INCREASING SUSTAINABILITY AND RESILIENCE OF EUROPEAN FORESTS AND RELATED VALUE CHAINS

CHALLENGES AND SOLUTIONS IN TIMES OF CLIMATE CHANGE

A policy brief based on the results from ForestValue projects

HORIZON RESULTS BOOSTER

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Executive Summary

ForestValue – Innovating forest-based bioeconomy (ForestValue) is a public-public partnership under the Horizon 2020 Framework Programme established to promote increased innovation and competitiveness of the forest-based sector in Europe and to support its transformation from a resource-intensive to a knowledge-based, productive, resource-efficient and resilient sector.

In the policy brief, we draw from a set of insights and lessons learnt that are based on recent ForestValue projects around innovative sustainable management of multifunctional forests and innovative industrial production and processing technologies, products, concepts and services. The main solutions offered from the projects range from (among others) forest management and logistics solutions to wood construction material innovations and guidelines, and more. All this aims to contribute to ongoing challenges in Europe around maintaining and increasing sustainability and resilience of European forests and related value chains in times of climate change.

The contributors represent a multidisciplinary set of scholars, researchers and practitioners involved in either implementing forest-based solutions, researching forest policy and governance, or finding technological solutions to support the forestry and forest-based industries in remaining competitive and efficient providers of sustainable bio-products and services.

One of the main challenges identified in this policy brief is that of intensifying collaboration between different stakeholders at both EU and national level in order to achieve the ambitious goals of the Green Deal and decarbonize the European economy. Our policy brief addresses this issue, providing dedicated recommendations across multiple policy levels (regional funders to pan-EU regulations) that highlight the need for

- i) better understanding of the challenges that are facing forest owners and operators, particularly the marginalized or smaller owners, and provide insights on how they can be supported,
- ii) understanding of the latest technologies, methodologies, processes that should be encouraged for implementation or viewed positively for funding, and
- iii) understanding the actual impacts of climate change to European forests and how this affects the wood economy.

The policy brief is elaborated within the context of the Horizon Results Booster, funded under Horizon 2020, and the recommendations are based upon the results of the projects participating in the HRB services.

1. Topic Overview

1.1. Topic

Circa 5% of the world's forests are located in the European Union (EU). Forests and other wooded land cover over 43.5% of the EU's landscape and are instrumental in a number of key policy areas. The forest-based sector provides 3-4 million jobs in rural areas and income for 16 million forest owners. It represents some 8% of the EU's total manufacturing value and provides for a wide range of other social, economic and ecological services. In addition, this sector removes the equivalent of approximately 9% of greenhouse gases emitted by other parts of the economy and is thus significantly contributing to achieving the European Commission's ambitious target of an 80% reduction in CO2 emissions by 2050.

As stated in the New EU Forest Strategy for 2030, forests are essential for our future: "Forests are a natural ally in adapting to and fighting against climate change and will play a vital role in making Europe the first climate neutral continent by 2050. Protecting forest ecosystems also lessens the risk of zoonotic diseases and global pandemics. A healthy future for people, planet and prosperity therefore depends on ensuring healthy, biodiverse, and resilient forests across Europe and the world."

1.2 Policy challenges

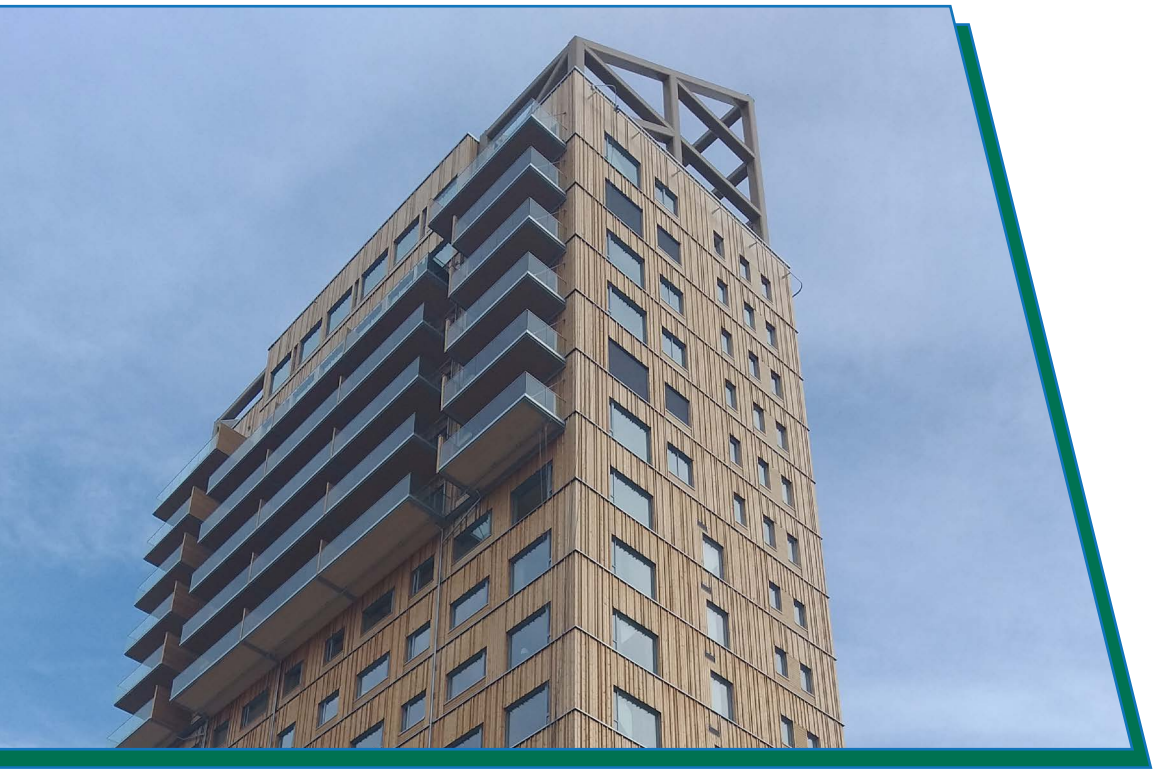
Society is witnessing an unprecedented series of crises at a global scale, both ecological (e.g., climate change, loss of biodiversity), economic (e.g., an unsustainable linear economic model) and social (e.g., COVID19-pandemic, rapid population growth, increasing inequality, weaponized conflicts). To overcome these challenges, the European Green Deal aims to transform the EU into a modern, resource-efficient and competitive economy.

Forests and forestry play a crucial role in facilitating this transition. On the one hand, forests are of key importance for terrestrial biodiversity and climate change mitigation; and thus, protection and conservation of forests is essential. On the other hand, forests and forestry provide jobs, raw materials, food, medicines, clean water and other important ecosystem services. Forests, forestry and the forest-based sector are therefore seen as central in reaching the EU's ambitious plans for a sustainable circular bioeconomy.

However, European forests are under increasing pressure, both due to environmental processes (e.g., fires, droughts, pests and diseases) and increased human activities (e.g., forest management, urbanisation and infrastructures). To overcome the challenges and to unlock our forests' full potential, we need innovative, knowledge-based solutions. This is also emphasised by the New EU Forest Strategy for 2030, which recognises the importance of research & innovation for the transition of the entire forest-based value chain, with the aim of achieving a sustainable economy by 2050 while ensuring forest ecosystems are restored, resilient and adequately protected.

Our European forests are subject to different, often conflicting demands, while also being under increasing pressures (including a growing number of social, economic, environmental, and climatic pressures threatening the condition of forests). Therefore, the entire forest-based sector is facing multiple policy challenges at EU, national and regional level.

Considering these challenges, and uncertainties about climate change, we need profound approaches to address the existing policy gaps. This is why ForestValue projects propose a few key recommendations for policy and regulatory changes.



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2. Recommendations

2.1 Recommendations: **NOBEL**

Research has identified Payments for Ecosystem Services (PES) as an important mechanism to close the gap between the demands of the society and the service providers (forest owners). PES mechanisms allow payments to landowners to maintain or enhance services that an ecosystem provides, or to mitigate and reduce pressures on forest ecosystems, or prevent a change of land-use with potential negative impacts on service provisioning. They create opportunities for new business models for landowners besides seeking social and environmental returns from their portfolios. Public instruments (e.g. taxes, subsidies, transfer payments), mixed public/private mechanisms (e.g. Public Private Partnerships or natural capital markets or auctions) or private mechanisms (e.g. licences, entrance fees) have been applied in recent years. However, many of those PES schemes that have been proposed or used in the past are not fully utilized. This is because awareness about market mechanisms is lacking, which might cause low participation or mistrust. **NOBEL** suggests the following activities to raise awareness about the importance of forest ecosystem services (FES) and promote the idea of PES:

- Social media tools and dissemination activities (e.g. videos on successful examples from case studies) can demonstrate the social and environmental achievements by PES mechanism;
- Workshops and trainings for different interest groups will make stakeholders (especially forest owners) aware about the opportunities related to PES;
- Auction platforms provide easy access to harmonized information about FES and bring providers and buyers in the market together;

As a result, trust, and transparency will be gradually increased among stakeholders, which will increase participation and engagement in a variety of successful business models established on the market.

2.2 Recommendations: **MultiForest**

European forests face increased pressures for multiple forest ecosystem services demanded by society, while being also central for biodiversity conservation. Current forest policies do not adequately address the links between these multiple demands, but rather focus on individual societal benefits or future challenges. The **MultiForest** project has developed new methodologies to evaluate (in)coherence between forest policies, both in terms of policy design and implementation. First, advanced policy analyses identified conflicts between the incoherent forest policy objectives and showed policy areas that require further coordination and harmonisation. Second, translating policy objectives into optimization scenarios provided lessons on how to combine different forest management approaches to better avoid trade-offs between divergent policy objectives. More generally, we have three messages for the design of forest-related policies:

- Policies should be more multifunctional by design, acknowledging the trade-offs between ecosystem services. For instance, we need to recognize the limits of using forest resources for climate change mitigation as those can conflict with biodiversity targets.

- More diverse forest management alleviates the challenges related to trade-offs between forest ecosystem services and divergent societal demands.
- Achieving the overall European policy targets depends on the distribution of efforts across member states and their successful national implementation.

2.3 Recommendations: **ValoFor**

About 60% of the forest area in the EU is privately owned and almost 90% of privately owned forest is smaller than 10 hectares. Small-scale forest owners have a great potential to maintain healthy forests and secure the diverse ecosystem services provided. The values of small-scale forest owners influence their management practices. To understand the impacts of these practices, we used models to simulate future forest development under different climate change and management scenarios (no management, close-to-nature, business as usual, and increasing wood production).

Forest growth modelling shows that no single forest management strategy is able to provide all ecosystem services to their full extent. However, the trade-offs existing between timber harvesting compared to biodiversity and climate change mitigation are heavily affected by selected management strategies.

Increased societal demand for biodiversity and climate change mitigation would reduce the income of small-scale forest owners, which could be offset by targeted payments for environmental services. This is in line with forest owners' preferences to participate in such payment schemes and their higher appreciation of environmental and social values over economic values, as shown in our **ValoFor** surveys.

Therefore, we recommend that a future targeted European forest subsidy system should focus more on the provision of environmental services. However, this system would also need to be flexible enough to account for the manifold forest ecosystems, different forestry practices and strategies across European countries.

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2.4 Recommendations: **I-Maestro**

If we want to support and adapt our forests to provide their valuable ecosystem services in challenging times, we need to investigate climate change and disturbances effects. Therefore, **I-Maestro** is i) working with simulation models which help us understand the dynamics that are happening in our forests and project them into the future, and ii) collecting information on past disturbances to better understand their effects.

By validating existing forest models against observational data to understand their strengths and weaknesses, we came up with 4 refined models. In our modelling efforts, we also include different forest management scenarios (e.g. intensification of management) to anticipate how management can impact our forests' recovery from disturbances. Eventually, these models will provide meaningful guidance for decision makers. Important information is also offered via the DFDE – the most comprehensive European database on forest disturbances (DFDE at EFI) – where we have added extensive information on past events. After a joint effort of research and practice, the updated DFDE now offers disturbance data from 1950 to 2020.

However, analysis of country data reveals that we still need more consistent data gathering on disturbance events. While larger disturbance events are generally well documented across Europe, there is much more variation and uncertainty regarding the reporting of smaller, dispersed damages. If we want to create relevant future disturbance risk scenarios and improve our management decisions accordingly, we need country support in collecting more consistent disturbance data from all over Europe.

2.5 Recommendations: **MULTIFOREVER**

Climate change is leading to a decrease in seed supply and thus endangers any national afforestation strategies. Forestry and wood products are not unlimited resources. Although generations of breeding efforts have led to productive forests with high value traits, we need alternative methods to be reliably in place to buffer exclusive dependency on seeds. Long-standing research efforts to guarantee a stable availability of climate adapted seedlings have explored somatic embryogenesis (formation of embryos from already differentiated, somatic cells to mass-propagate selected genotypes) as a tool to fill the gap. This in vitro method, when paired with multi-varietal forestry (combining suitable clone mixtures to establish genetically diverse, climate adapted and economical forests), offers a solution to the problem, as shown in the project **MULTIFOREVER**: Herein, demonstration plots with various conifer species were initiated in several EU countries to exhibit the benefits of somatic plants. Furthermore, to access productivity and markets, an automation pilot was tested for various species and user expectations were analysed. The system is far advanced and partly successfully applied in forestry – mainly in Scandinavia – but we consider further development as necessary, because it is not properly acknowledged yet.

To be able to have access to the renewable resource wood also in the future, we need to consider and enable alternative tree propagation methods for valuable and adapted varieties and genotypes. This means 1) promoting basic research on somatic embryogenesis, 2) the optimisation of the process chain as well as 3) raising awareness and opportunities for users (nurseries, land owners etc.).

2.6 Recommendations: **FIRENWOOD**

The requirements for more environmentally friendly building materials in constructions are growing internationally. However, energy efficiency must not come at the expense of fire safety. Wood is traditionally appreciated as a construction material due to its flexibility, strength, environmental friendliness, esthetical nature and good fire technical properties. However, there is a high focus on developing and using innovative wood systems in construction, commonly used as loadbearing elements and, in some cases, as fire separating walls and ceilings, as substitutes for traditionally used incombustible products. There is also an increasing motivation to extend the application areas of such products to taller and larger buildings. Even though the fire performance of wood-based materials as such is well elucidated, the implementation of engineered wood systems in taller and larger buildings is in general expensive and limited by regulations and perceived fire risks. Existing fire design models are often not applicable to the new products used in practice, or they are too conservative. Thus, the fire performance of innovative wood systems is required to be tested in expensive and limited fire test setups, e.g. full-scale furnace tests or uneconomical compartment tests in the USA.

Based on the research results, the following recommendations are made by **FIRENWOOD**:

- Classification methodology of adhesives used in structural applications exposed to elevated temperature and fire based on developed small-scale test methods. The improved classification method will be proposed in CEN TC 250 /SC5 “Eurocode 5” (Design of timber structures) and in CEN TC 193 /SC1 “Adhesives for wood and derived timber products”.
- Improved fire design models for cross-laminated timber (CLT), glue-laminated timber (GLT) and I-joists.
- Targeted dissemination of the results to facilitate change in negative public opinion of timber structures in fire.

To gain smoother fire design and pre-accepted solutions to strengthen the economic and competitive potential for the wood-based construction industry compared to traditional solutions of concrete and steel.

2.7 Recommendations: **CLICK*design***

The increased use of sustainably sourced wood as a low carbon building material is one strategy for mitigating climate change. Standards refer to ineffectual terms to describe wood performance such as “a reasonable working life”. This creates doubt for the user in terms of longevity of the wood products to store carbon. Hence, there is an immediate need to increase users’ confidence when it comes to selecting wood as a reliable product on the market. Furthermore, we need proper legislation to support and adopt low carbon construction options.

One solution openly available and easy to use are performance-based specification software tools such as the one provided by the ForestValue **CLICK*design*** project. Performance based specification will both strengthen consumers’ confidence in the specification of wood and support long term reliable carbon storage in wood products in construction. The project also provides input to standardisation. The goal is that performance-based specification will inspire novel strategies, methods and products for the use of forest-based industries ensuring a confident movement towards a bio-based economy.

2.8 Recommendations: **ReadiStrength**

Timber utilisation and wood construction are fundamental components of Europe's strategy on progressing towards a sustainable bio-based economy, and both require optimised strength grading procedures.

To improve the current production procedures in the sawmilling industry quality assessment needs to start before logs are sawn. Pre-grading of logs has the potential to significantly improve raw material utilisation, e.g. by adapted sawing patterns. **ReadiStrength** aimed to improve the current strength grading concepts of sawn timber by investigating three new approaches, which additionally include assessments on the log level.

These approaches were tested for three different log scanning technologies: 3D optical scanning of the log shape, discrete X-ray scanning of logs, and computed tomography (CT) log scanning. The results showed that optical scanning had limited potential for predicting the sawn timber quality. Discrete X-ray scanning data allowed significantly better prediction of sawn timber quality than optical scanning. CT log scanning, given its high detail level, had the highest prediction potential for individual sawn timber quality. Combining less expensive solutions like optical or discrete X-ray scanning with acoustic log measurements also gave improved results for pre-grading.

We conclude that pre-grading of logs could significantly change the strength characteristics of sawn timber. Our study also shows possibilities to reconcile such a change with the requirements for machine strength grading according to the current standard EN 14081-2.

2.9 Recommendations: **InFutUReWood**

Modern timber building design is not designed for reuse/recycling. This means it e.g. generates waste, and loss of material through incineration. In the **InFutUReWood** project, we focused on investigating how wood from current buildings can be reused especially as structural material. Here are the recommendations based on our research results:

- Small changes in design can have a big impact in improving building details for deconstruction and reuse. They contribute to resource efficiency and reduce the buildings' environmental impacts/footprint. For new buildings, deconstruction plans made by designers should be demanded by the local or the building authority to get permission to build, to enable reconstruction in the future. Such plans should be combined with

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material passports and recycling information to enable the circular use of the materials in the future.

- The cascading use of wood needs to be encouraged by taxes and subsidies so that renovation and reuse is favoured over new construction, when this contributes to sustainability and circularity.
- Industry can only innovate towards new greener ways if standards for construction products, and European Assessment Documents are harmonized. This should be addressed by the revision of the Construction Products Regulation.
- We need policy frameworks for the building process and recycling industries/recycling process (or similar), so that the investment costs are considered as an investment into a global resource deposit.
- Finally, if general solutions cannot be found there should be streamlined processes (or assistance) for lower risk circular economy products.

2.10 Recommendations: **DynaTTB**

Due to the global population expansion and concentration in urban regions, housing shortages are an increasing global issue. If we use more wood-based products as renewable raw material in mid-rise and tall buildings we assist in the transition towards a circular based bioeconomy, moving away from a dependence on fossil fuels and extractive materials.

With the **DynaTTB** project we learned to understand wind-induced dynamic behaviour of mid-rise and tall timber and hybrid timber buildings better by performing experimental and numerical assessments of several building types. The buildings we investigated represent different structural systems used for multi-storey and tall buildings from several European countries.

Following **DynaTTB** we need to:

- increase European and national incentives for mid-rise and tall timber and hybrid timber construction to further expand the wood construction sector in the efforts towards decarbonisation of Europe.
- enable growth opportunities for sawmills and wood products manufacturers in rural regions for providing the needed wood-based construction material, which will also foster local-based economic growth and job opportunities.
- establish a government-industry and technical associations supported initiative, to provide independent, non-proprietary information about timber and wood products to stakeholders involved in building design and construction at the European level.
- promote research programmes on human health, comfort and wellbeing in a sustainable built environment.

2.11 Recommendations: **InnoCrossLam**

Timber products, including composites and corresponding connection technologies have undergone impressive development in recent decades, leading to their increasing use in construction. In particular, massive timber elements made of cross laminated timber (CLT) have expanded the market for the wood processing industry.

Despite many advantages, the application of CLT still lags behind mineral-based building materials such as (reinforced) concrete and masonry. The reasons for this are to a large extent also due to deficits in standardisation. A candidate harmonised product standard for CLT is still not cited in the Official Journal of the European Union, nor is it binding. This leads to quite heterogeneous manufacturer-specific European Technical Assessments. Products from different manufacturers can therefore not easily be replaced by others without redesigning the respective structure. The design of CLT is also not addressed in the current Eurocode 5-1-1, the European design standard for timber structures, but is planned to be included in the next version. The lack of product standardisation makes it difficult to develop user-friendly design rules that can be applied to any product. Since CLT is still a new product, research is needed on new types of CLT, design, and ease of use.

Dissemination of knowledge is essential to provide architects and engineers with the tools they need for their daily design practice. To redirect the construction industry towards innovative mass timber applications and fully integrate the wood processing industry into the circular bioeconomy, policy makers at the local, national, and European levels should support actions for the future standardisation of CLT and develop supportive favourable policy frameworks, regulations, investments and incentives. To achieve the ambitious goals of the Green Deal and decarbonize the European economy, **InnoCrossLam** finds it necessary to bring together a wide range of stakeholders in the wood processing industry to jointly develop the next generation of mass timber products. To achieve this goal, a well-structured support base for researchers, companies and industry is needed.

2.12 Recommendations: **AVATAR**

Because of increased structure of forest stands and climate-change induced operating difficulties, sustainable forest management requires high-tech mechanised forest operations. We have to enhance production and workplace health and safety by operating sophisticated machinery such as single grip harvesters and forwarders for timber harvesting and extraction. Furthermore, these machines are able to provide detailed data of processed logs, characteristics of the remaining stand and trafficability. However, operating these machines requires comprehensive skills and knowledge. Recommendations from the ForestValue **AVATAR** project for future use of these machines are:


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1. Equipping machines with additional sensors and scanners allow for detailed localisation and assessment of the operating environment for low environmental impact and increased efficiency.

2. Implementation of quality assurance measures for securing high quality of machine generated data.
3. Design of operator assistance systems for easing machine handling and increasing job enjoyment for retainment of personnel.
4. Establishment of operator feedback systems to support skill development and enhance job satisfaction.
5. Intensifying collaboration between machine users and manufacturers upgrading machines based on needs assessment.
6. Taking advantage of science for its contributions to #1- #5.

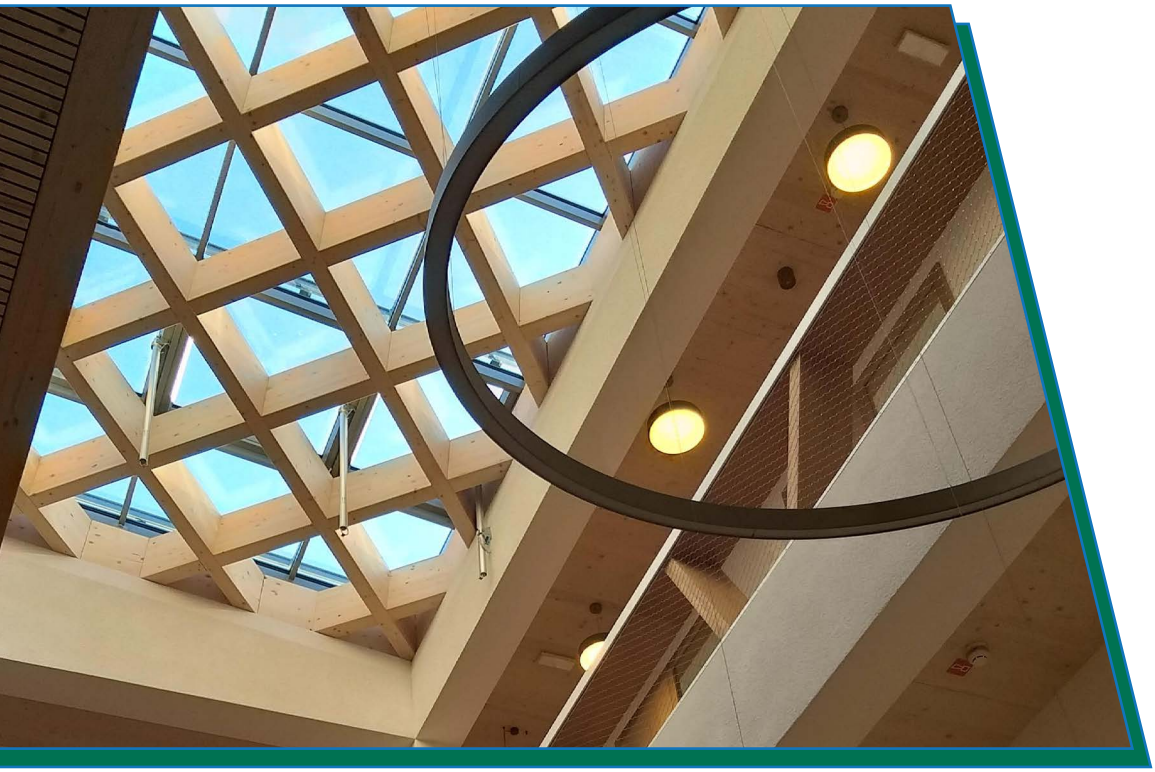

Photo: InnoRenew CoE

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