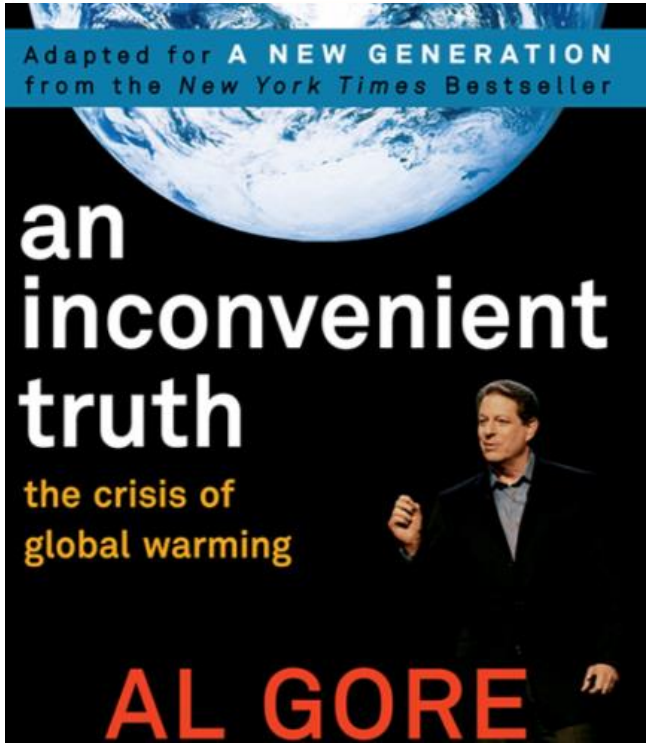
BIOKOMPOSITER I NÄSTA GENERATIONS 3D-PRINTADE PRODUKTER

MIKAEL LINDSTRÖM



150

tons crude oil pumped each second

54

tons steel produced each second

130

tons of cement produced each second

3000

TONS CELLULOSE PRODUCED EACH SECOND BY PHOTOSYNTHESIS

Photo: NASA

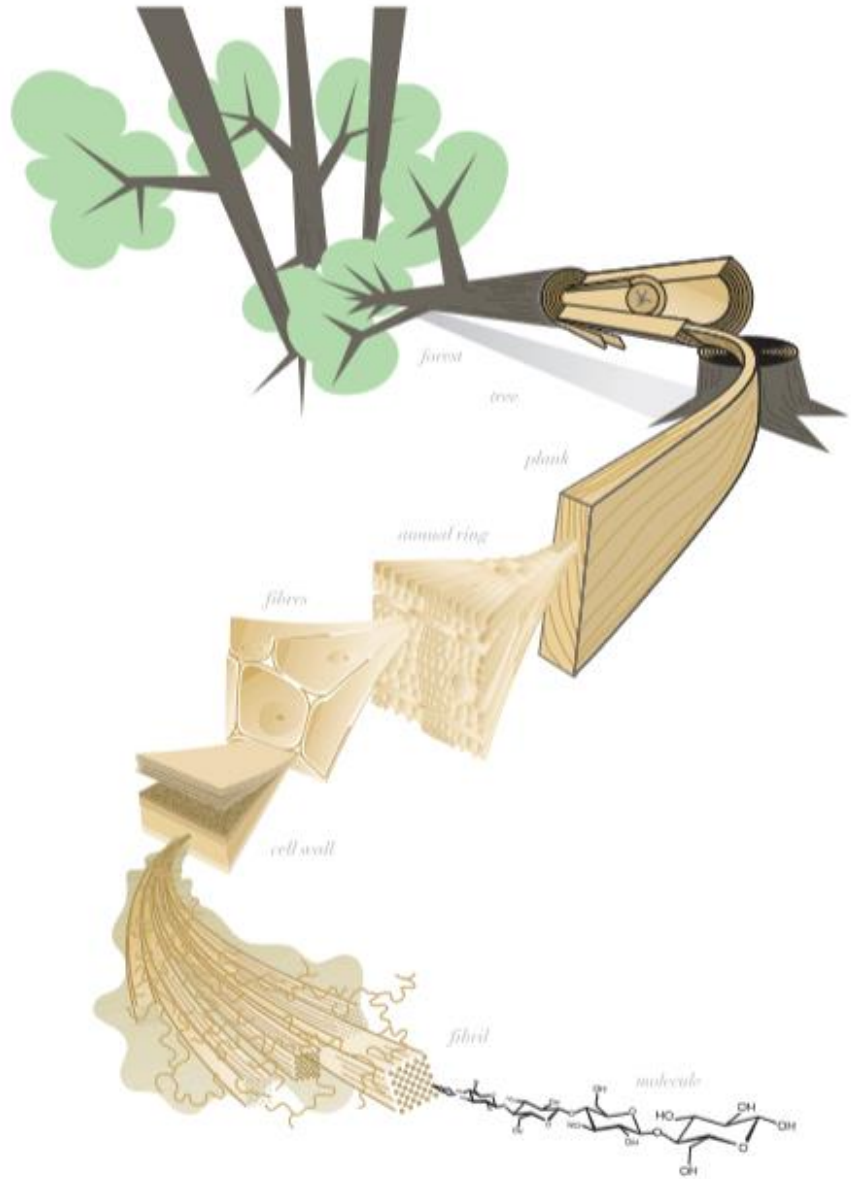


Figure 3. Hierarchical structure from the tree to the molecular level (Illustration: Airi Illiste).

WOULDWOOD

TreeD Printing to reduce waste and provide new opportunities in the timber construction industry

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Conventional processes in construction industry

Construction site at Royal Columbian Hospital, City of Vancouver

THE FORESTRY INDUSTRY AS A SOURCE OF MATERIAL. FIGURES ON LUMBER PRODUCTION AND WOOD WASTE IN SWEDEN

SWEDEN THIRD global producer of wood products

18.5 MILLION TONNES every year

[4% of total world production]

DOMINANT TIMBER PLANTS

(saw) CHIPS

(grind) PARTICLES

(pulping) CELLULOSE PULP

(wet-lay) PAPER

(wet-spinning) FIBRES

[add binder] (compression) MEDIUM-DENSITY FIBREBOARD (MDF)

[add binder] (compression) PARTICLE BOARD

[add binder] (compression) ORIENTED STRAND BOARD

(saw) LUMBER

(saw) SHEETS

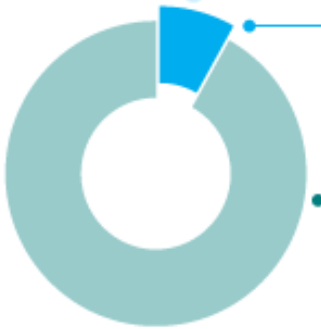
[add binder] (laminate) PLYWOOD

(saw) BEAMS & PLANKS

direct application in the construction industry

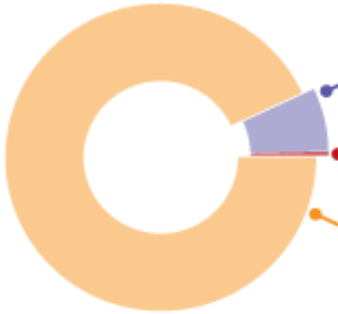
[non-hazardous] WOOD WASTE

1.42 MILLION TONNES every year



8.8% From construction industry [125,000 tonnes]

91.2% From other economic sectors [1,295,000 tonnes]



6.57% Recovery other than energy

0.04% landfill disposal

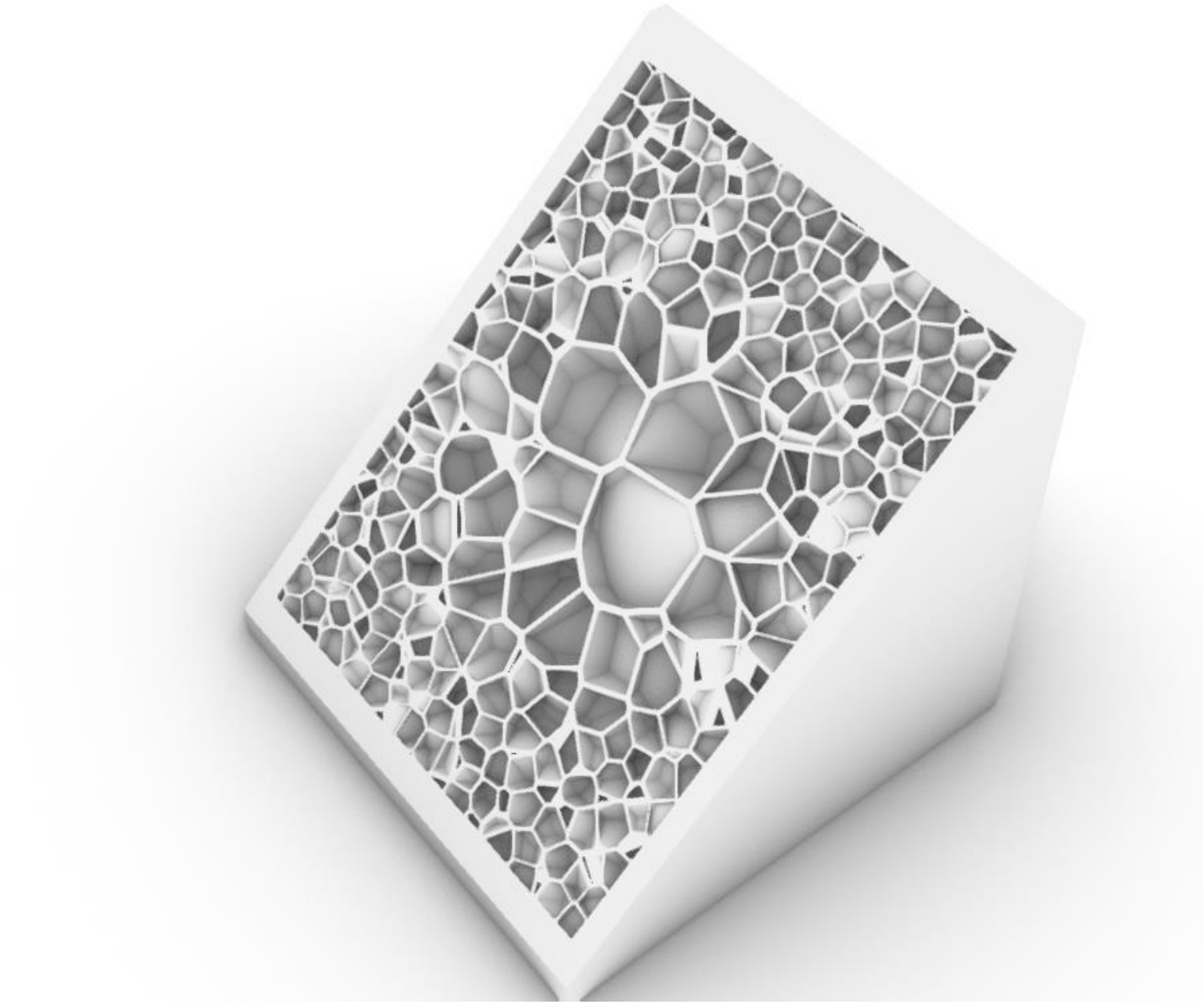
93.39% Energy recovery, incineration

Source: Based on "Growth material (R)evolution". Material ConneXion. 2015. Pictures: 7-themes.com (pine), www.pixelstalk.net (birch).

Sources: Eurostat, 2013. World Atlas, 2016.

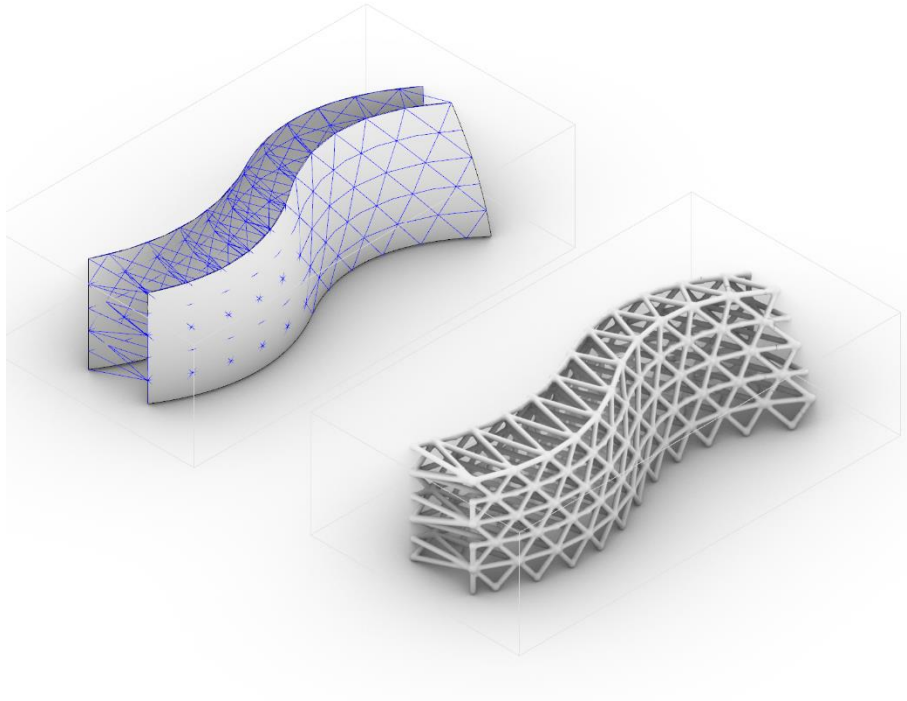
Vision WouldWood

To establish a sustainable, industrial Swedish design and manufacturing 3D-system based on Swedish technology and raw materials.

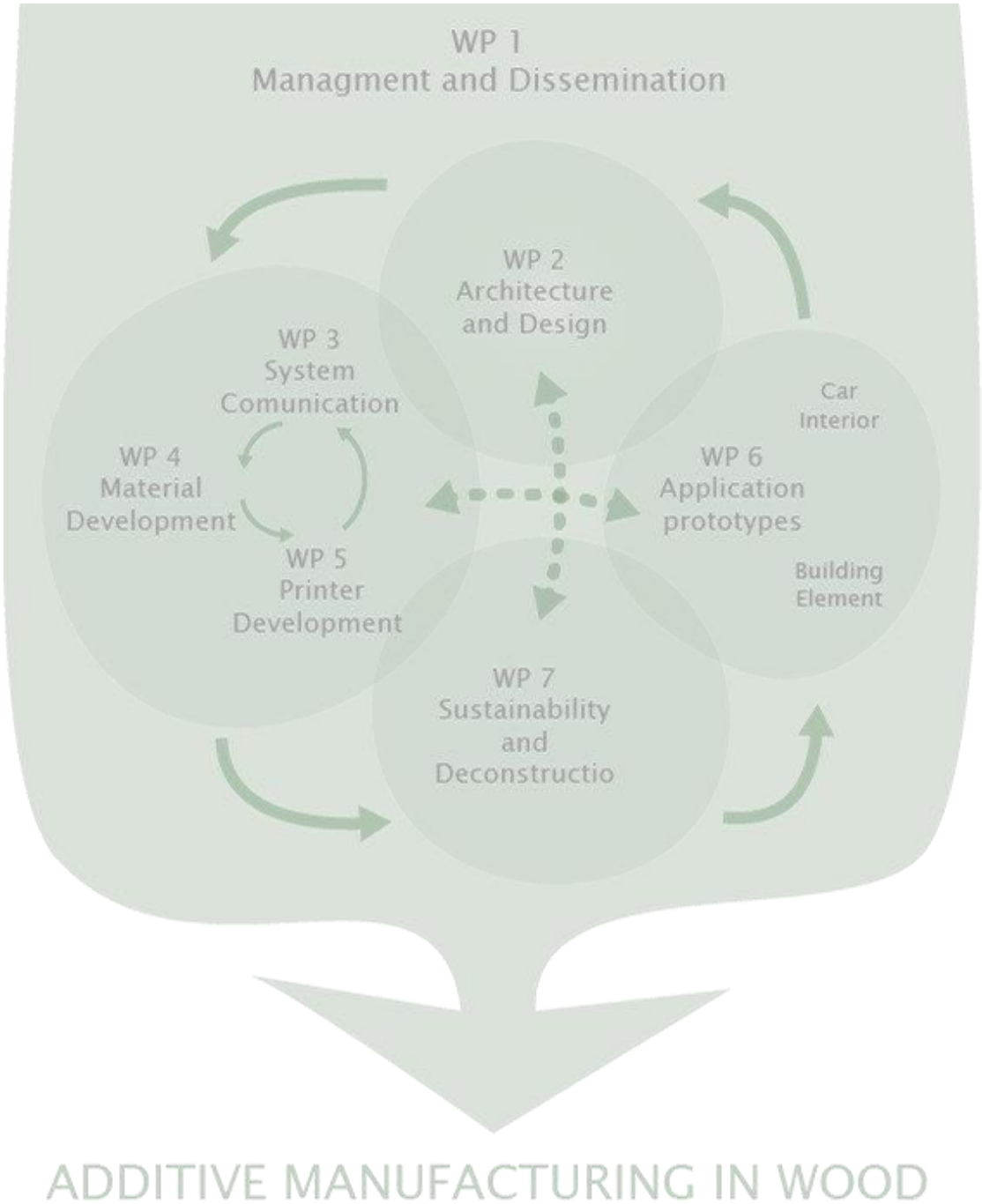


Mission WouldWood

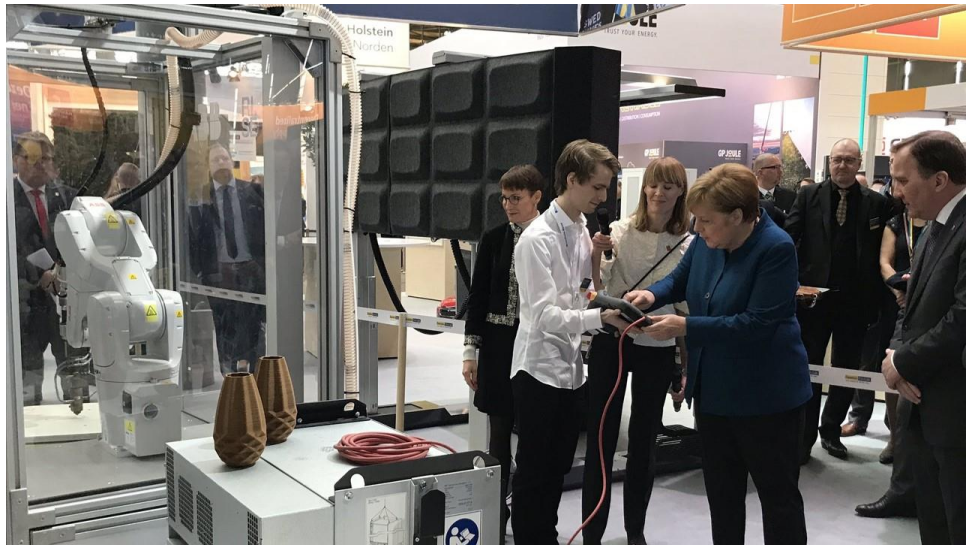
- Introduction and implementation of WouldWood, a system for big scale additive manufacturing for design and architecture, using wood-based material.



Our **Work Packages**



Work package 1



Management and dissemination

- Project management
- Information sharing
- ?

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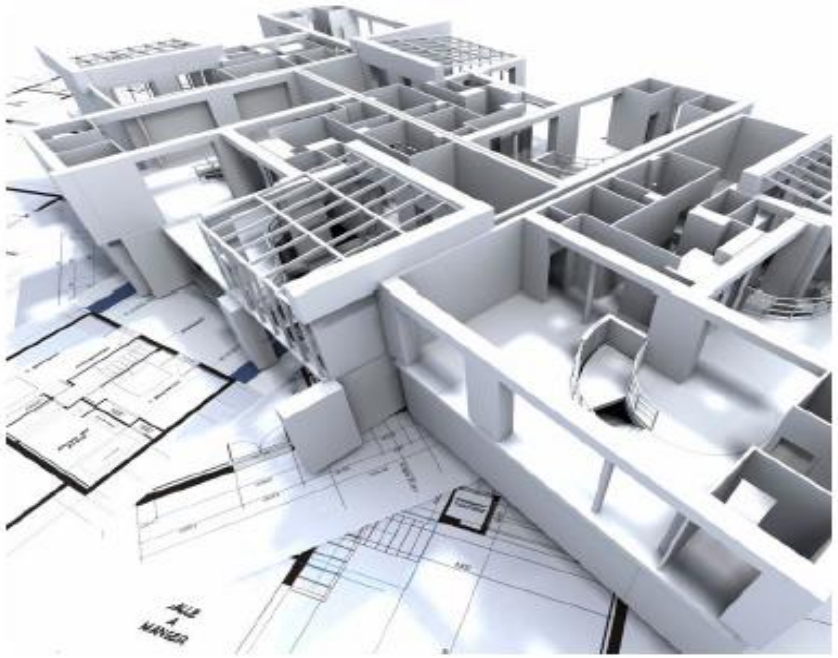
Work package 2



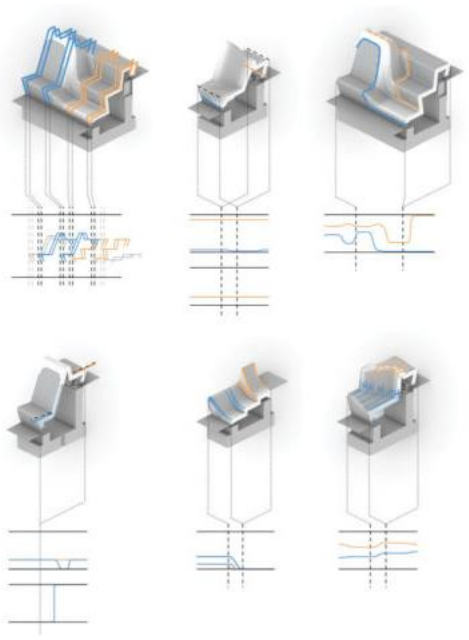
Architecture and design

- Design for additive manufacturing
- Application demonstrators
- Material requirements

white

Phenotype Studio

Work package 3



System Communication

- From CAD to code - secure the digital chain
- BIM (Building Information Modelling)
- Design, manufacturing and deconstruction of demonstrators

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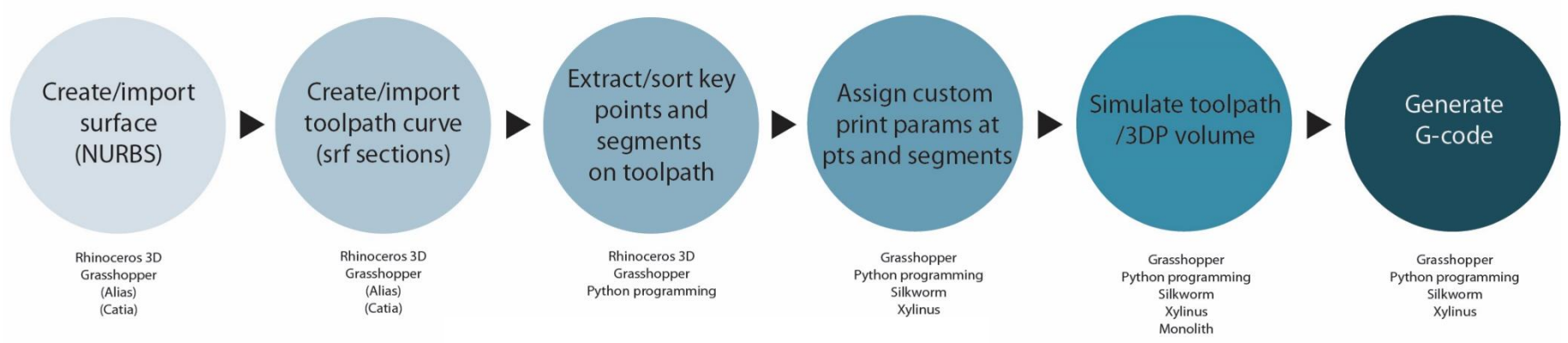
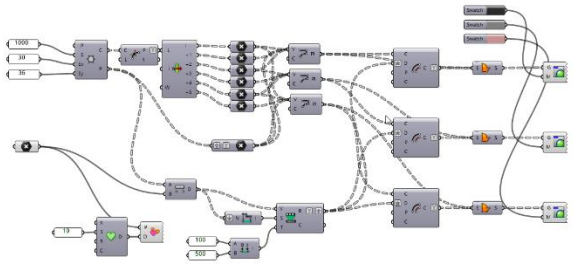
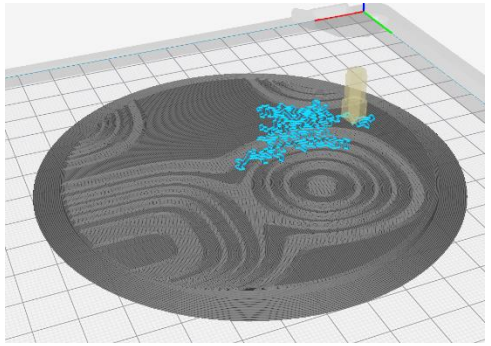
Software process

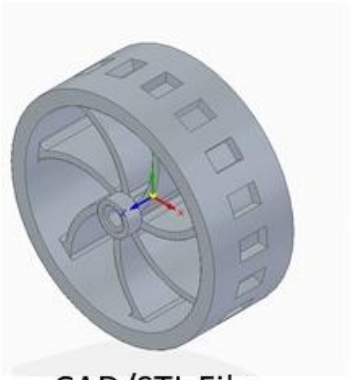
- Joined work by engineers and architects







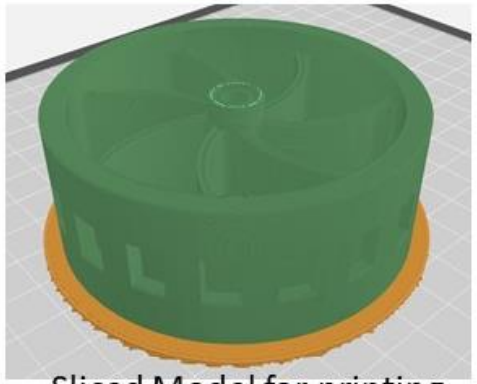
Software/post processing



CAD/STL File

Model sliced in slicing software

(Planar or non-planar method)

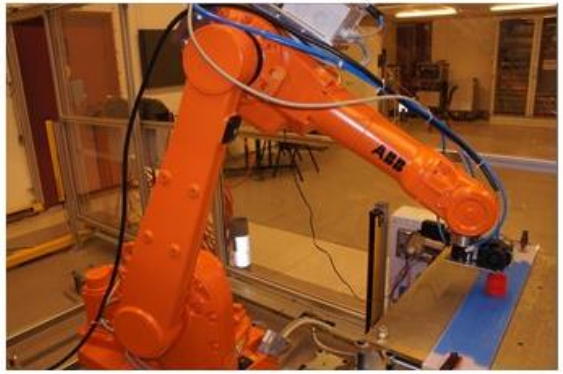


Sliced Model for printing

Converting slice data to machine G-code

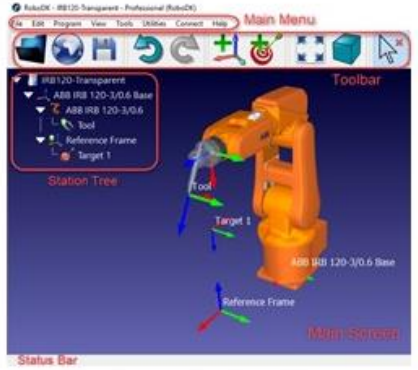
```
 89 G1 F600 X61.533 Y60.654 E2.39774
 90 G0 F2400 X62.098 Y60.654
 91 G1 F600 X61.293 Y61.46 E2.42616
 92 G1 X61.265 Y61.488
 93 G0 F2400 X61.293 Y62.025
 94 G1 F600 X62.664 Y60.654 E2.47452
 95 G1 X62.692 Y60.626
 96 G0 F2400 X63.23 Y60.654
 97 G1 F600 X61.294 Y62.59 E2.54282
 98 G1 X61.266 Y62.618
 99 G0 F2400 X61.294 Y63.156
100 G1 F600 X63.708 Y60.742 E2.62798
101 G1 X63.736 Y60.714
102 G0 F2400 X63.708 Y61.308
103 G1 F600 X61.294 Y63.722 E2.71314
104 G1 X61.266 Y63.75
105 G0 F2400 X61.294 Y64.288
106 G1 F600 X63.708 Y61.873 E2.79832
```

G - Code



Robot with printing head

Instructions from software to robot controller



Robot control software

G-code as input to robot control software/simulation environment

Work package 4

Material Development

- Thermoplastic materials containing cellulose fibers
- Additives for tailored performance
- 300 kg batches
- Thermoset for spatial printing

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storaenso

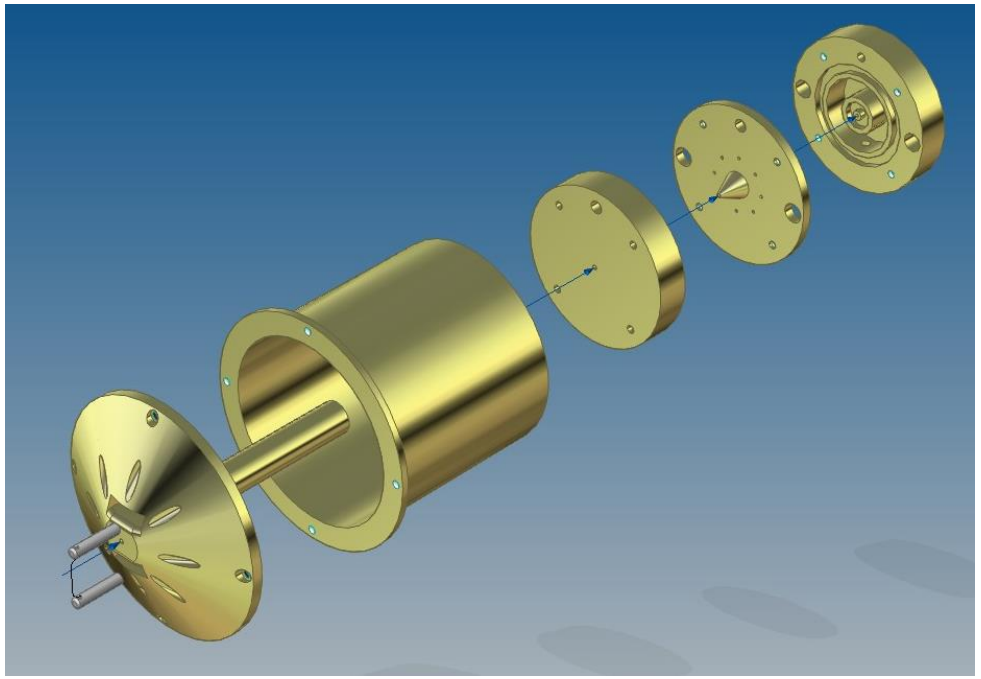
NESTE

Nouryon

SVENSKT TRÄ


ABB
RI
SE

Work package 5



Printer Development

- Tools for 3D-printing wood-based materials
- Printer head allowing fiber orientation
- Allowing spatial printing

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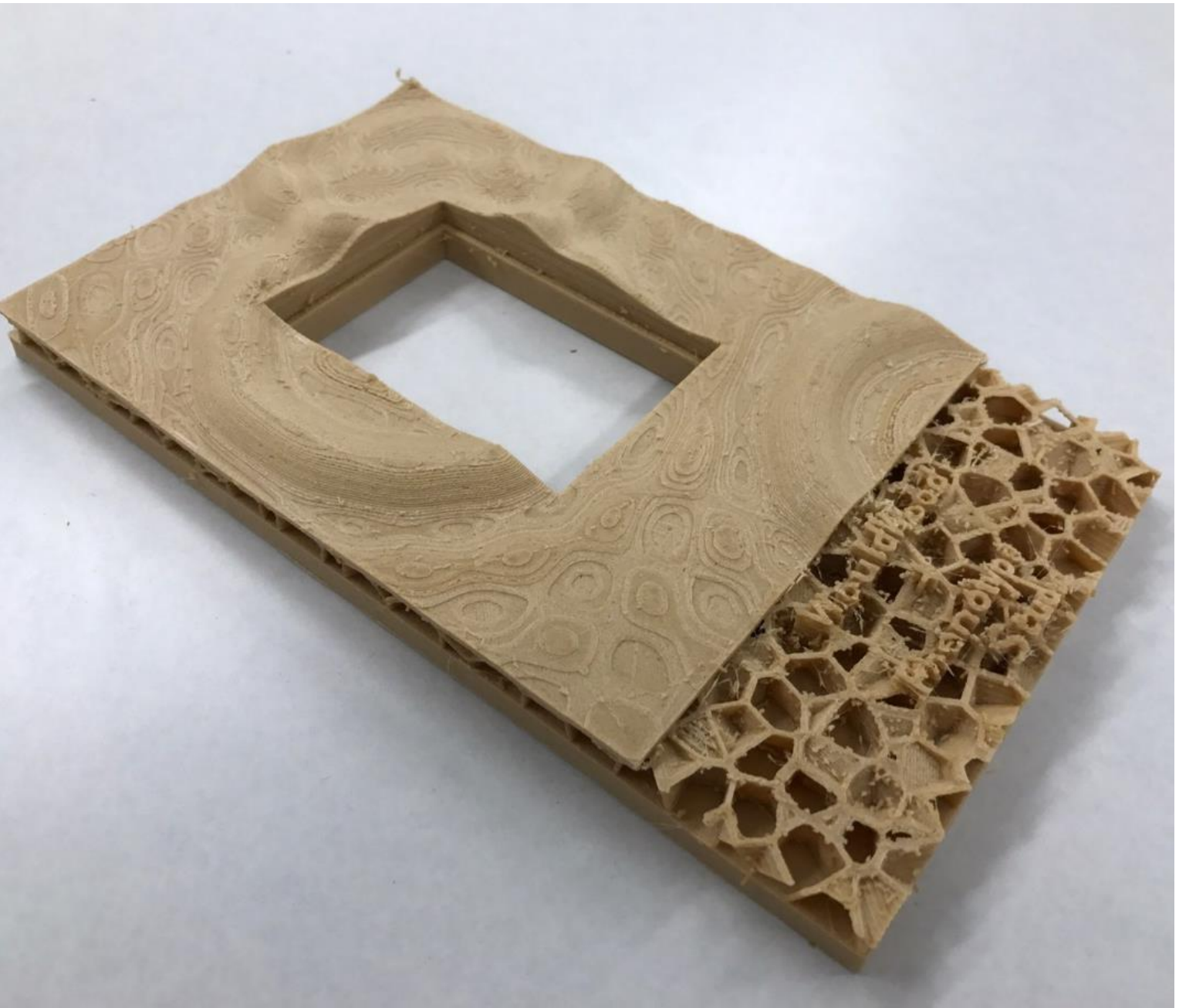
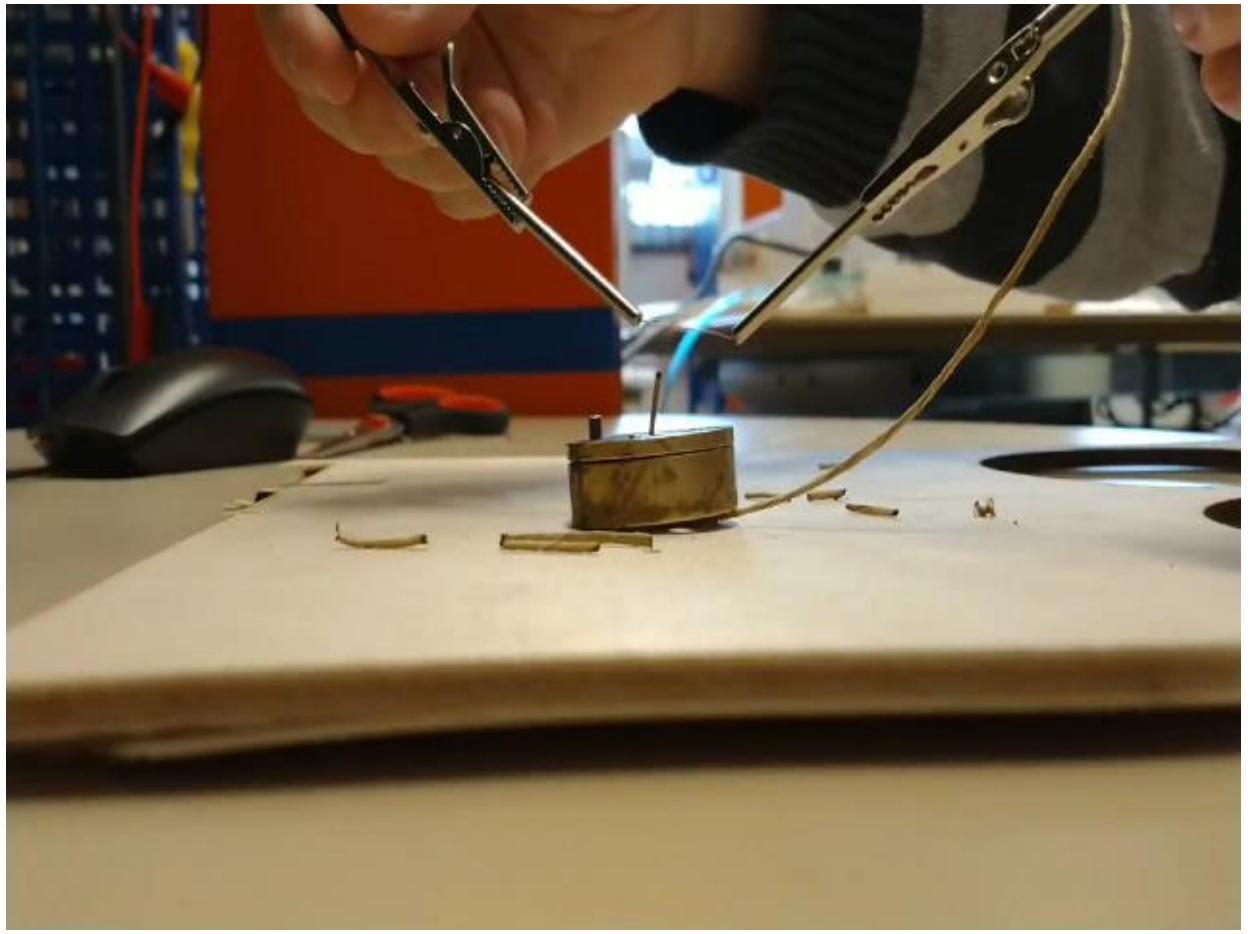
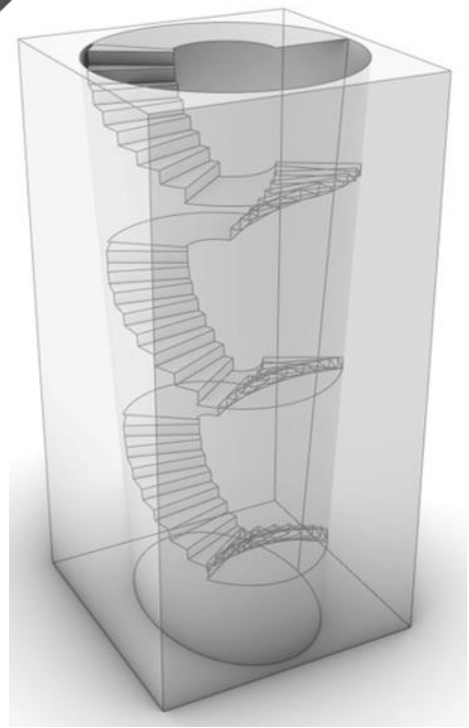


Work package 5



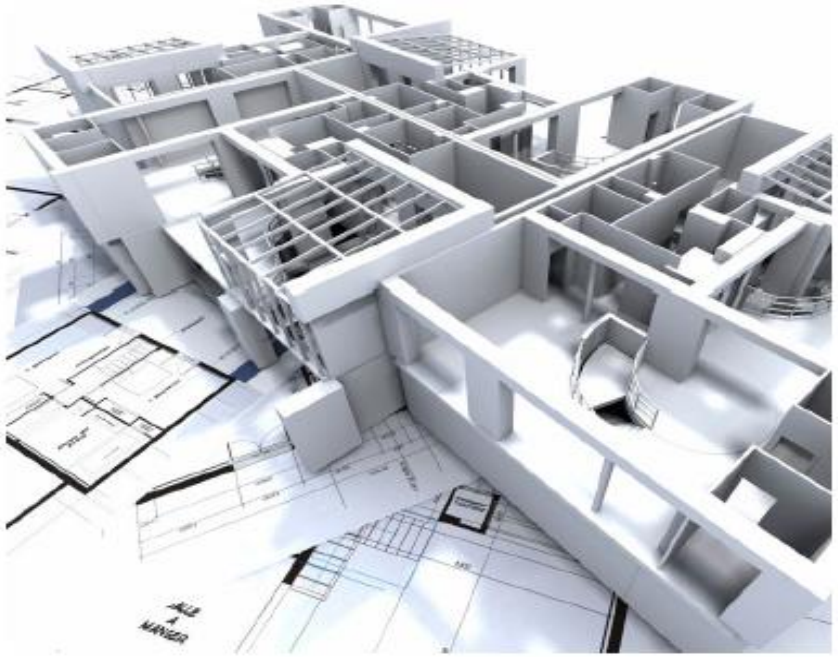
Work package 6



Application Prototypes

- Customized car interior for Scania
- A challenging housing detail for White arcitects
- A construction component for Veidekke

Work package 7



Sustainability and Deconstruction

- The potential environmental impact is analyzed for the product in a life cycle perspective (LCA)
- Cost over life cycle is also analyzed (LCCA)
- Recyclability strategies

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RAGN-SELLS
En del av kretsloppet

WouldWood **partners**

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CHALMERS UNIVERSITY OF TECHNOLOGY

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Coordinating Partner

SVENSKT TRÄ

NESTE

Nouryon

RAGN-SELLS En del av kretsloppet

stora enso

VEIDEKKE

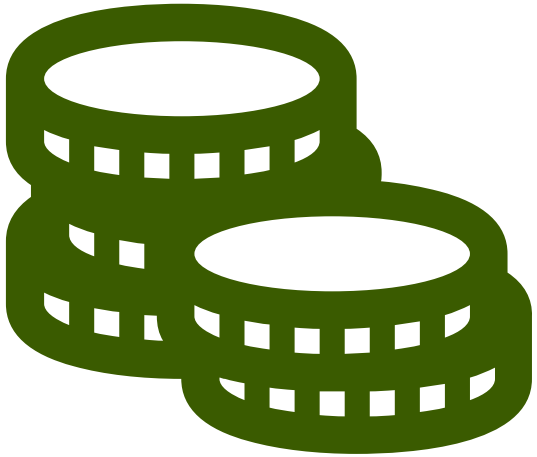
SCANIA

Phenotype Studio

VINNOVA Sveriges innovationsmyndighet

WouldWood – in numbers

13
Partners



Total budget
14 912 000 SEK

Project running
May 2018 – August 2020

VINNOVA
Sveriges innovationsmyndighet

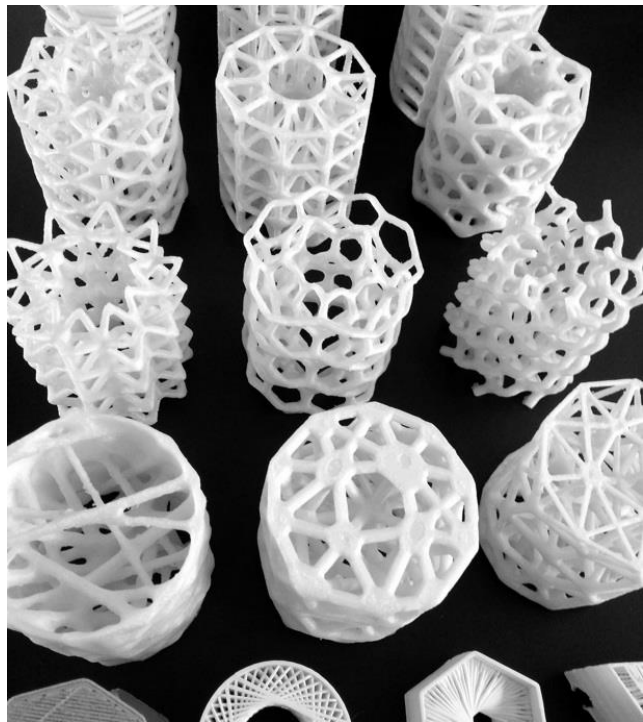
UDI2 Project

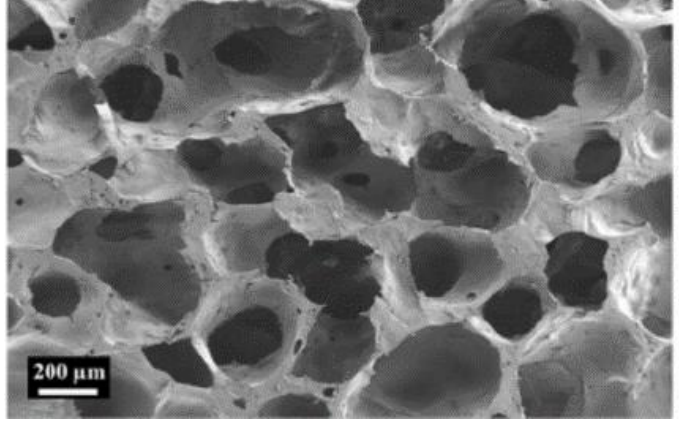
COMPETENCE PLATFORM BISC

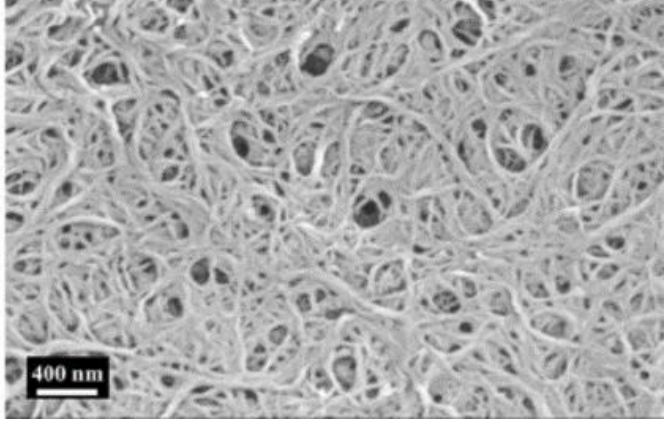
Biomaterial Scale Up Centre

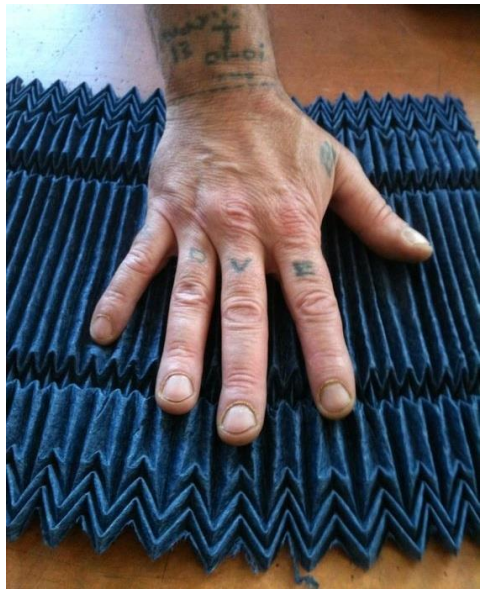
Leader: Dina Dedic

Bioeconomy



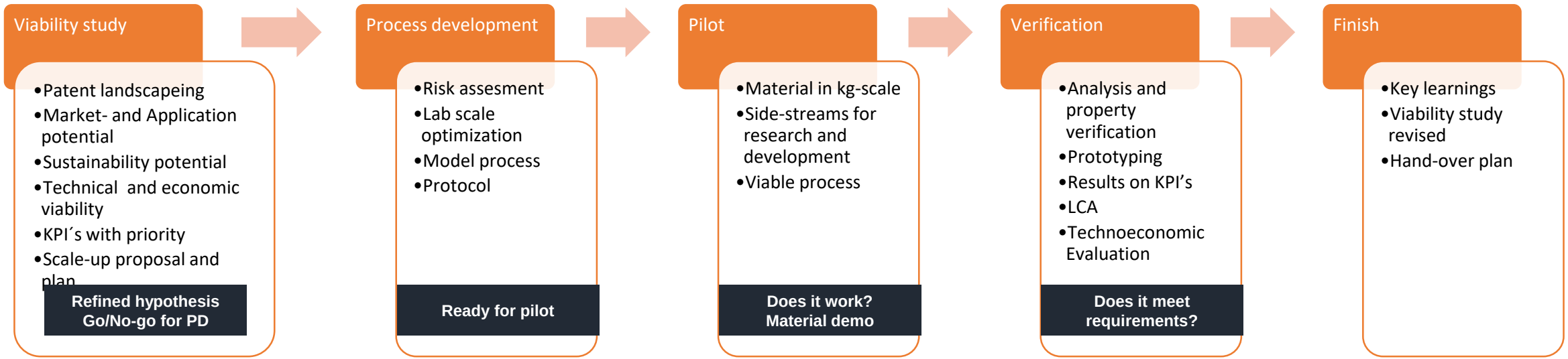






From component to material

BISC Case Modules



Thank you!

- For more information, visit WouldWood.se

- mikael.lindstrom@ri.se