# Laminated Structures for Interior Architecture

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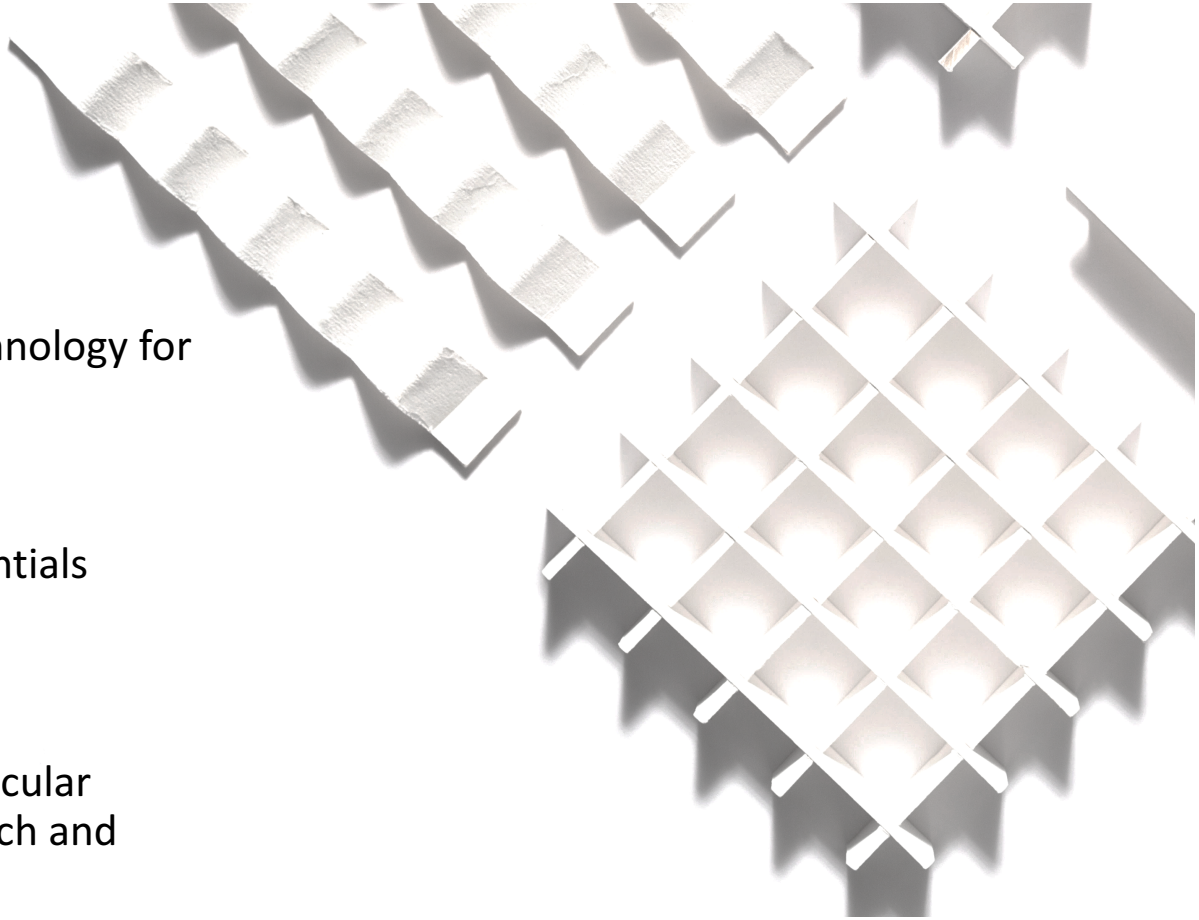
# Objectives



- Create manufacturing technology for base material and explore machinability
- Visualise preliminary potentials outside of labscale
- Develop a comprehensive understanding of this particular material for further research and products

Photo: Eeva Suorlahti

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# Technology Overview

- Novel manufacturing technology to produce ridig and solid structures from pulp and nanocellulose
- Structures may serve as alternative for
  - Domestic dividing walls instead of gypsym and chip board
  - Office dividing walls being light and sound absorbing
  - Furniture
- Entirely bio-based and bio-degradable
- Various finishing possibilities
  - Embossed patters
  - Pictures
  - Painting

Photo: Eeva Suorlahti

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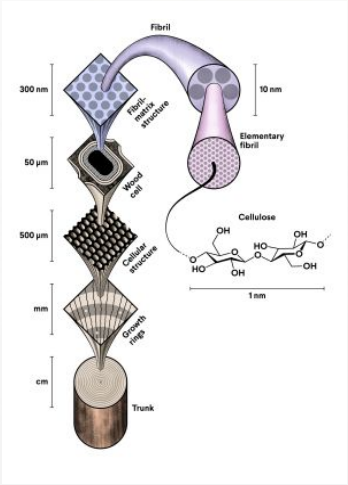
# Introduction to Nanocellulose

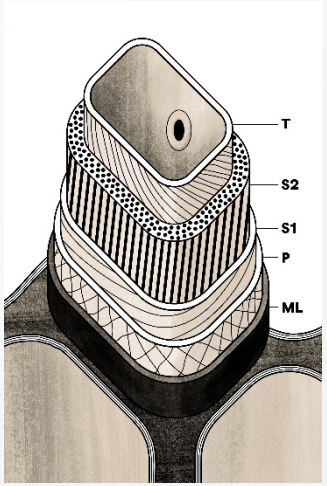
Nano/Microfibrillated cellulose (N/MFC)

Cellulose nanocrystals (NCC)

Bacterial cellulose (BC)

High-Consistency enzymatic fibrillated cellulose (HefCel)*




Illustrations: Safa Hovinen, VTT (Cell wall structure, Fiber structure)
*FI126698 Process For Producing Fibrillated Material

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# Technology Description*
# Basic structure


| STEP 01 | STEP 02 | STEP 03 | STEP 04 | STEP 05 |
|---|---|---|---|---|
| MANUFACTURE AND DILUTION OF NANOCELLULOSE | SELECTION OF RIDIG CELLULOSE CORE MATERIAL | GLUING AND PILING OF INDIVIDUAL LAYERS | PRESSING AND WATER REMOVAL | DRYING OF STRUCTURE |
| 80…100 g/L | APPLICATION ORIENTED | THICKESS DEPENDANT ON LAYER COUNT | PLANAR LEVELS, STRUCTURES SURFACES OR NIP | 105 °C OR HIGHER TEMPERATURE |

*Patent application 20185017

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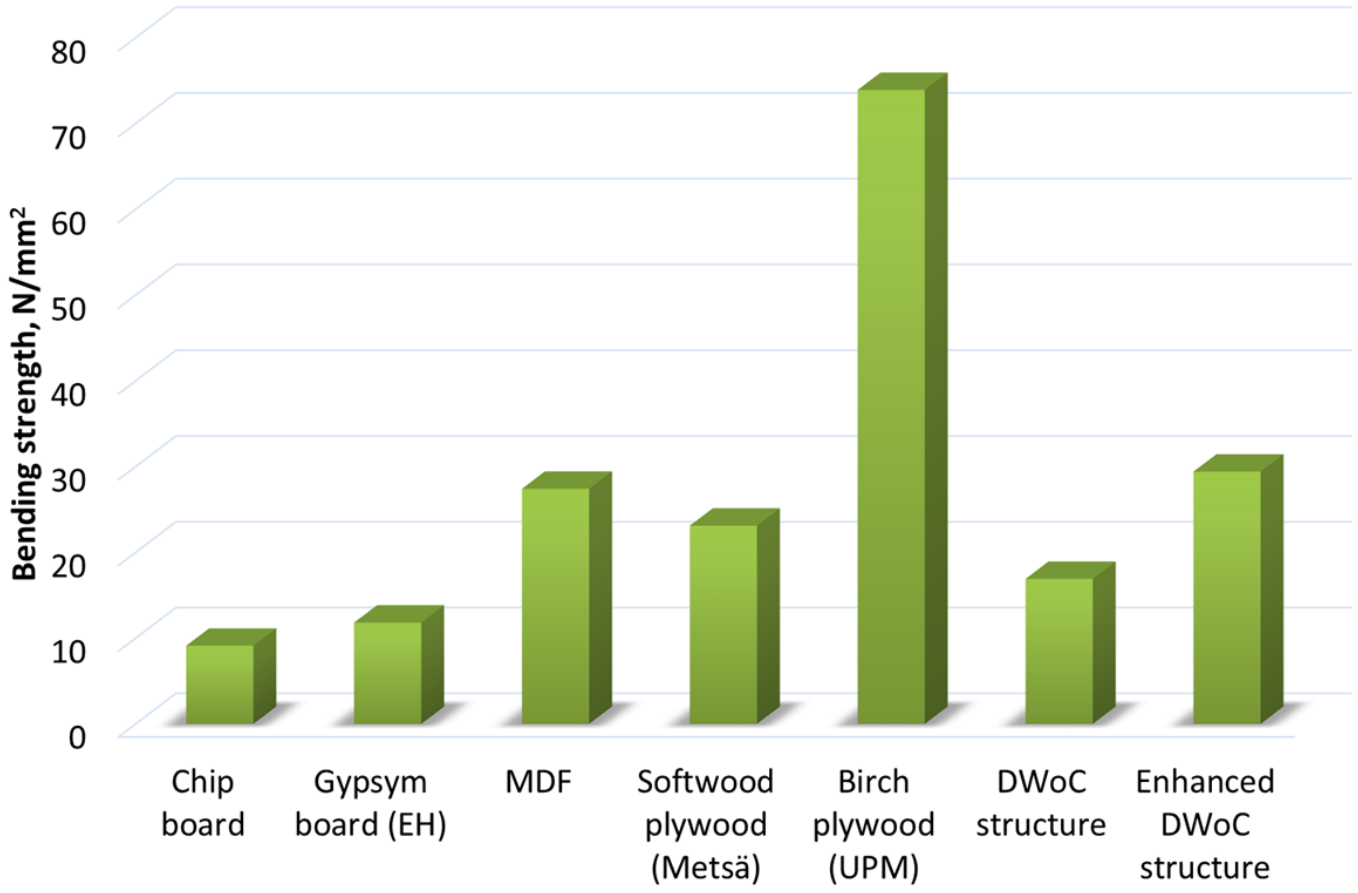
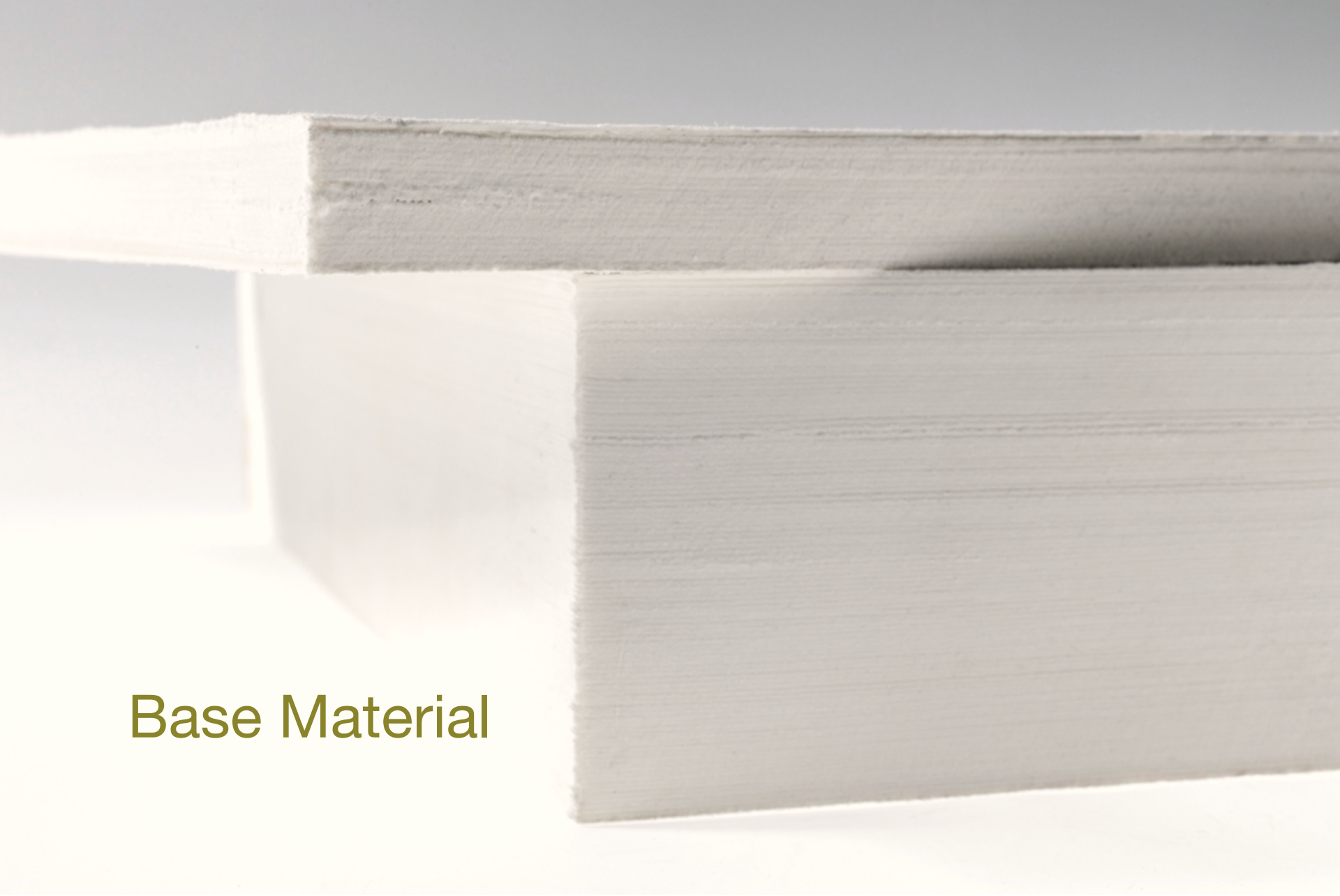
# Performance of Rigid Layered Structures

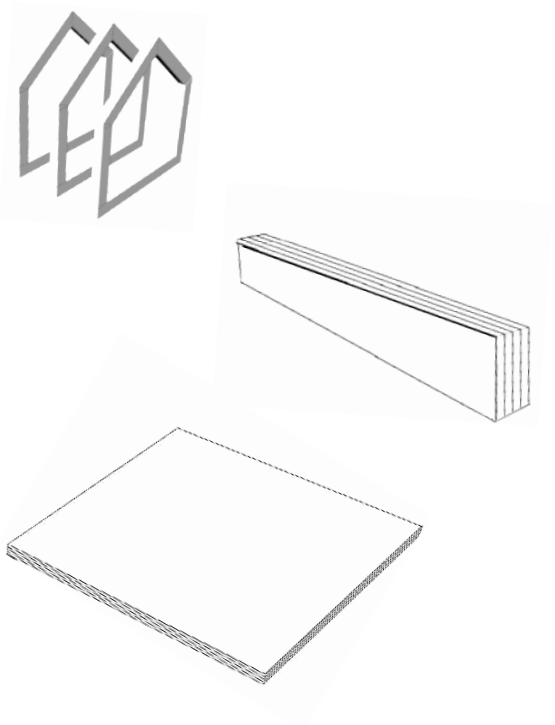




# Base Material

Photo: Eeva Suorlahti

# Shaping Boards



- Drilling & sawing by using woodworking tools

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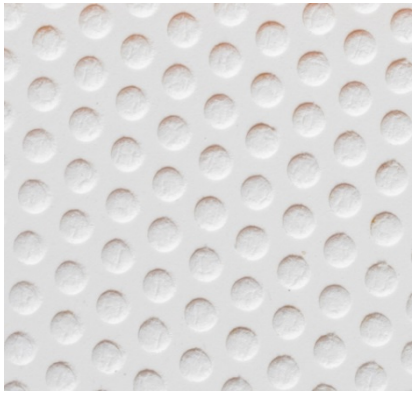
# Visual Potentials of Base Material



Surface patterns

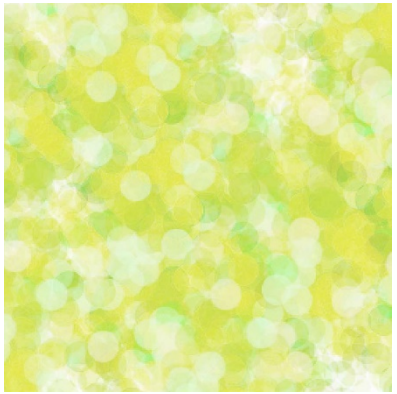
Photos / Pictures

**Finnish Forest Industry.** *Forest industry based products are significant part of Finnish export accounting for 13.1 % of the export value (2015). Due to the declining markets of newsprints the forest industry is constantly seeking for new business opportunities. The current large players in the forest sector are excellent in dominant B2B business, whereas for more consumer oriented business concepts are expected. The number of cellulosic SME companies is also very limited as the industry has been based on bulk and large volumes. In order to attract future investments and entrepreneurs to the ecosystem, new attractive high-value product visions have to be generated.*

*The current annual growth of Finnish wood biomass ~104 million m3 and the current annual use is 65.3 million m3 (2014) of wood. Thus the usage of Finnish forest resources could be increased significantly. The imbalance will become even greater through three main factors: increasing through systematic natural resources policy, forest management and effect of global warming and reduced use of traditional forest industry. Thus, the national cellulose raw material asset will increase in its significance and products derived thereof should subsequently be an increasing part of our economy. Furthermore, the wood in Finland is produced sustainably in certified forest and this offers potential added value in branding.*

www.cellulosefromfinland.fi

Text



Printed visualisations / Colours / Painting

Photo: Eeva Suorlahti

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# Structural Experiments

Photo: Eeva Suorlahti

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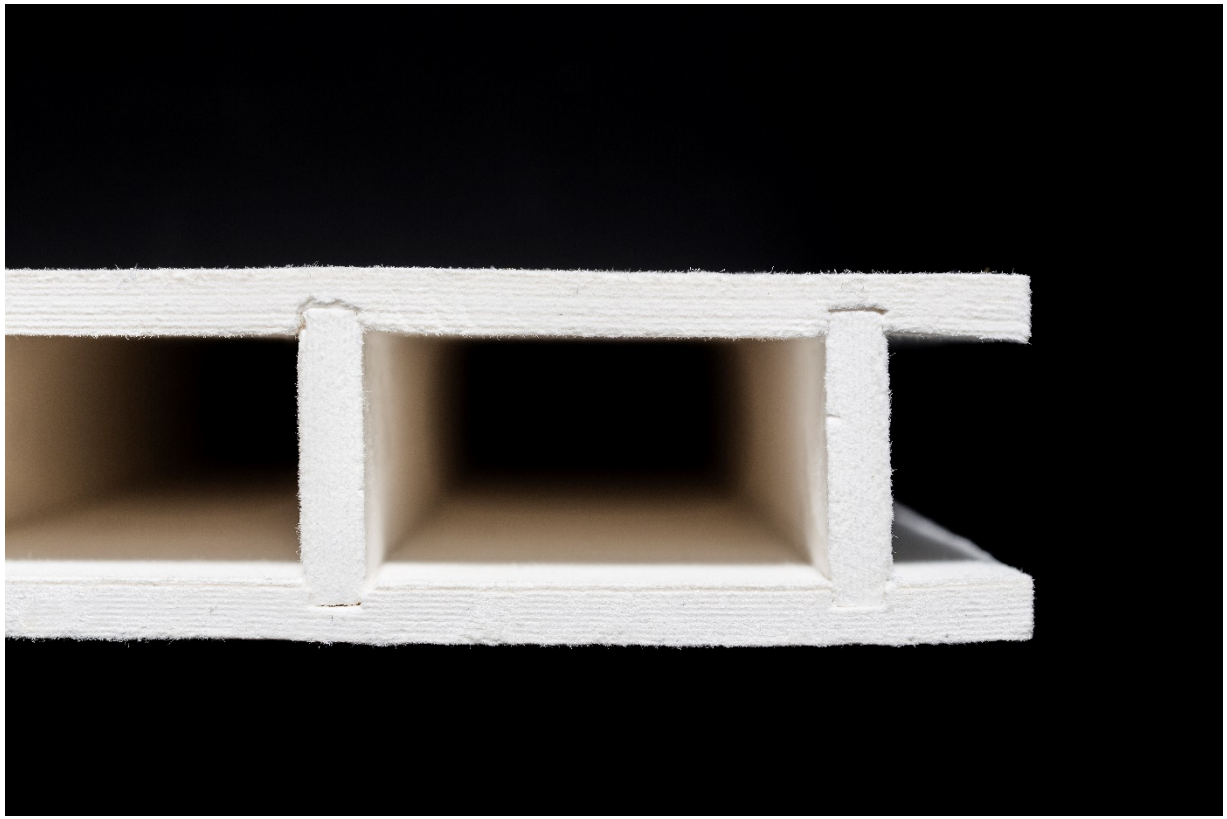
# Slab Structure



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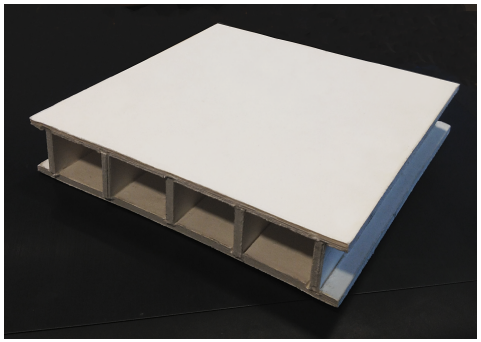
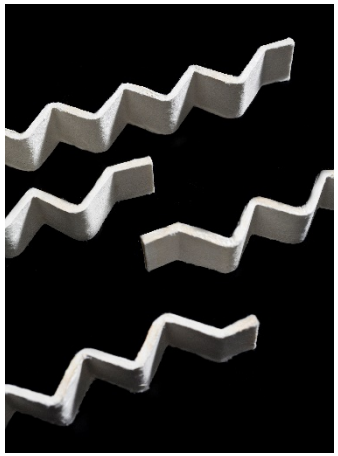


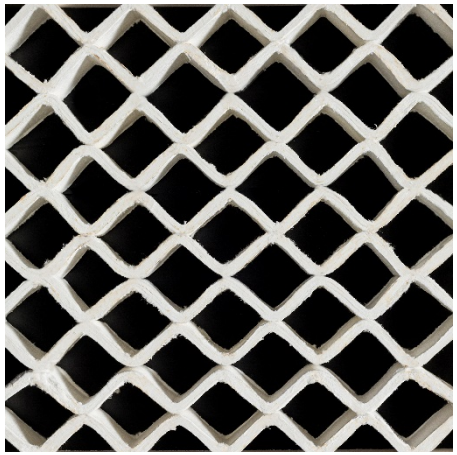
With cellulose fillings

Photo: Eeva Suorlahti

# ZigZag Structure



Moulded Slats

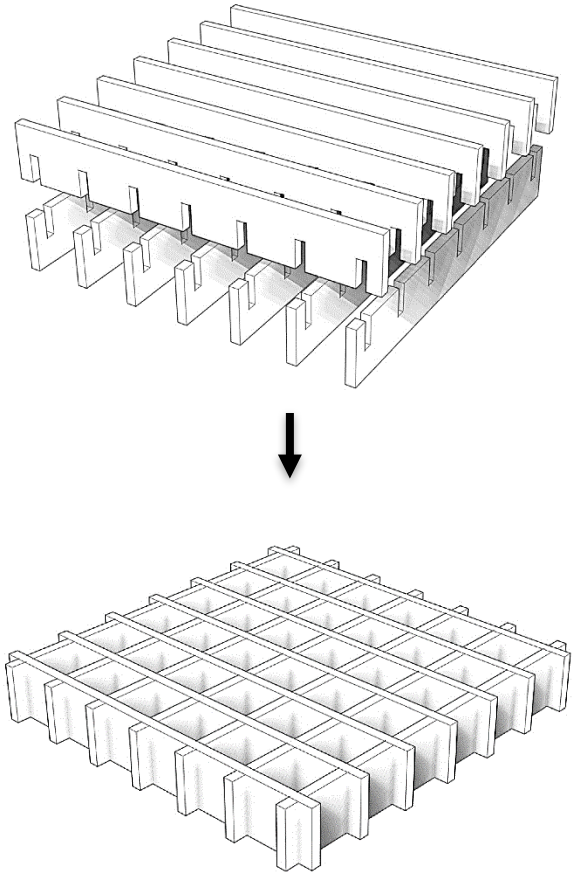


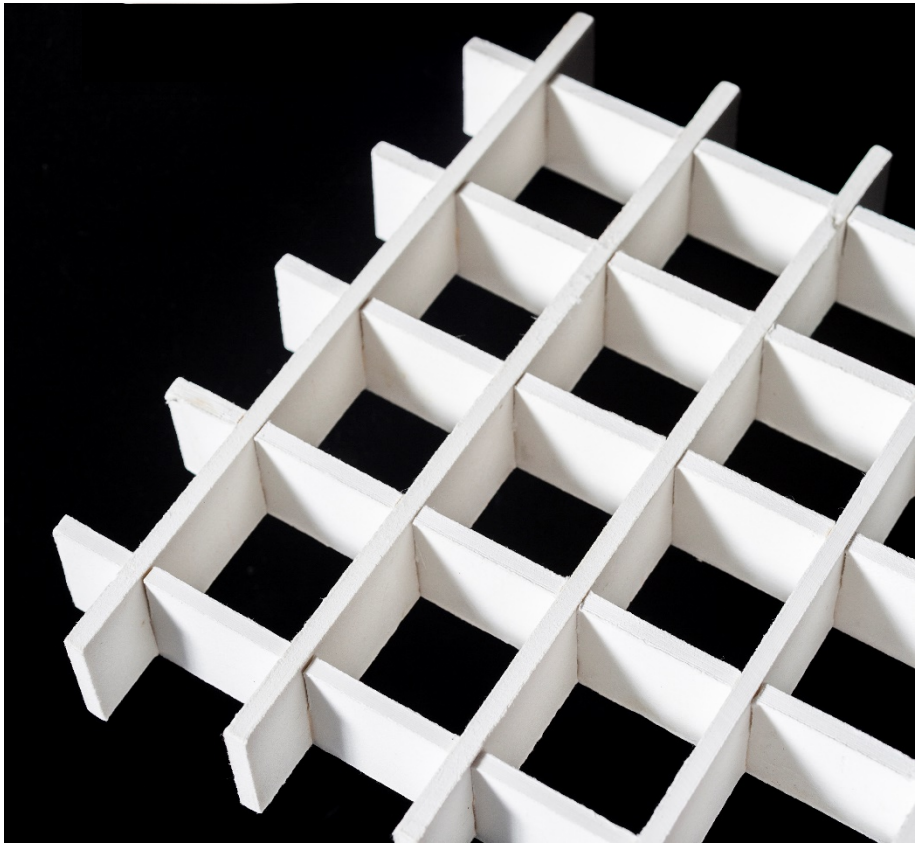
Core structure

Structure with boards

Photos: Eeva Suorlahti

# Grid Structure





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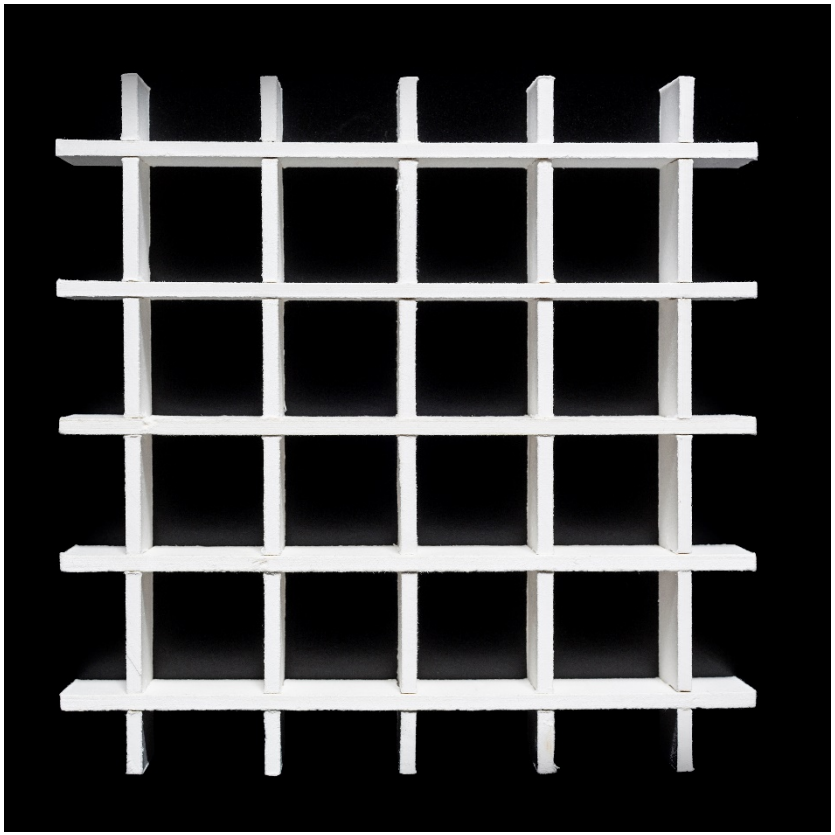
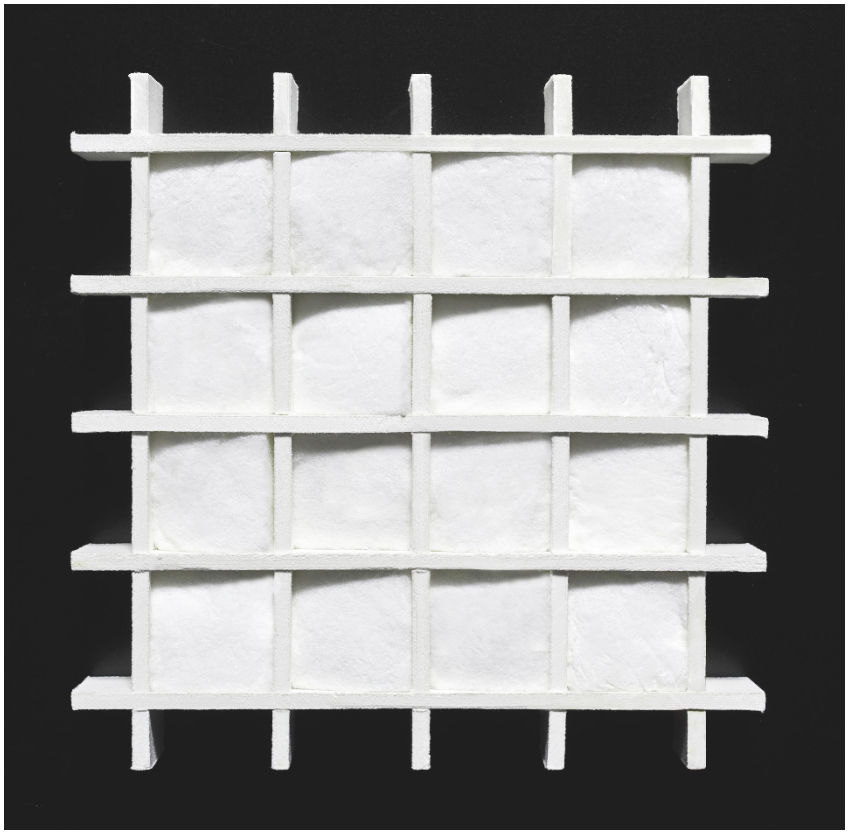
# Foam Filled Grid Structure





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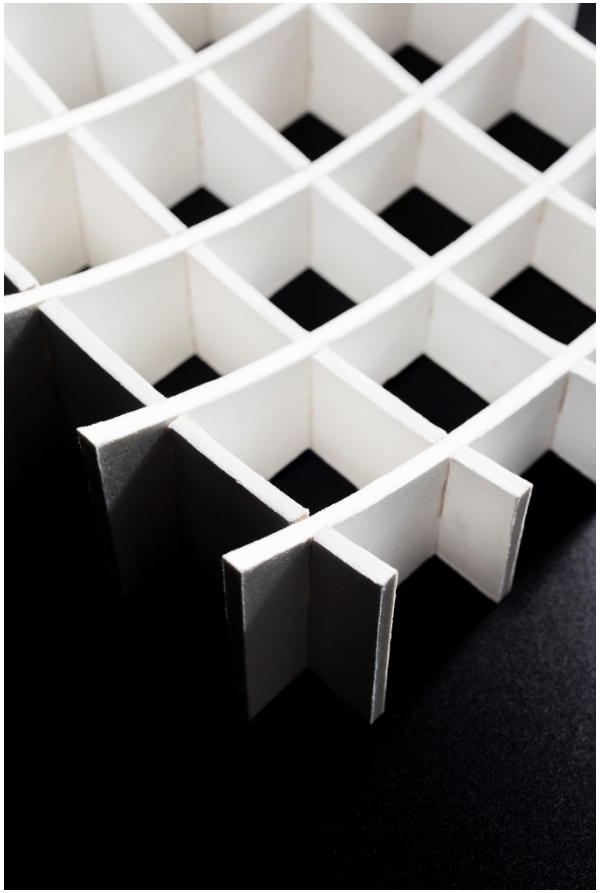
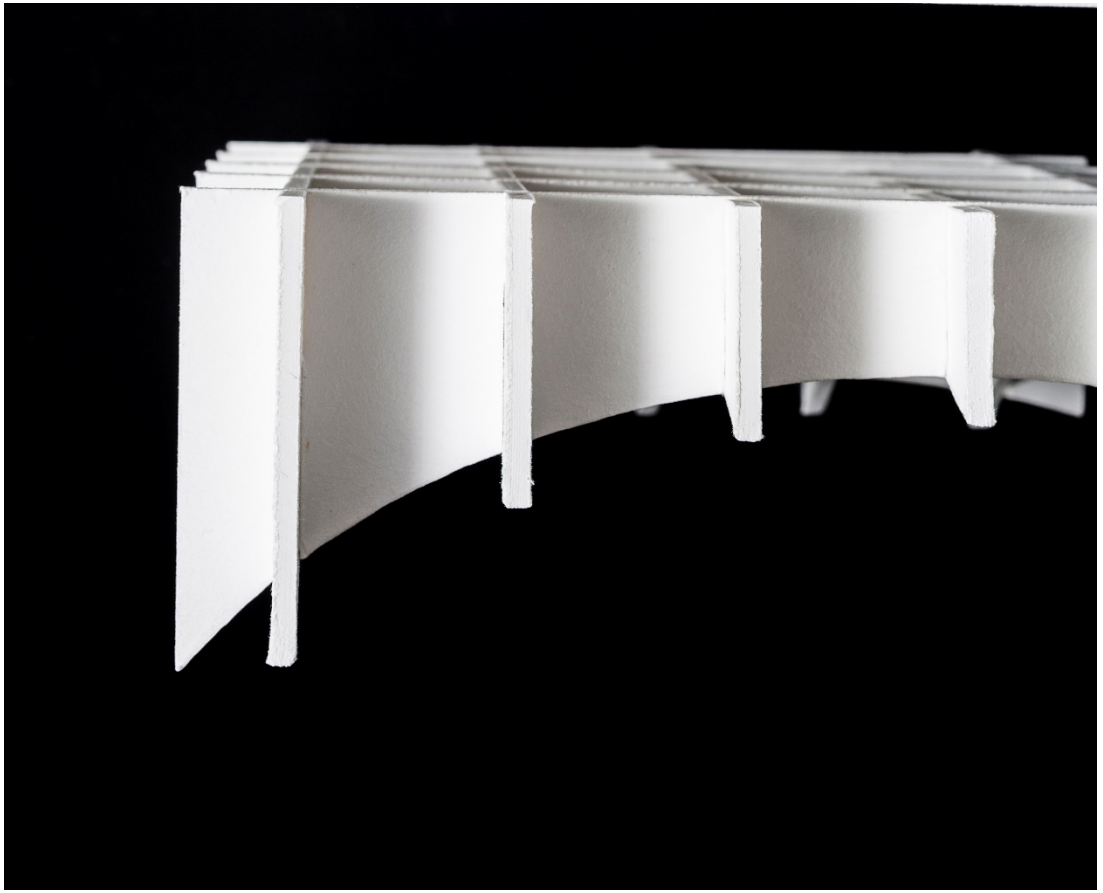
# Curved Grid Structure





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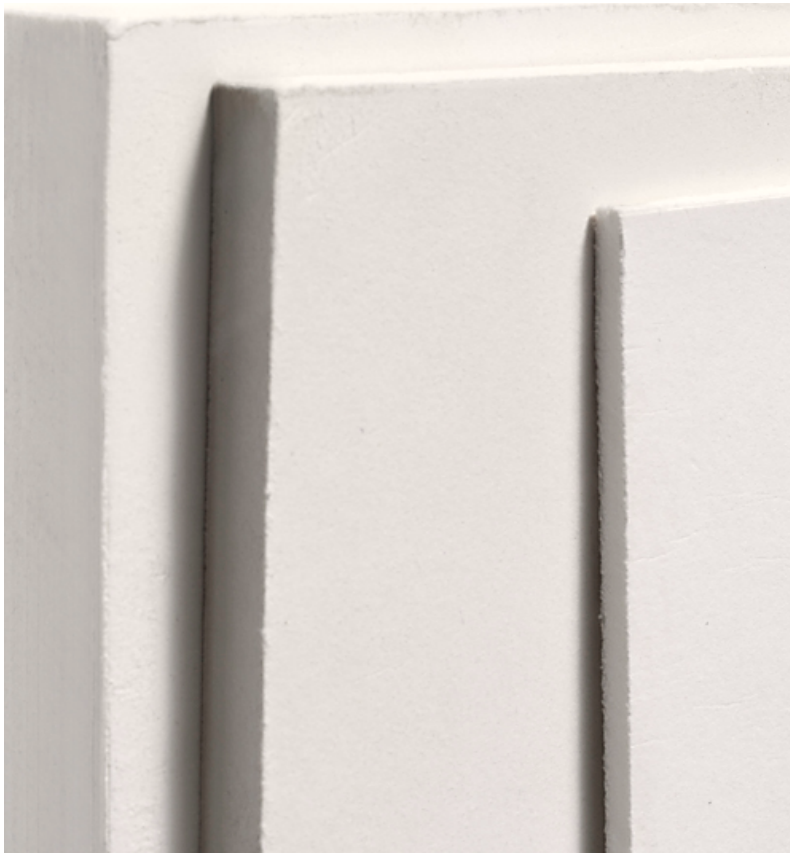
# Conclusions and Value Propositions

- Method to produce a novel structure combining nanocellulose and cellulose was developed
- Method was demonstrated by creating interior architecture design elements
- Strength properties surpass reference materials
- Surface of structure can be finished using
  - Patterns, pictures or 3D forms
- Bio-based and bio-degradable
- Economy: competitive raw material price, simple production process



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