CRESTIMB: InCREased Service life of innovative TIMber Building systems

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Agenda

1. INTRODUCTION AND BACKGROUND
2. THE CONSORTIUM
3. PROJECT OBJECTIVES
4. PROJECT DESCRIPTION
5. PRELIMINARY RESULTS
6. PROJECT CHALLENGES
7. CONCLUSIONS AND RECOMMENDATIONS
8. ACKNOWLEDGMENTS




INTRODUCTION AND BACKGROUND

Building with timber

- Low emissions
- Speed of construction
- Material efficiency

INTRODUCTION AND BACKGROUND

Disadvantages of CLT and post-and-beam systems

- Limited space
- Expensive/ Complex
- Difficult demolition

INTRODUCTION AND BACKGROUND

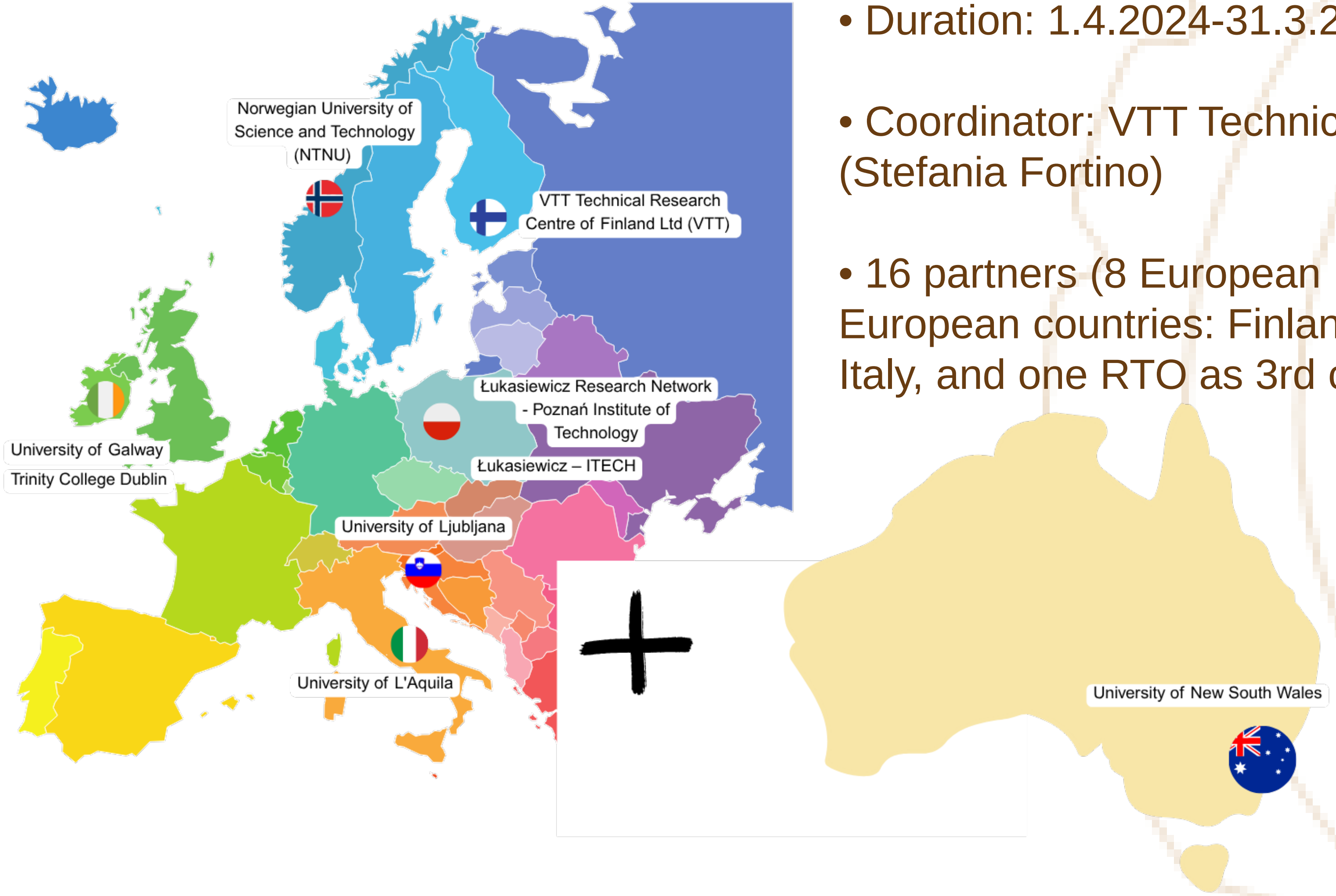
THE NEED FOR A NEW APPROACH:

1. Open-plan layouts
2. Enhanced durability
3. Potential for disassembly and reuse

CRESTIMB goal:

Develop a novel structural system combining MRTF frames with DCLT floors.

THE CONSORTIUM



- Duration: 1.4.2024-31.3.2027 (3 years)
- Coordinator: VTT Technical Research Centre of Finland Ltd (Stefania Fortino)
- 16 partners (8 European RTO and 7 industries from six European countries: Finland, Norway, Ireland, Slovenia, Poland, Italy, and one RTO as 3rd country partner from Australia)

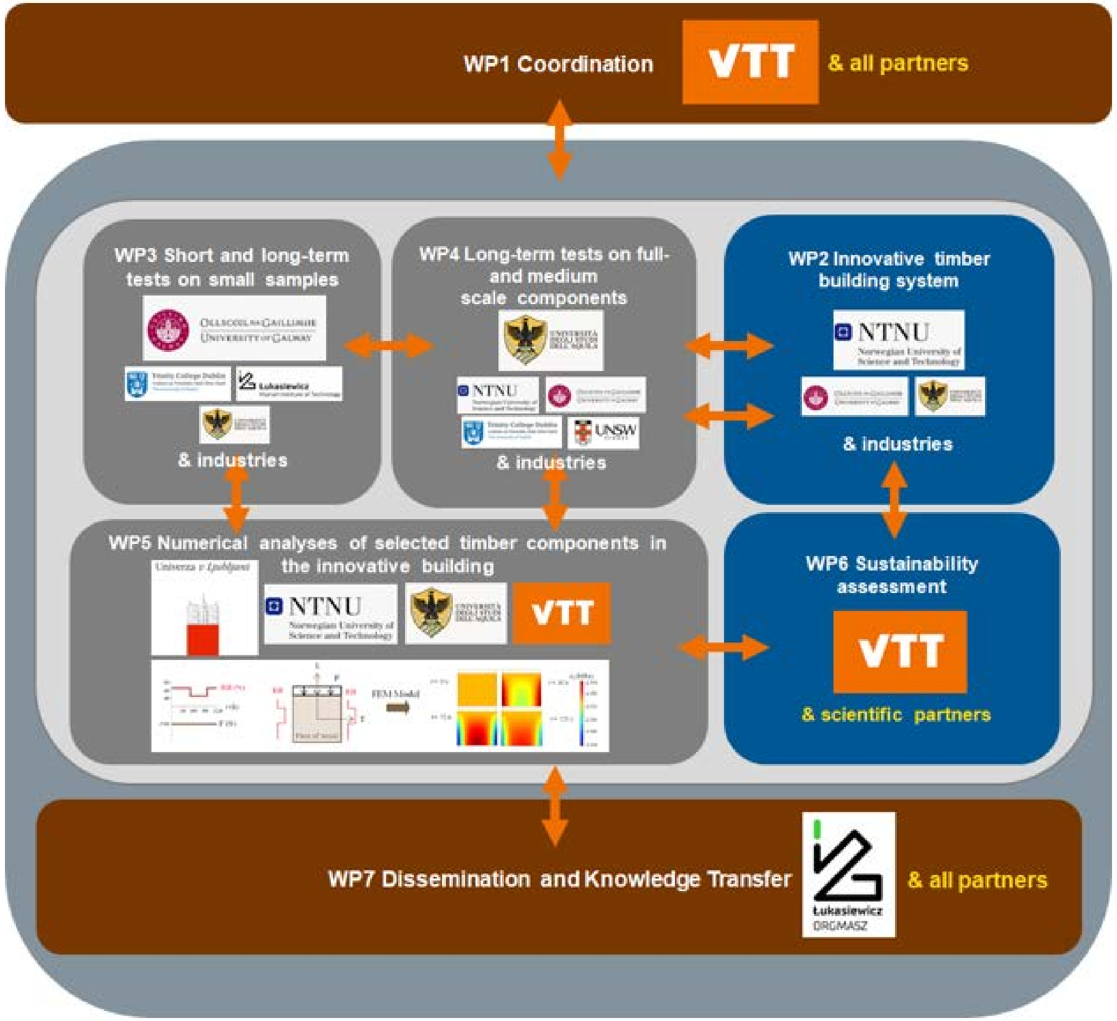
PROJECT OBJECTIVES

CRESTIMB

- CRESTIMB is developing an **innovative timber system** for multi-storey buildings with open spaces.
- **Long-term performance** will be evaluated through advanced numerical modelling and experimental testing on softwood, hardwood, and full-scale elements.
- Results will be made accessible via a data interface using the VTT Modelling Factory and applied in **environmental studies** including Life Cycle Assessment (LCA).
- **Collaboration with industrial partners** will support the creation of feasible and **cost-effective design guidelines**.

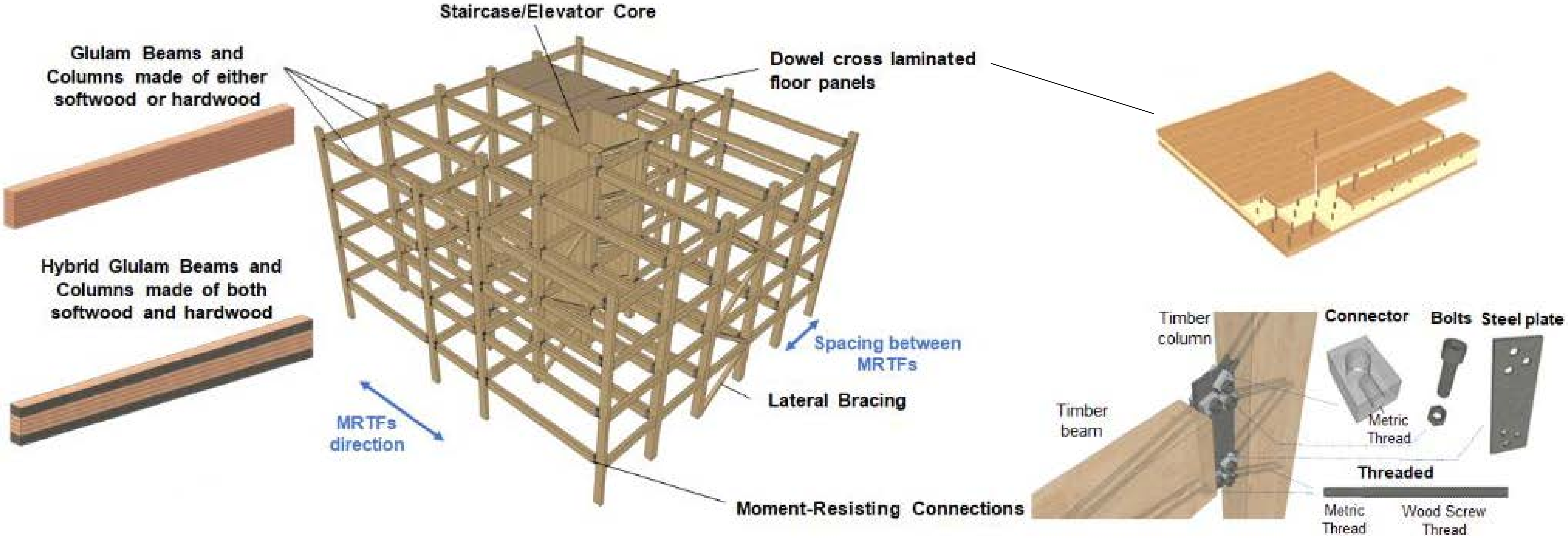
PROJECT DESCRIPTION

- **WP1 Coordination**
- **WP2 Innovative timber building system (NTNU)**
  - WP 2.1 Identification of the structural frame and integration of selected components in the innovative system
  - WP 2.2 Moment-resisting connections with screwed-in threaded rods
  - WP 2.3 Hardwood (and hybrid) glued laminated timber for beams and columns
  - WP 2.4 Dowel cross laminated timber floors
  - WP 2.5 Design recommendations for the long-term performance of the system and its components
- **WP3 Short and long-term tests on small scale wood samples**
- **WP4 Long-term tests on full- and medium-scale components**
  - WP 4.1 Long-term tests of medium-size components
  - WP 4.2 Long-term tests of full-size components
- **WP5 Numerical analyses of selected timber components in the innovative building**
  - WP 5.1 Structural analysis of the timber building system
  - WP 5.2 Hygro-thermal and mechanical analyses of components
  - WP 5.3 Development and validation of a new rheological model for wood
- **WP6 Sustainability assessment**
- **WP7 Dissemination and knowledge transfer**



THE INNOVATIVE TIMBER SYSTEM

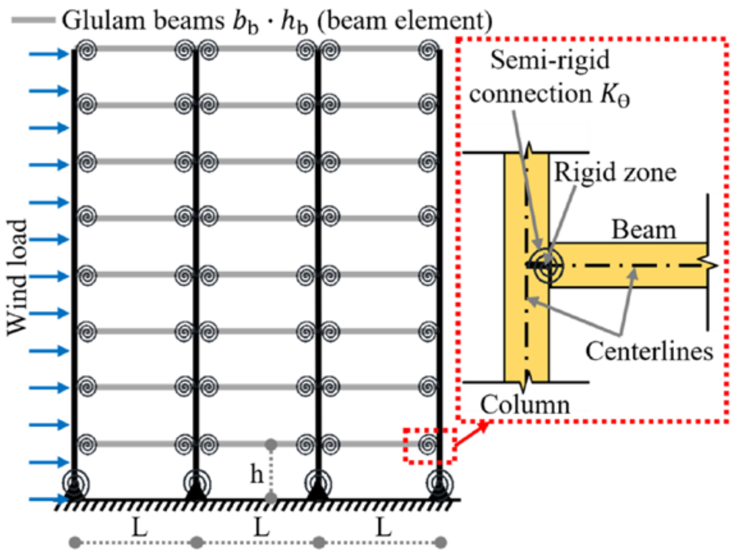
The system includes **moment-resisting timber frames (MRTFs)** made of **glulam beams and columns**, **semi-rigid moment-resisting connections**, and **dowel-cross laminated floor panels** simply supported on the beams of the MRTFs.



PRELIMINARY RESULTS

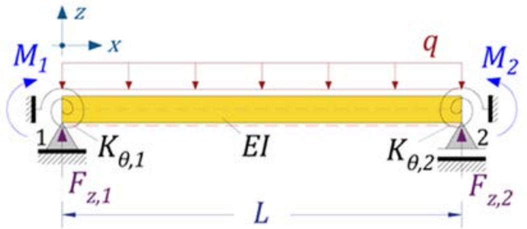
1. FRAME IDENTIFICATION (ULS, SLS wind induced accelerations, SLS deflections and human induced vibrations

- **Dimensions of glulam elements and connection stiffness** (columns: 430×585 mm, beams: 2×215×585 mm)
- **Storeys, bays and frames** 4–6 storey buildings with 3 m floor height, 8 m spans



- **Estimated load and moments**

$$q_{QP} = g + \psi_2 \cdot q$$



- $q_{\text{quasi permanent}} \approx 10\ \text{kN/m}$ or $\approx 2.5\ \text{kN/m}^2$
  300mm-thick floor, $c/c = 4.0$ m, considering weight of non-structural elements, and live load of 2-3 kN/m^2
- $M_{\text{connection,sustained}} \approx$ 23-38 kNm
  $\approx 5-8\%$ of mean experimental resistance → conservatively 10%
- $M_{\text{span,sustained}} \approx$ 42-57 kNm
  $\approx 4-6\%$ of mean experimental resistance → conservatively 10%.
- $F_{\text{ax,sustained,rods}}$ = less than 10% of mean withdrawal capacity
  By use of the component method

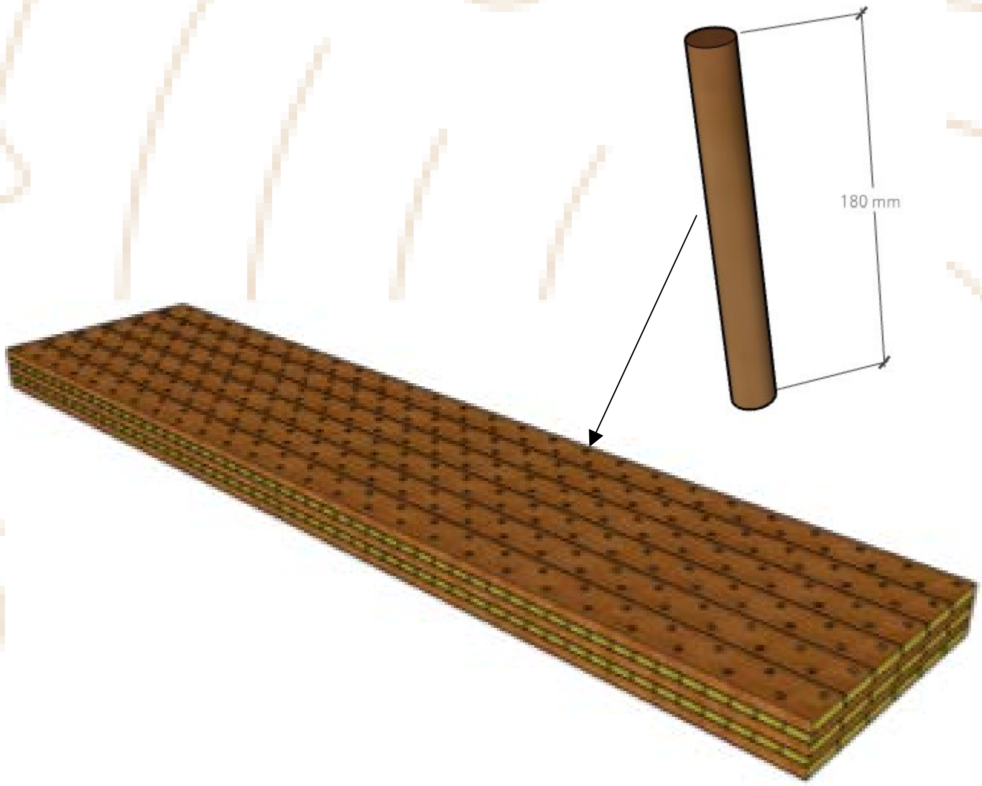
PRELIMINARY RESULTS

2. FLOOR IDENTIFICATION

The thickness of DCLT floors is expected to be approximately 250 - 300 mm with at least **5 cross layers of softwood boards** (minimum strength class of C16 spruce).

Birch dowel diameter and spacing will be varied but existing results indicate that spacings of 100 mm and a dowel diameter of 20 mm may need to be targeted.

The aim is to achieve a sufficient response against human-induced vibrations for a **span of 4.0 m.**



PROJECT CHALLENGES

CRESTIMB

Pre-drilling

hardwood

CHALLENGING

Pre-drilling

softwood

CONCLUSIONS AND RECOMMENDATIONS

1. **CRESTIMB** develops an innovative timber system for multistorey buildings, based on glulam moment-resisting frames (MRTFs), reversible semi-rigid connections with threaded rods, and dowel-cross laminated timber (DCLT) floors.
2. The system is designed to support long service life and reusability by addressing creep and mechano-sorptive effects through experimental validation and numerical modelling.
3. Short-term analyses confirm feasibility for 4–6 storey buildings with 3 m floor height, 8 m spans, and DCLT floors 250–300 mm thick supported by glulam elements (columns: 430×585 mm, beams: 2×215×585 mm).

ACKNOWLEDGMENTS

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Thank you for your attention

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