformative potential of small, innovative companies in the Nordic region, whose efforts to (re)introduce sustainable, place-based materials and circular practices offer a pathway toward a greener future.

Through this investigation, our aim was to highlight the opportunities and challenges for scaling these solutions within a sector still heavily dominated by conventional methods and influential industry players.

The content of this report is based on input from 42 experts and practitioners connected to the value chains related to construction and housing in the Nordics with a main interest in small and medium sized enterprises working with nature-based and circular alternatives to conventional construction materials.

The knowledge base has been harvested through 3 events with more than a hundred participants, 17 interviews with small and medium sized enterprises in Nordic construction, as well as numerous conversations with experts connected to the Nordic Sustainable Construction program. A list of all the involved direct and indirect contributors can be found at the end of this report.

The wealth of data collected has been carefully processed, observations clustered and analysed, and classified by topic, type of challenge, opportunity or tendency. All recommendations found in this report are based on repeated statements from several voices representing the many angles around the building industry.

All recommendations represent the views and interpretation of the authors.

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Photo: Form/Design Center



At the conference "Place-based and Nature-based Architecture in the Nordics" several of the contributors to this report met to discuss the conditions and role of small, innovative players in construction and their relentless effort to replace conventional, CO2 heavy materials in a paradigm where sufficiency replaces eternal growth. The conference was hosted by Form/Design Center with funding from Nordic Innovation.

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Nordic Co-operation

Nordic co-operation is one of the world's most extensive forms of regional collaboration, involving Denmark, Finland, Iceland, Norway, Sweden, and the Faroe Islands, Greenland and Åland.

Nordic co-operation has firm traditions in politics, economics and culture and plays an important role in European and international forums. The Nordic community strives for a strong Nordic Region in a strong Europe.

Nordic co-operation promotes regional interests and values in a global world. The values shared by the Nordic countries help make the region one of the most innovative and competitive in the world.

Read more Nordic publications on www.norden.org/publications



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This project is part of the **Nordic Sustainable Construction** programme initiated by the Nordic Ministers for Construction and Housing and funded by Nordic Innovation. For more information on Nordic Sustainable Construction, visit our website at nordicsustainableconstruction.com