

**Interreg**  
Baltic Sea Region



Co-funded by  
the European Union



CIRCULAR ECONOMY

**GlassCircle**

# Exploring full cycle circular economy for glass fibre industry

Aarhus, DK | 01/03/2024

Michail Beliatis

[interreg-baltic.eu/project/glasscircle](https://interreg-baltic.eu/project/glasscircle)



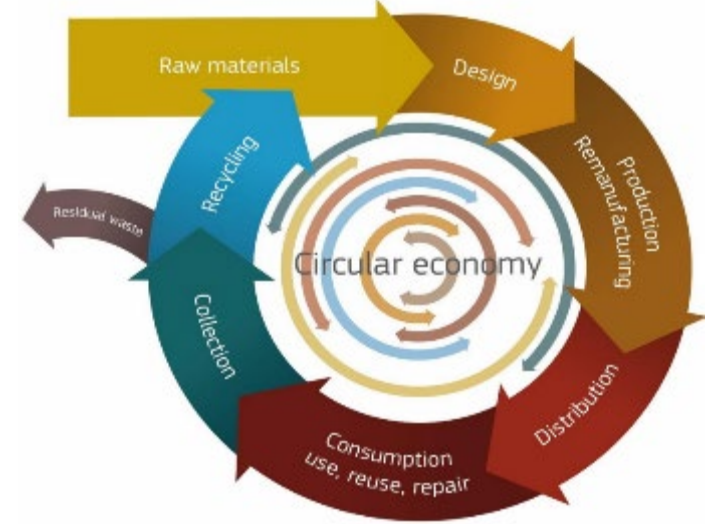


# Background

## How it all came together:

During glass fibre manufacturing, as well as in many composite manufacturing processes a significant amount of residue material is generated.

Currently, a large amount of this residue glass fibres product is buried in a landfill



# Background

## How it all came together:

Part of this residue consists of relatively good-quality glass fibres or fabrics

This problem of glass fibre residue is common for many companies dealing with glass fibre or composite manufacturing – thus it would be more efficient to work together to solve this issue

**In this project we want to promote the circular economy/ use in glass fiber industry** as possible solution to mitigate the generated large amount of residue glass fibre.

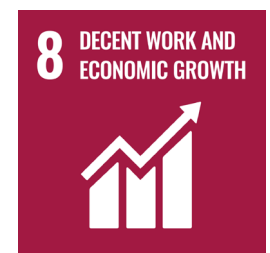
# GlassCircle

## Objectives

*The goal of the project:* To create a public awareness and a **strong cluster** consisting of key players within the **glass fibres life cycle** (manufacturers, users, re-users, recyclers, etc.) within the Baltic Sea region

The project aims to **bring together** *industry, experts, and scientists*, as well as *public authorities* within the field – to **exchange knowledge** and **discuss the possible solutions** and **necessary next steps** for faster change from a linear to a circular economy within the glass fibre and composite industry.

# Reaching UN sustainability goals





# Project funding

## Interreg Baltic Sea region

This project funded by European Union for 2 years and this project call funds four priorities:

1. Innovative societies;
2. Water-smart societies;
3. **Climate-neutral societies;**
4. Cooperation governance

# Project consortium

## Partners from Latvia, Sweden, Denmark

*Project lead partner:*

**Riga Technical University (Latvia)**

Contact person: Liva Pupure, [Liva.Pupure@rtu.lv](mailto:Liva.Pupure@rtu.lv)



*Project partners:*

**Lulea University of Technology (Sweden)**

Contact person: Roberts Joffe, [Roberts.Joffe@ltu.se](mailto:Roberts.Joffe@ltu.se)

**Aarhus University (Denmark)**

Contact person: Michail Beliatas, [mibel@btech.au.dk](mailto:mibel@btech.au.dk)

**Podcomp AB (Sweden)**

**Hitachi Energy Sweden AB, Composites (HPAG) (Sweden)**

**Valmiera Municipality Government (Latvia)**

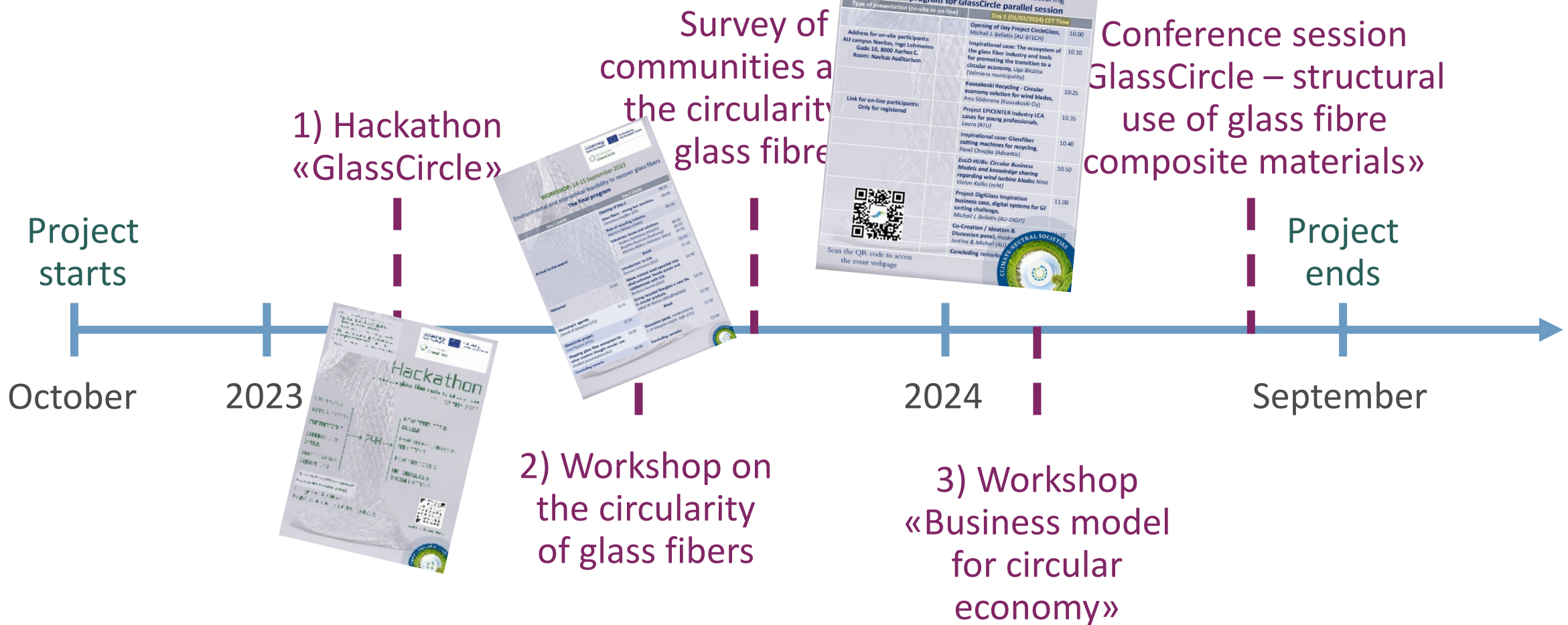
**HITACHI**

**VALMIERAS  
NOVADS.**



# Project activities

## Timeline



# Previous 1st activity

## Hackathon «GlassCircle»

### Hackathon «GlassCircle»

1. Participants from Latvia, Denmark and Sweden
2. Five new ideas generated
3. Student groups did excellent in the short time span they got.

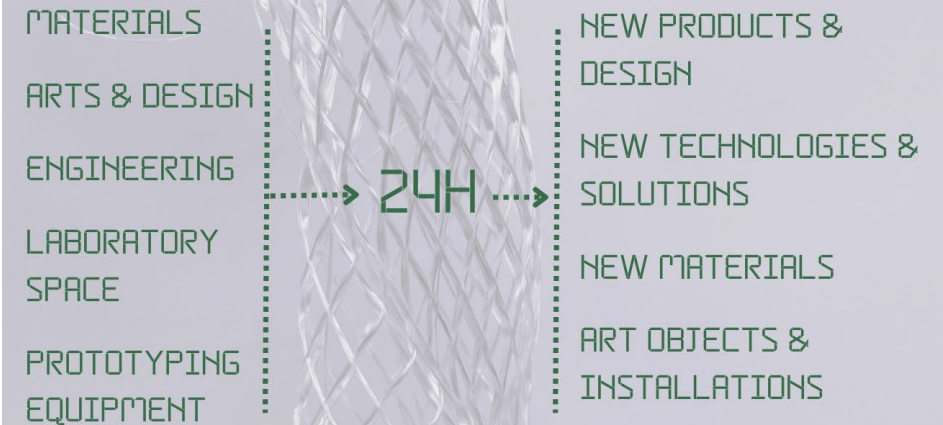
- Hybrid event: join online or on-site:  
Riga Technical University (Latvia)  
Aarhus University (Denmark)  
Lulea University of Technology (Sweden)
- Mentors for teams: high-level experts
- Prize pool of more than 1000.- EUR
- International and cross-disciplinary team work



# Hackathon

on residue glass fiber material circular use

10 – 12 MAY, 2023



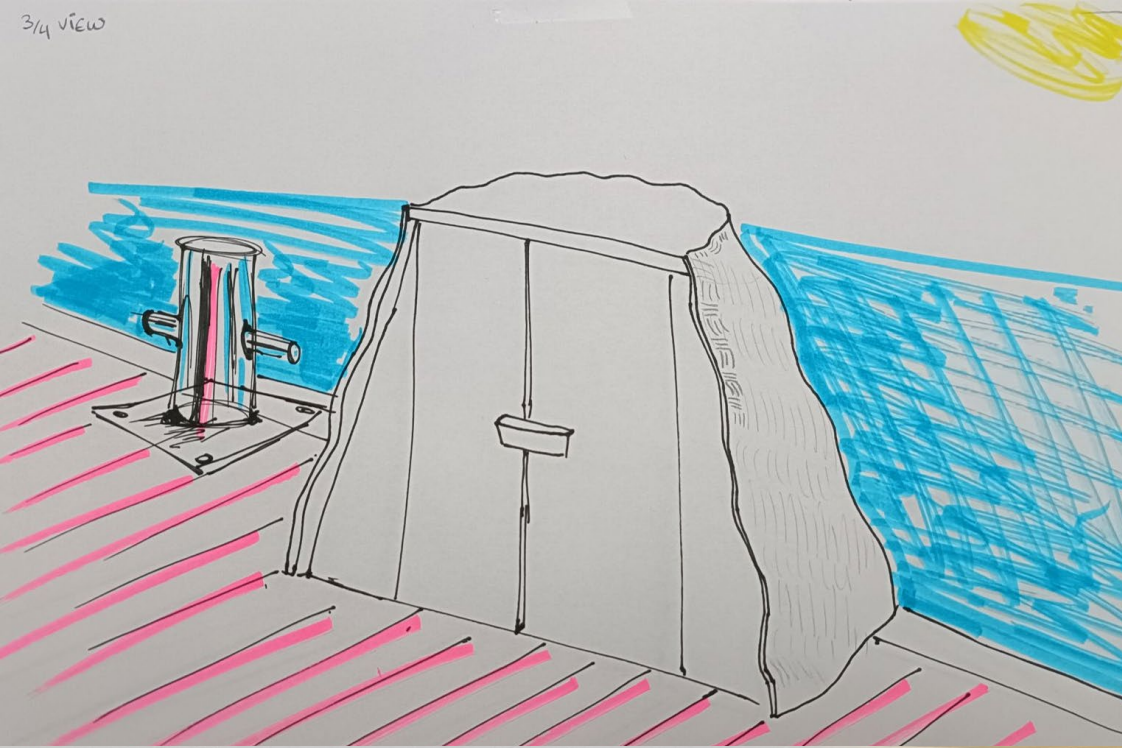
Students from different area of subjects are welcome to apply

To register click [HERE](#).

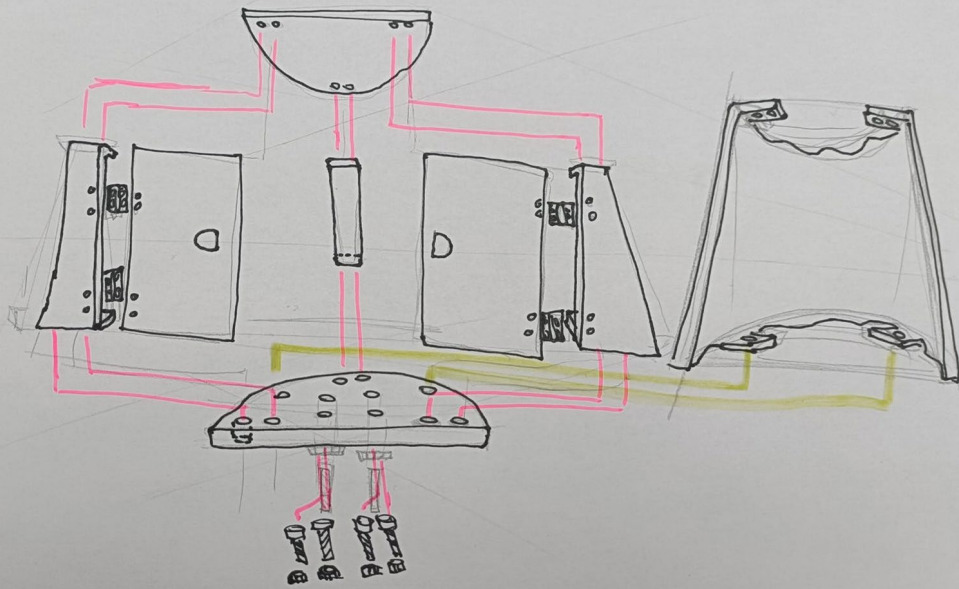
Registration open: until [28th April 2023](#)







Exploded VIEW



## Winners:

Team 2: Interior design or furniture elements with specific requirements:

**Locker out of glass fibers – from marine industries residue.**



# EcoFlight Component

- Designed and manufactured using recycled glass fiber materials
- Compression molding with 3D-printed molds – 1<sup>st</sup> draft!
- Sustainable alternative to traditional RC drone components made from virgin materials
- This component is placed within the structural frame
- Offers comparable performance to conventional components while reducing the reliance on new raw materials



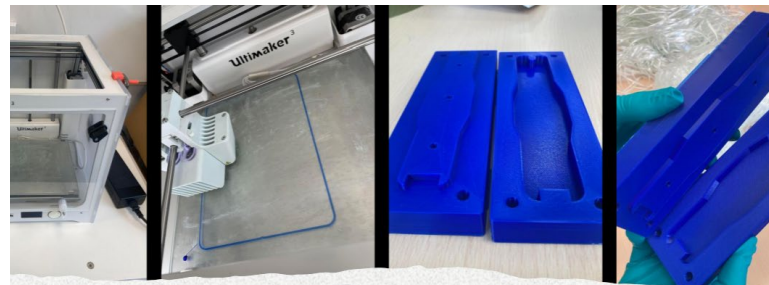
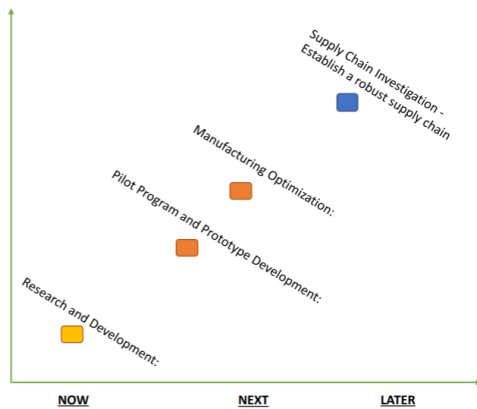
## Business Case (CE): Recycled Glass Fiber Drone Components

- **Market Demand:** Customers who prioritize eco-conscious practices that value sustainable and environmentally friendly solutions
- **Cost Savings:** Recycling glass fiber drone components can lead to significant cost savings for both manufacturers and end-users - reduce the need for raw materials and lower production costs
- **Sustainability and Corporate Social Responsibility (CSR):** aligns businesses with sustainability goals and demonstrates a commitment to CSR
- **Regulatory Compliance:** Recycling initiatives are gaining momentum globally, and governments are increasingly implementing regulations and incentives to promote recycling practices
- **Long-Term Cost and Supply Chain Stability:** Reducing reliance on virgin materials, less vulnerable to price fluctuations and disruptions



## Roadmap for Introducing Recycled Glass Fiber Drone Components:

- Later
- Next
- Now



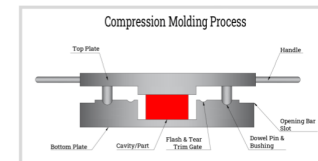
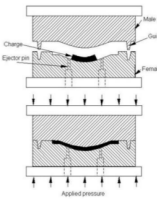
Instant compression molding method for recycling of glass fiber materials

# 2nd Place



## Compression molding

- Speed and design flexibility
- Customization
- Enhanced Material Properties: Glass fiber-reinforced materials offer excellent strength, stiffness, and lightweight properties



(Dhananjayan, V. K. (2013). Design And Analysis Of A Compression Molded Carbon Composite Wheel Center. <https://rc-library.uta.edu/uta-ir/handle/10106/11909>

# 3rd place:

Team 3: Glass fiber textiles as a framework for concrete



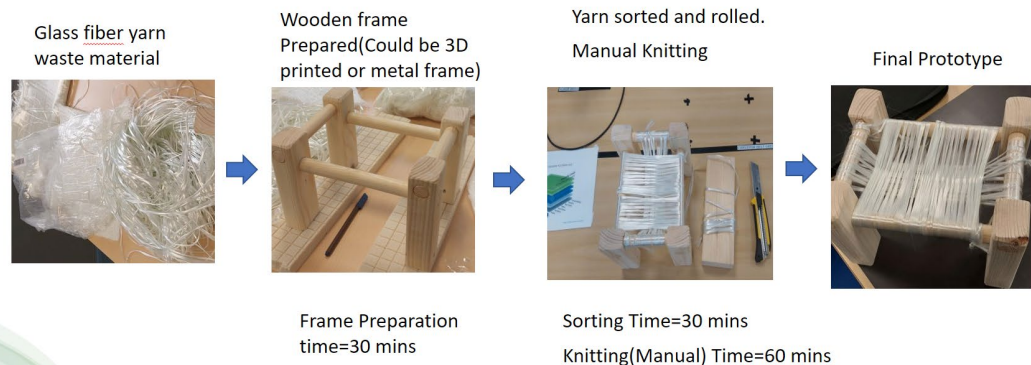


## Team 1: Transforming wind turbine blades into practical objects

## Team 5: Reuse of glass fiber – home furniture



### Prototype Process



Total effective manufacturing time around=2 hours

Around 25 meters length of fiber yarn used to build this prototype.

# Previous activity 2<sup>nd</sup> Workshop

## 14-15 September, 2023

### Dissemination - Workshop

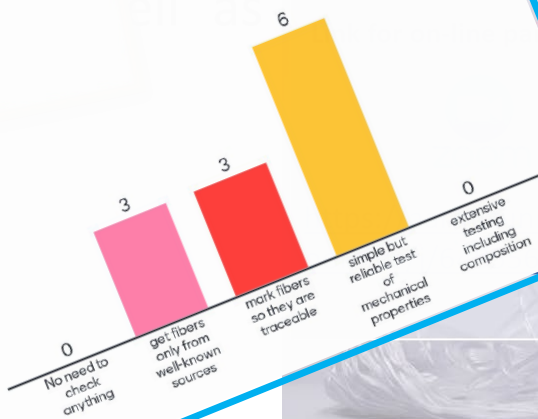
#### 1. Expert

What do we need to know about the residue fibers before we can use them in new industry?

11 responses

elemental setup  
 material history  
 gf grade  
 mineralogy  
 mechanical properties  
 glass composition  
 size  
 source  
 size

How to ensure the quality of GF from residue?



Register [here](#) (participation in the workshop is free of charge).



**WORKSHOP: 14-15 September 2023**

Environmental and economical feasibility to recover glass fibers

The final program

Day 1 (14/9)		Day 2 (15/9)	
Welcome!	15.00	Opening of Day-2	08.55
Workshop's agenda, Zainab Al-Maqdasi (LTU)	15.15	Glass fibers - strong but sensitive, Christina Scheffler (IPF)	09.00
GlassCircle project, Liva Pupure (RTU)	15.30	Role of recycling industry, Martins Niklass (ZAAO)	09.30
Mapping glass fiber ecosystem for value creation through circular use, Student Association (AU)	16.00	Industries: issues and solutions - Anders Holmberg (Hitachi) 09.50 - Birgitha Nystrom (PodComp) 10.10 - Martins Millers (Valmiera Glass) 10.30	
	16.30	<b>Break</b>	10.50
		Introduction to LCA, Carmen Cristescu (SLU)	11.10
		Waste mineral wool upcycled into alkali-activated facade panels and cobblestones with LCA, Barbara Horvat (ZAG)	11.40
		Giving recycled fiberglass a new life in circular products, Jakob W Nielsen (MILJØSKÆRM)	12.10
		<b>Break</b>	12.30
		Discussion panel, moderated by Z. Al-Maqdasi and R. Joffe (LTU)	12.50
		Concluding remarks	13.50

Scan the QR code to access the event webpage



# GlassCircle 2nd Hackathon & Workshop

Register [here](#) (participation in the workshop is free of charge).



## 14-15 September, 2023

**WORKSHOP: 14-15 September 2023**

Environmental and economical feasibility to recover glass fibers

The final program

Day 2 (15/9)		
15.00	Opening of Day-2	08.55
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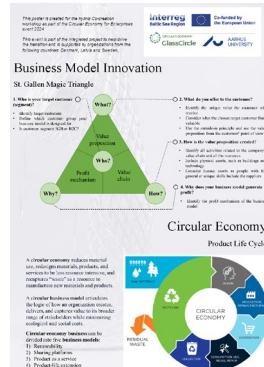
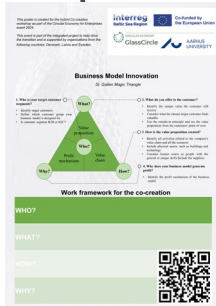
Click the QR code to access the event webpage

# Current activity 3<sup>rd</sup> Workshop

## 1st March, 2024

### Dissemination - Workshop on Business Model co-creation for Fiber Glass circular economy

1. Experts from industry, academia and policy makers will come together to present successful circular economy cases and co-create about GF business models;
2. During the workshop participating companies will have the possibility to describe their needs in terms of recycling glass fibres and have the opportunity for networking with leading experts in LCA as well as composite professionals



Register [here](#) (participation in the workshop is free of charge).



Co-creation WORKSHOP: 1<sup>st</sup> March 2024

Business Model Co-creation / Ideation for Digital Circular Economy in GlassFiber Large Scale Manufacturing  
The final program for GlassCircle parallel session

Type of presentation (on-site or on-line)	Day 1 (01/03/2024) CET Time	
	Opening of Day Project CircleGlass, Michail J. Beliatis (AU-BTECH)	10.00
Address for on-site participants: AU campus Navitas, Inge Lehmanns Gade 10, 8000 Aarhus C. Room: Navitas Auditorium	Inspirational case: The ecosystem of the glass fiber industry and tools for promoting the transition to a circular economy, Liga Biezīņa (Valmiera municipality)	10.10
	Kuusakoski Recycling - Circular economy solution for wind blades, Anu Söderena (Kuusakoski Oy)	10:25
Link for on-line participants: Only for registered	Project EPICENTER Industry LCA cases for young professionals, Laura (RTU)	10.35
	Inspirational case: Glassfiber cutting machines for recycling, Pavel Chvojka (Advantis)	10.40
	EoLO-HUBS: Circular Business Models and knowledge sharing regarding wind turbine blades Nina Vielen-Kallio (echt)	10.50
	Project DigiGlass Inspiration business case, digital systems for GF sorting challenge, Michail J. Beliatis (AU-DIGIT)	11.00
	Co-Creation / Ideation & Discussion panel, moderated by Justina & Michail (AU)	11.10
	Concluding remarks	



Scan the QR code to access the event webpage



# More about current activity

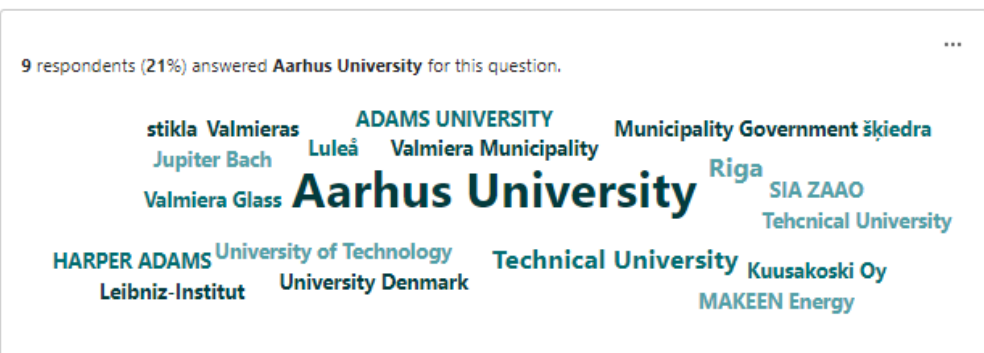
## 1st March, 2024

### Attendee confirmation for GlassCircle Workshop (3) Business Co-Creation

42 Responses

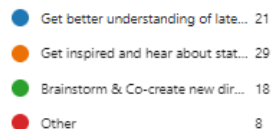
13:00 Average time to complete

Active Status



#### 6. Purpose of joining this event.

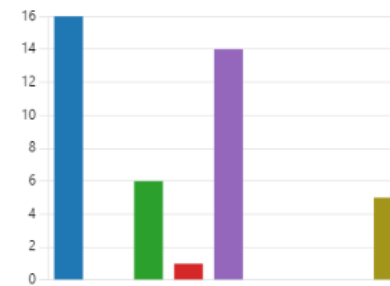
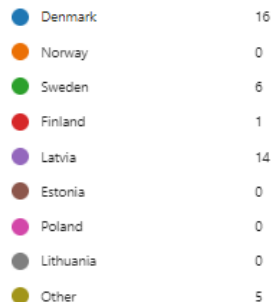
[More Details](#)



#### 7. In which country are you based ? (only for statistical purpose reporting in the project)

[More Details](#)

[Insights](#)



#### 8. Would you be interested to participate in an Interview/Survey later on?

[More Details](#)

[Insights](#)



Register [here](#) (participation in the workshop is free of charge).



Co-creation WORKSHOP: 1st March 2024

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	Concluding remarks	



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The workshop is organized as parallel session within [Circular Economy for Enterprises](#) event organized by Aarhus University, CircThread, Clean Cluster, and TechCircle.

# Digital Survey/Interview for developing strong cluster establishment

<https://forms.office.com/e/Q6rxpnU89M>

A Digital Survey as entry point to digital Atlas tool for mapping the GlassFiber Circular Economy Ecosystem in Nordic/Baltic Countries and identify successful green business cases as *light-houses* of circular economy among different ecosystems as well as bottlenecks in Horizontal and Vertical applications.



interreg Baltic Sea Region Co-funded by the European Union  
GlassCircle

## GlassCircle

This survey is part of the research project **GlassCircle**, which is run as a collaboration between Riga Technical University (Latvia), Lulea University of Technology (Sweden) and Aarhus University (Denmark). The GlassCircle project aims to explore a complete cycle circular economy for the glass fibre industry. The project is co-funded by the European Union, Interreg Baltic Sea Region. The main goal of this project is to help glass fiber and composite manufacturing companies move towards a circular economy, reduce the produced waste and the negative impact on the environment as well as to adapt more efficient use of available resources thus making the industry more sustainable. In order to achieve this goal, the first step is to build a strong network, establish a full cycle circular economy within this industry and exchange knowledge that different members of the glass fiber industry have acquired.

This survey targets businesses whose **activities involve working with glass fiber-containing materials** (including raw glass fiber, production of glass fiber products, and services related to products containing glass fiber and waste). The survey aims to identify businesses working with glass fiber and create a network creation and research database. The survey will take approximately 2-3 minutes to fill out.

Thank you for taking part in this survey.

If you want to hear more about the project, please contact Liva Pupure <[Liva.Pupure@rtu.lv](mailto:Liva.Pupure@rtu.lv)> , Roberts Joffe <[Roberts.Joffe@itu.se](mailto:Roberts.Joffe@itu.se)> , Michail Beliatz <[mibel@titech.au.dk](mailto:mibel@titech.au.dk)>.

Project Webpage: <https://interreg-baltic.eu/project/glasscircle/>

\* Required

### Information about business 🗒

The following questions are related to information about the business working with glass fiber materials and products.

**1**

Does your business work with glass fiber materials and/or products containing glass fiber? 🗒

Yes

No

**2**

Does your business generate glass fiber waste? \* 🗒

Yes

No

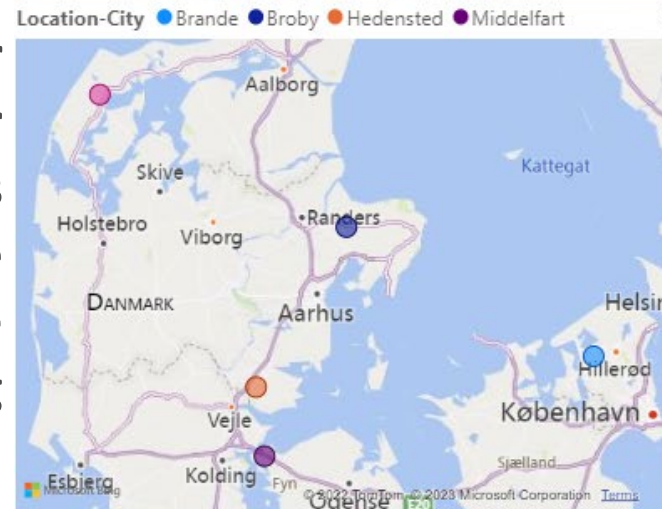
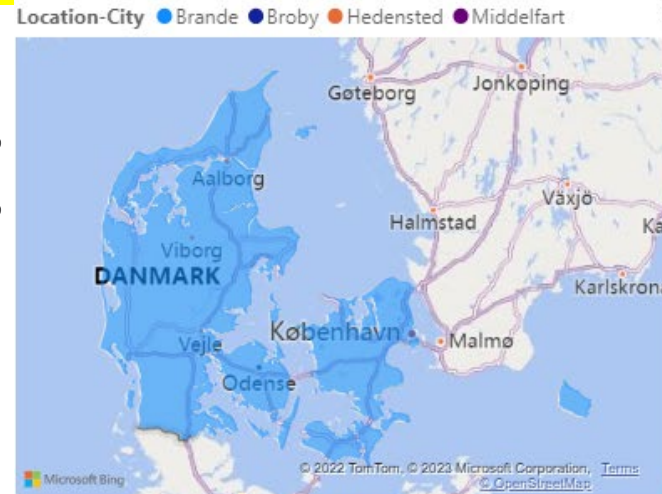
# CircleGlass- Digital tool for mapping the GlassFiber Circular Economy Ecosystem in Nordic Countries

Get access in the open digital Atlas tool it allows you to:

Map key players for Glass Fiber within the glass fibers life cycle (manufacturers, users, re-users, recyclers, etc.) within the Baltic Sea region and

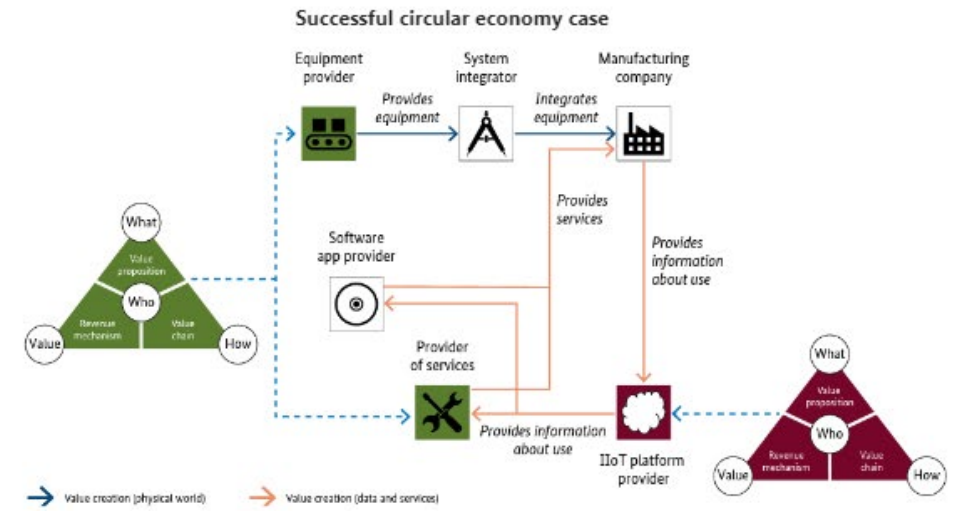
Create a value circular network mapping to foster best practices & connections between glass fiber residue donors with possible receptors for boosting circular use of fiberglass.

First Name of company and First Location-Address by Location-Country and Location-City



Location-Country	Location-City	Name of company	Production	Re-use/repair	Recycle	Supply Chain	Consumption
------------------	---------------	-----------------	------------	---------------	---------	--------------	-------------

Denmark	Brande	Siemens Gamesa					X
Denmark	Broby	Dansk Polyglas A/S	X				
Denmark	Hedensted	Poca	X				
Denmark	Middelfart	Fiberline composites					
Denmark	Ringkøbing	Gurit Wind Systems A/S					
Denmark	Roslev	ReFiber			X		



# One demo product from Glass Fiber reuse

## Supplementary Material

### Circular Economy Strategies at Nordic Industrial Ecosystems: Creating Additive Value from Residue Glass Fiber & Circular Business Model Innovation

Mads K. Nielsen, Anders M. S. Jakobsen, Michael Lystbæk, Michail J. Bellatis\*

Department of Business Development and Technology, Aarhus University, Birk Centerpark 15, 7400 Herring, Denmark

\*Corresponding author: [mibel@btech.au.dk](mailto:mibel@btech.au.dk)

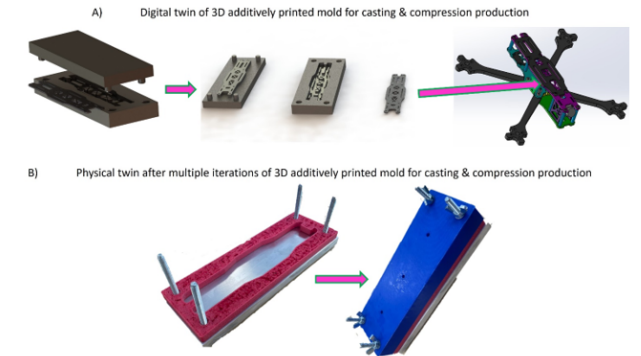
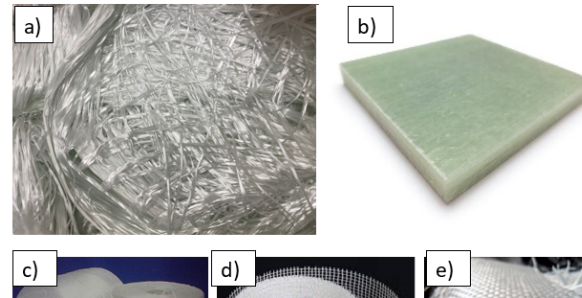


Figure SM 2, a) Digital twin of 3D printed casting/compression mold for developing an aeronautical component for the open-source drone frame SourceOne V5 b) the physical twin of 3D printed casting/compression mold for developing an aeronautical component utilizing reused glass fiber material.

# Developed one demo product from Glass Fiber reuse

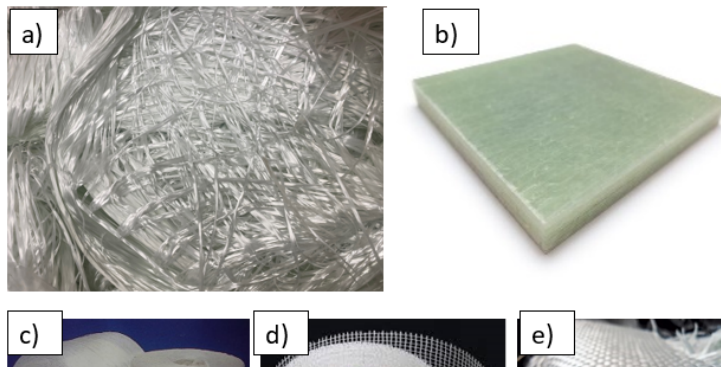
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Michael K. Nielsen, Anders M. S. Jakobsen, Michael Lystbæk, Michail J. Beliatis\*

Department of Business Development and Technology, Aarhus University, Birk Centerpark 15, 7400 Herning, Denmark

\*Corresponding author: [mibel@btech.au.dk](mailto:mibel@btech.au.dk)



To be published soon

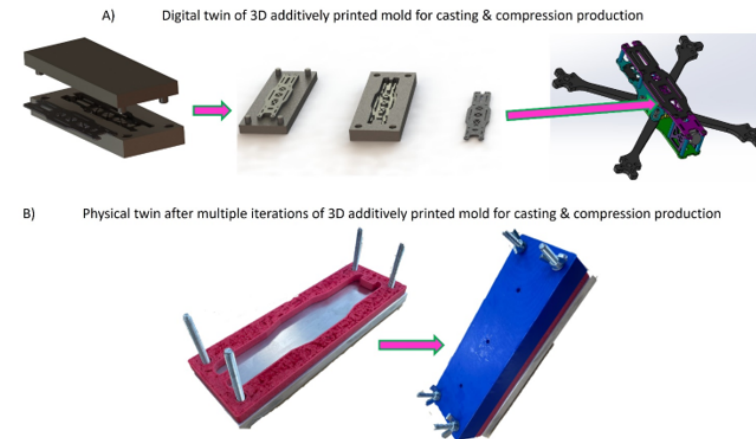


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# Other Planned activities

## Beginning of 2024

### Workshop «Business model for circular economy»

1. **Survey and Mapping** of the fibre glass manufacturers and users during various activities at the project Industry. Relevant actors in the fibre glass industry are mapped across the different Baltic sea regions in order to locate the critical subprocesses in the industry that could be supported by digitalization and a circular economy; **ON-GOING**
2. **Identification of case companies.** Suitable companies that could benefit from the developed digitalization and circular economy solution are identified in corresponding municipalities/countries. 3-5 actors are selected to create a focus group within a specific part of the value chain to co-create a prototype and test the effect before the solution is applied to a larger part of the industry. **ON-GOING we welcome suggestion from industry**
3. **Development of white paper** with findings from the glass fibre industry on transitioning to a circular economy **ON-GOING we welcome contributions from industry and academia**

# Other Planned activities

## Middle of 2023-2024

### Survey of communities about the circularity of glass fibre

1. Important information about society's view of glass fibre and its circularity will be obtained;
2. This will also be a way to ask the larger society about their needs since they represent the product end-users
3. Awareness raising of the glass fibre residue waste issue in the larger society

# Planned activities

## Autumn of 2024

### Conference session «GlassCircle – structural use of glass fibre composite materials»

1. Gathering experts from academia and industry to present the latest innovation in the field of reuse, recycling, or recovery of glass fibres;
2. It is planned to have a special issue within a scientific journal with all the session presentations;
3. Separate session where policymakers meet and discuss their approaches, success stories and problems

# Database «GlassCircle cluster»

## Main outcome of the project

- During the project interested companies will have the opportunity to join our GlassCircle cluster in a form of a database;
- Our target audience is mainly small and medium enterprises, however, we welcome also large enterprises, that produce a large amount of this residue material;
- With the help of this database, we hope to foster practices of the circular economy;
- There is hope, that we might connect glass fibre residue donors with possible receptor companies;
- This database is an opportunity to create new networks and use the obtained information and connections to create further cooperation initiatives

# Interested in joining our database?



- Liva (RTU, Latvia):  
[Liva.Pupure@rtu.lv](mailto:Liva.Pupure@rtu.lv)
- Roberts (LTU, Sweden):  
[Roberts.Joffe@ltu.se](mailto:Roberts.Joffe@ltu.se)
- Michail (Aarhus, Denmark):  
[mibel@btech.au.dk](mailto:mibel@btech.au.dk)

- Or join via our digital survey:  
<https://lnkd.in/dUmiUDd8>

- More information can be found on the project web-page:
- [interreg-baltic.eu/project/glasscircle](https://interreg-baltic.eu/project/glasscircle)

GlassCircle V2a



# Acknowledgments

**This project has been funded by European Union**

**Interreg**  
Baltic Sea Region



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<a href="https://aarhusuniversity.zoom.us/j/65274254226">https://aarhusuniversity.zoom.us/j/65274254226</a>	Inspirational case: Glassfiber cutting machines for recycling, Pavel Chvojka (Advantis)	10.40
	<i>EoLO-HUBs: Circular Business Models and knowledge sharing regarding wind turbine blades Nina Vielen-Kallio (echt)</i>	10.50
	Project DigiGlass Inspiration business case, digital systems for GF sorting challenge, Michail J. Beliatis (AU-DIGIT)	11.00
	Co-Creation / Ideation & Discussion panel, modern Justina & Michail (AU)	11:10
	Concluding remarks	

Scan the QR code to access  
the event webpage





# The Ecosystem of the Glass Fiber industry and Tools for Promoting the Transition to a Circular Economy

Liga Biezina,  
Valmiera Municipality  
Government, 01/03/2024

**VALMIERA**

## Valmiera

Founded in  
**1283**

**19,35**  
km<sup>2</sup> area

**24 868**  
Population

**VALMIERAS  
NOVADS.**

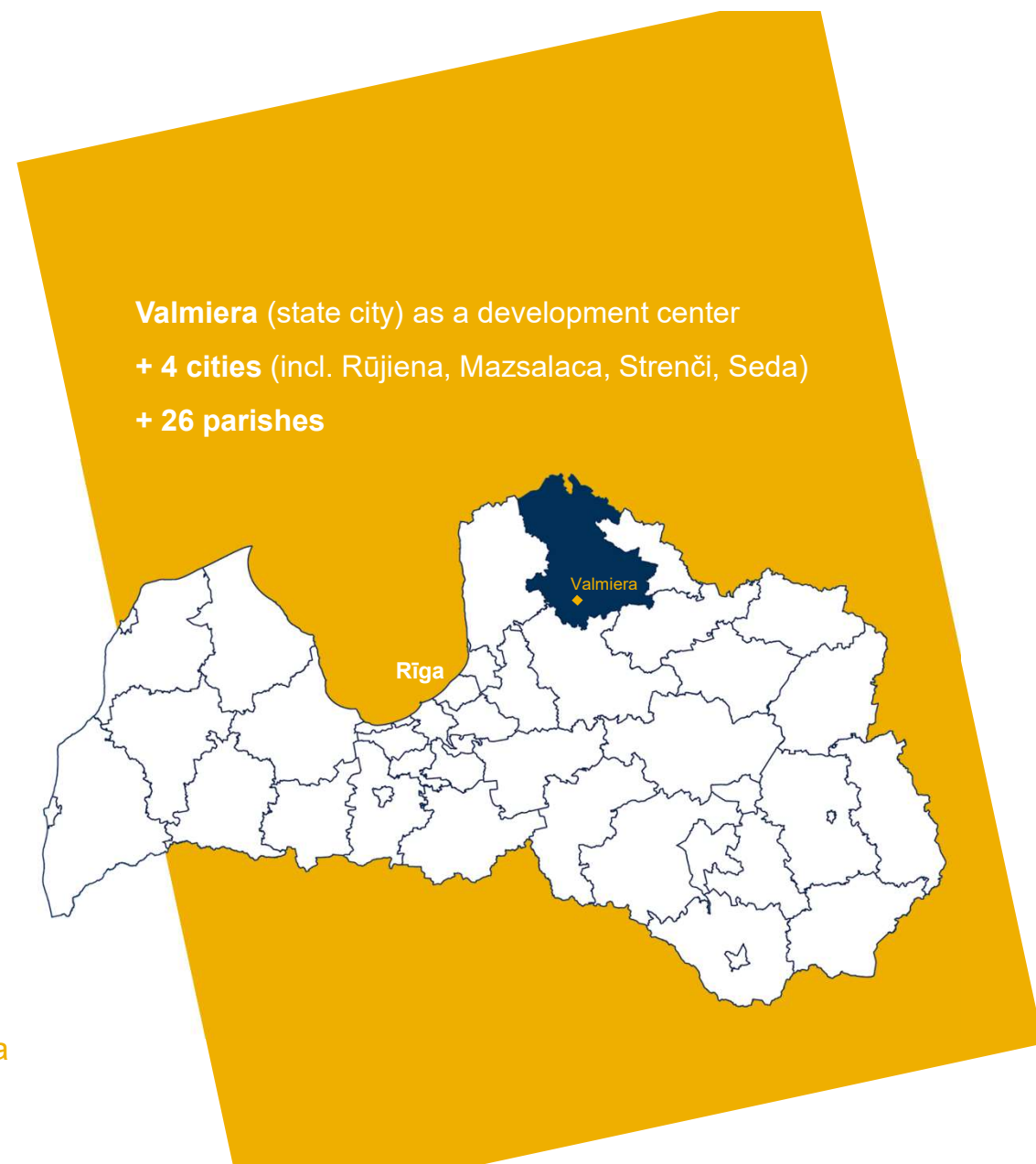
## Valmiera county

Founded in  
**2021**

**2946**  
km<sup>2</sup> area

**54 642**  
Population

The 2nd largest county in Latvia



**Valmiera City** is an **industrial city** of national importance – it is the **second leading city** in the country in terms of per capita output and exports. The manufacturing industry represents 25% of turnover in Valmiera region and 28% in Valmiera City.

**4649**

the number of companies in the county

2,8 % in Valmiera  
3,3 % in county

**33 806**

Population of working age

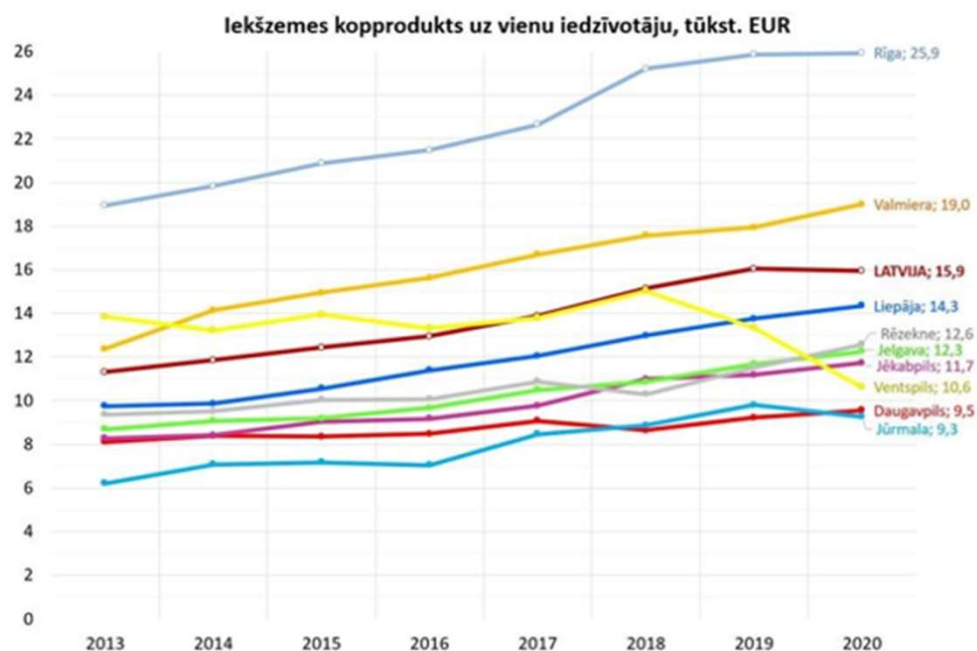
unemployment rate

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NOVADS.**



## An industrial micro-city

Gross domestic product in 2nd place after Riga  
**EUR 19 000 (2020) per capita**



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## Turnover share of TOP business sectors of Valmiera region

<b>28%</b> agriculture, forestry, fisheries	<b>17%</b> wholesale and retail
<b>11%</b> glass fiber production	<b>11%</b> construction
<b>5%</b> food and beverage production	<b>5%</b> health and social care
<b>4%</b> production wood and paper products and furniture	<b>3%</b> mechanical engineering and metalworking

# Glass fiber industry in Valmiera region



Number of companies

4

The largest companies in the sector by turnover:

- VALMIERA GLASS Jsc
- CULIMETA BALTICS Ltd.
- PADTEX INSULATION Ltd.
- THERMAL TEX Ltd.

**DYNAMICS OF THE GLASS FIBER INDUSTRY  
2019 – 2021 [source: Lursoft, 2022]**



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NOVADS.**

\* Financial data are presented for the years 2019 - 2021. The data summary shows data for 3 companies, not including SIA Thermal-Tec, which was founded in 2022.



total number of employees:

1332

turnover, euro:

117 078 825

profit, euro:

8 414 613

tax payments to the state budget,  
euro:

9 504 530

**Tax payments to the state budget 2019 – 2021  
[source: Lursoft]**



# Glass fiber industry in Valmiera region

## Products

fiber thread



carved fiber



fabrics and filters



textile membranes



steam, gas and sound turbine insulation solutions



fire blankets



heat and sound insulation materials

## Export countries

Germany



Finland



Belgium



Czech Republic



United Kingdom



United Arab Emirates



Italy



Poland



**VALMIERAS  
NOVADS.**

# Valmiera Glass



**VALMIERAS  
NOVADS.**

# Culimeta Baltics



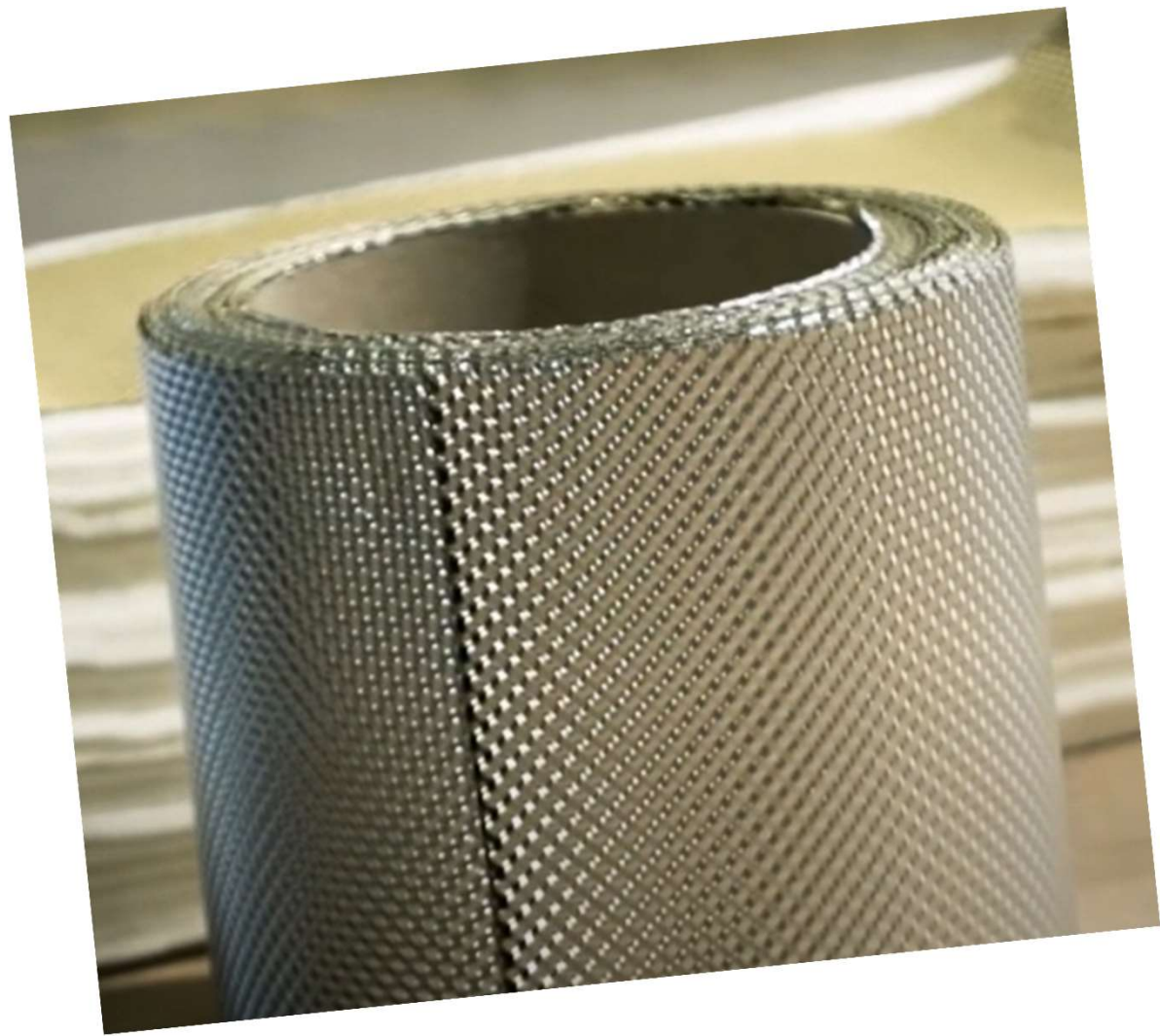
**VALMIERAS  
NOVADS.**

# Padtex Insulation



**VALMIERAS  
NOVADS.**

## Thermal - Tec



**VALMIERAS  
NOVADS.**

# The circularity challenge

- Growing restrictions and rising costs of the waste storage
- The solutions found, mostly, are not cost-effective or commercializable
- The waste and emission treatment of chemical formulations like sizing, finishing and coating are not the least issues for the glass fibre producers
- Environmentally-friendly solution for the desizing and the solutions for waste logistics might be a game-changer for the use of the glass fibre companies



**VALMIERAS  
NOVADS.**

# Municipal tools for promoting transition

- ◆ Planning documents
- ◆ Green public purchase
- ◆ Support for business reorientation through structural funds of the European Union
- ◆ Citizen information and promotion of collective consciousness
- ◆ Application of circular economy principles in the daily operation of the municipality, e.g.,
  - ◆ responsible consumption of resources,
  - ◆ the use of smart technologies,
  - ◆ digitization of processes,
  - ◆ recycling

# Planning documents – EU level

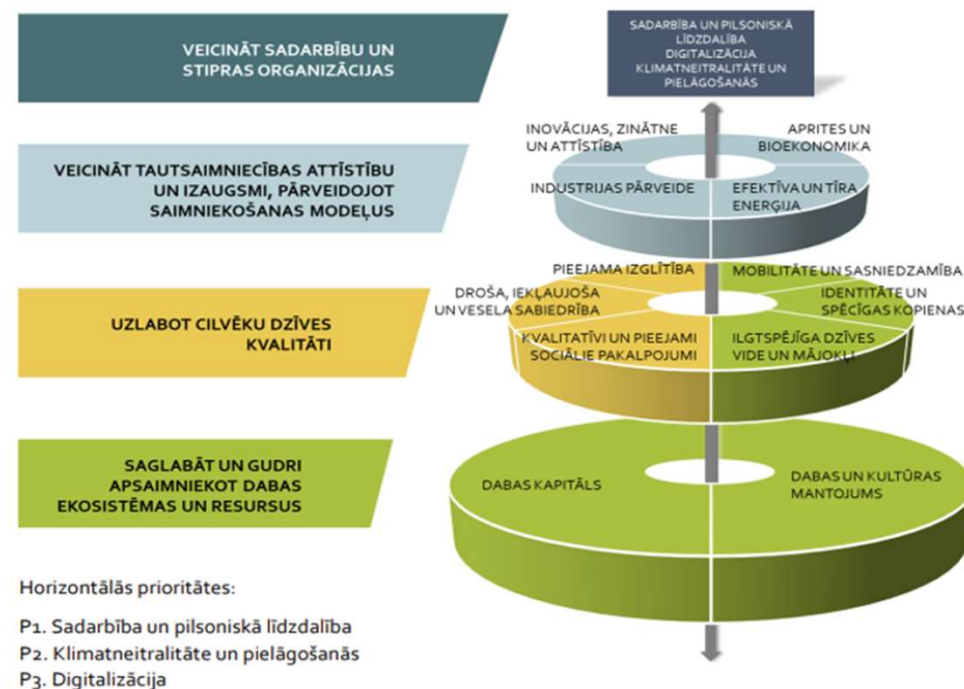
- ◆ European Green Deal
- ◆ Agenda to transform EU economy into a circular one
- ◆ The new Circular Economy Action Plan as part of the New Industrial strategy

# Planning documents – national level

- ◆ Latvian Strategy for Reaching Climate Neutrality by 2050
- ◆ Action plan for the transition to the circular economy 2020-2027
- ◆ National waste management plan 2021-2028

# Planning documents – regional level

- ◆ Development programme 2022-2027 of Vidzeme Planning Region
- ◆ Vidzeme Regional waste management plan for 2023 - 2027



# Planning documents – municipal level

- ◆ Sustainable Development Strategy 2022 – 2038
  - ◆ industrialization and growth of circular economy as part of the vision
  - ◆ Every economic sector as a sector of circular economy
  - ◆ The promotion of wider application of circularity principles within the current companies
- ◆ Development programme 2022 – 2028
  - ◆ Circularity within the top-down priorities
  - ◆ Circularity within the horizontal priority – “Climate change policy (the Green Deal)”

# Waste management & circular economy & Climate neutral society

For fostering the transition to circular economy three projects financed by the INTERREG programme are being implemented:

- Glass Circle
- BALTIPLAST
- Circular Spaces

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# Hackathon “Daibe Zero”

[www.daibezero.lv](http://www.daibezero.lv)

DaibeZero2021 and DaibeZero2023



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VALMIERA

# EPICENTRE

Educational Platform life  
Cycle assessment  
structures

Laura Vitola

Aarhus, 1.03.2024.



**The European Institute of Innovation and Technology RawMaterials connects stakeholders and actors from different parts of the raw materials value chain creating a unique collaborative environment for breakthrough innovations.**



## Synergy

Synergies between academia and industry are vital for the development of society



## Sustainability

Sustainability is the main key to preserving our planet



## Policies

The GreenDeal aims to set the EU on the path to a green transition, with the ultimate goal of reaching climate neutrality by 2050.



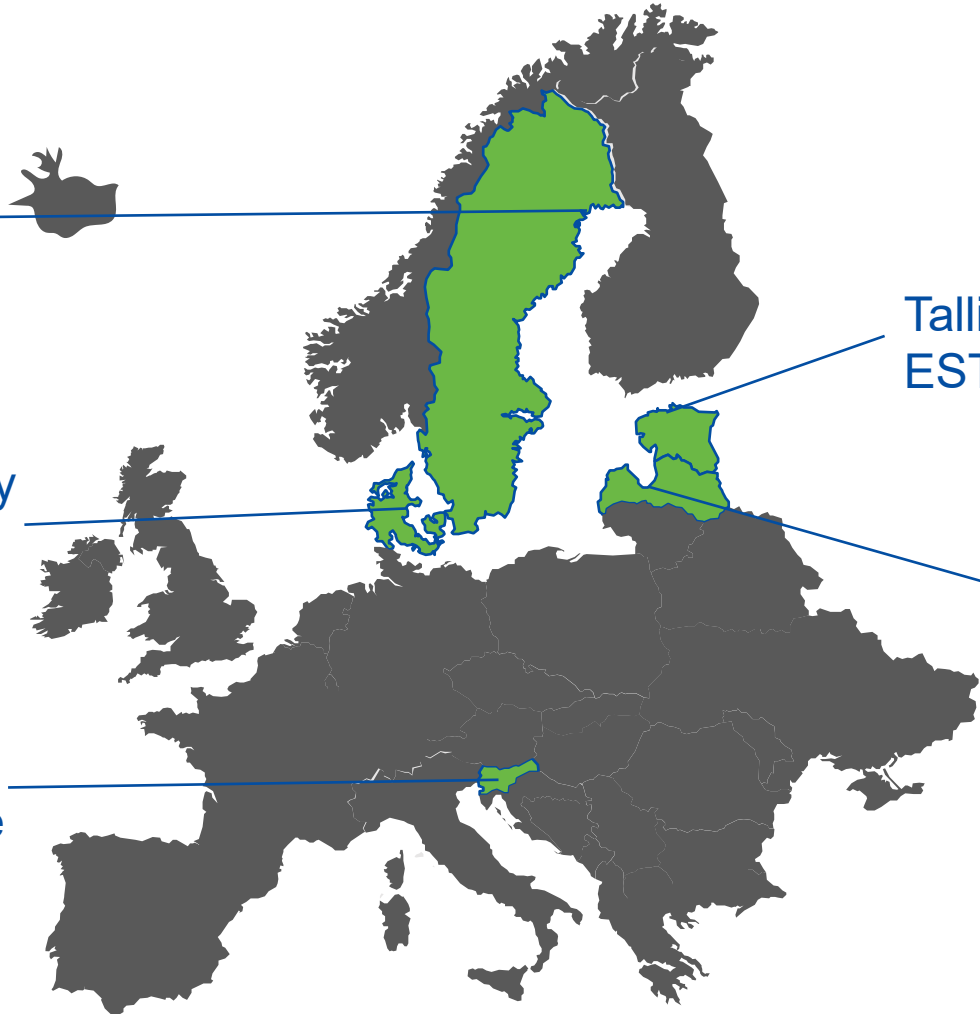
## LCA/LCC

Increasing demand for life cycle assessment in both academia and industry



# The team of EPICENTRE

Lulea University of Technology  
SWEDEN



Tallinn University of Technology  
ESTONIA

Aarhus University  
DENMARK

Riga Technical University  
LATVIA

Slovenian National Building  
and Civil Engineering Institute  
SLOVENIA



ZAVOD ZA  
GRADBENIŠTVO  
SLOVENIJE

SLOVENIAN  
NATIONAL BUILDING  
AND CIVIL ENGINEERING  
INSTITUTE

# The aim of EPICENTRE



To fill a critical gap in the sector's education and training programs by providing an **innovative and dynamic platform** for learning, assessing, and improving **LCA/LCC methodologies**.



# The roadmap of EPICENTRE

Ready on-site LCA/LCC school @ Tallin

Sep 2026

Test on-site LCA/LCC school @ Riga

Sep 2025

Finaling materials for LCA/LCC school

Test online LCA/LCC school

Kick-off

Jan 2024

Preparing materials for LCA/LCC school

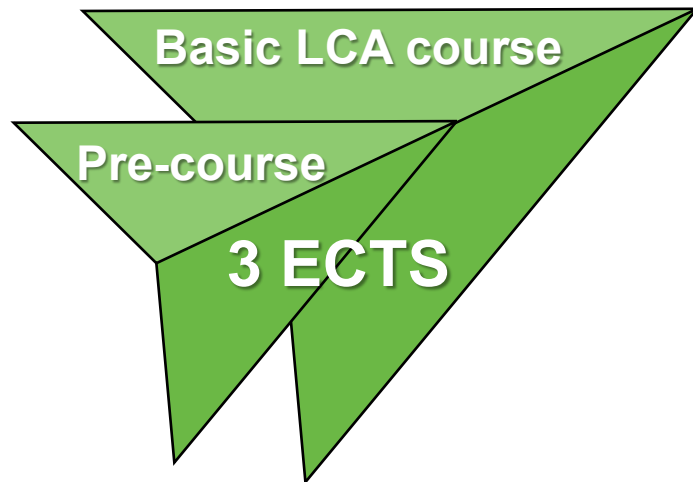
Sep 2024

Improving materials for LCA/LCC school

# Structure LCA/LCC school

## Basic level

- Online pre-course (3-4 weeks)
- On-site Basic LCA course (2 days or 16 acad. hours)
- Independent work
- Includes mentoring



Sustainability assessment

**2 ECTS**

Business course

**2 ECTS**

## Advanced level

- On-site LCA and LCC course (3 days or 12 acad. hours)
- On-site Business course (3 days or 12 acad. hours)
- Independent work
- Includes mentoring



**Be ambitious and take the opportunity to understand the life cycle of your product/technology/process!**

**Join EPICENTRE LCA/LCC school!**

@RTU

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@LTU

**Roberts Joffe**

roberts.joffe@ltu.se

@AU

**Michail Baliatis**

mibel@btech.au.dk

@ZAG

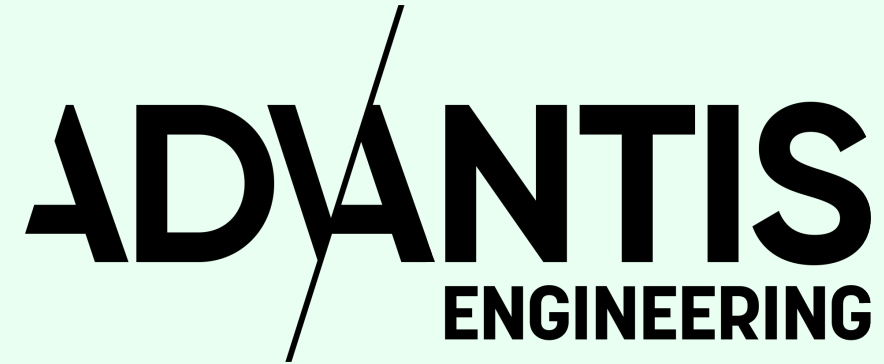
**Davor Kvočka**

davor.kvočka@zag.si



# EPICENTRE

for sustainable future



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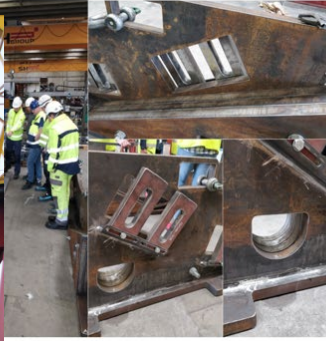
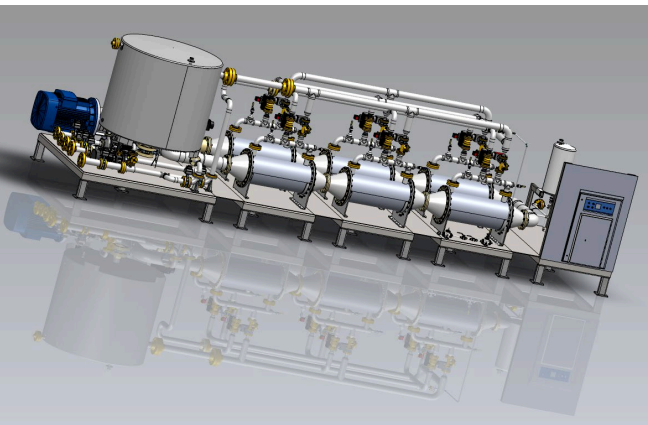
**DEVELOPMENT OF FLEXIBLE WTB CUTTING SYSTEM FOR  
END-OF-LIFE BLADES**

**ADVANTIS, Project Engineer – Pavel Chvojka**

---

- **Advantis Founded in 2017 by Allan Wad Petersen, Kim D. Jensen & Peter Ejs Eltzholtz**
- **Consulting Mechanical Engineering Company**
- **Office and Prototype Facilities in Hinnerup, Denmark**
- **Currently 12 Mechanical Engineers & 2 Projects Managers**
- **Renewable Energy Sector – OEMs - Vestas & Siemens Gamesa**
- **Strategy of Incubating Own Products - Development and Commercializing of Own Products e.g. Flexible Blade Cutter System -> To be separated into own entity “SUSTEQ”**
- **Partnering and Exploring New Business Opportunities**





CONFIDENTIAL

## Wind industry calls for Europe-wide ban on landfilling turbine blades by 2025

<https://windeurope.org/newsroom/press-releases/wind-industry-calls-for-europe-wide-ban-on-landfilling-turbine-blades/>

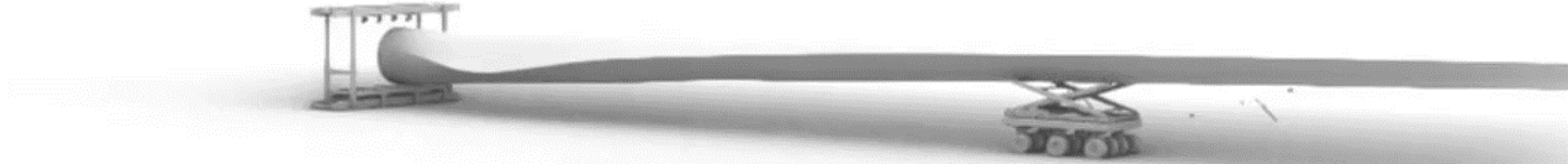
## Vattenfall commits to landfill ban and to recycle all wind turbine blades by 2030

<https://group.vattenfall.com/press-and-media/pressreleases/2021/vattenfall-commits-to-landfill-ban-and-to-recycle-all-wind-turbine-blades-by-2030>

## Ørsted commits to either reuse, recycle, or recover all of the wind turbine blades in its global portfolio of onshore and offshore wind farms upon decommissioning

<https://orsted.com/en/media/newsroom/news/2021/06/702084352457649>







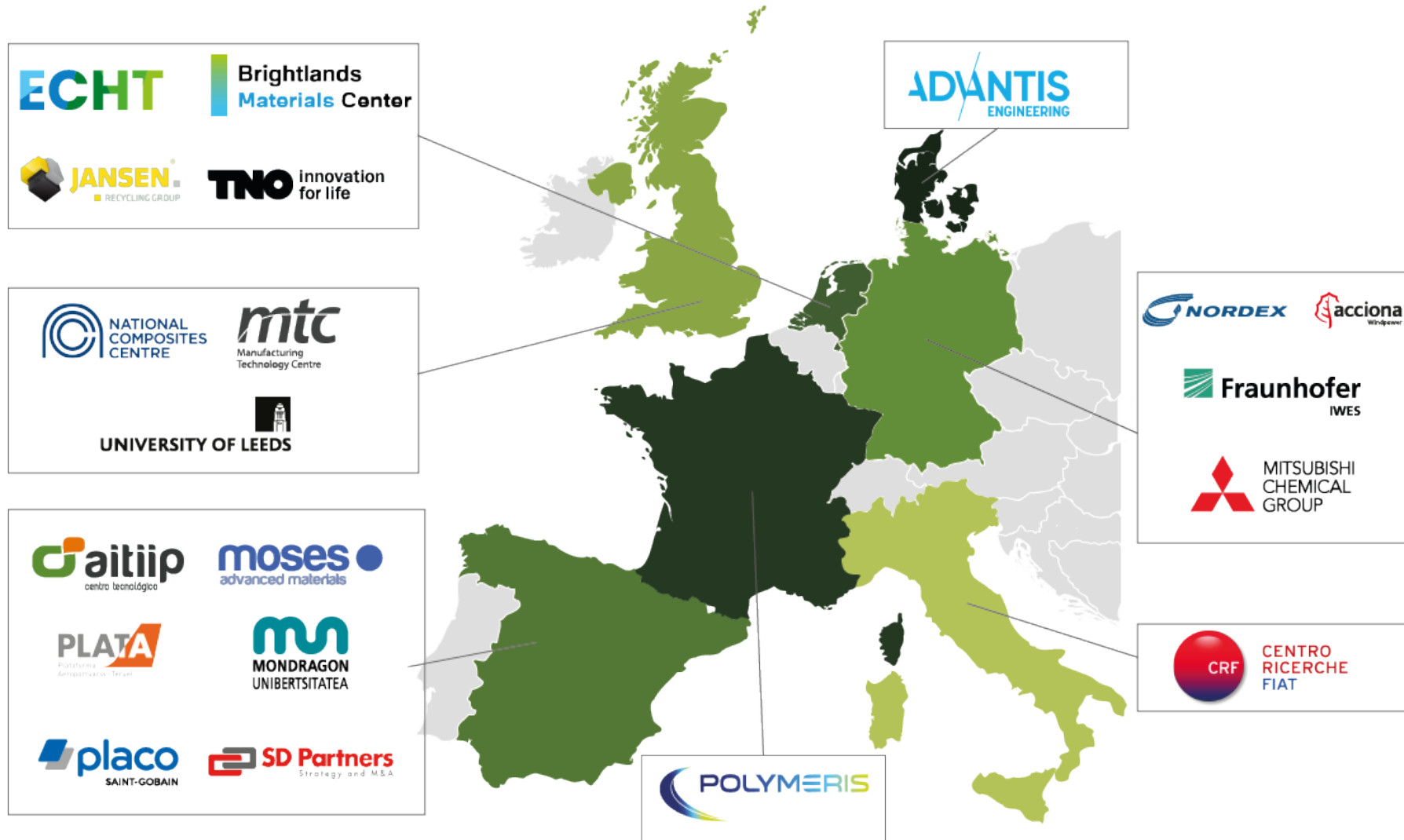
# EoLO HUBS

**European project EoLO-HUBs will develop innovative solutions to recycle high value materials from wind turbine blades**

**PARTNERS**



Co-funded by  
the European Union



## European project EoLO-HUBs will develop innovative technologies to recycle high value materials from wind turbine blades

**EoLO-HUBs**, co-funded with almost 10 million euros by the European Union, **will recover glass and carbon fibre from large thermoset structures** which have reached the end of their useful life.

**EoLO-HUBs' solution** will provide an answer to the three main areas involved in the decommissioning and recycling of end-of-life wind turbines:

- 1.Decommissioning and pre-treatment of wind turbine blades**, including handling, non-destructive inspection tools, cutting, shredding, and sorting.
- 2.Sustainable fibre reclamation processes** addressing two alternative technologies: Low carbon pyrolysis and green chemistry solvolysis.
- 3.Upgrading processes for the recovered fibres**, including both glass fibre and carbon fibre.

## Goal of the WTB cutting machine

- **Decrease costs** associated with WTB decommissioning by introducing an automated process
- **Improve workplace safety** by automating the process of cutting, and de-creasing exposure to hazardous dust.
- **Increase the possibilities and likelihood of recycling WTBs** through separation of un-wanted material
- Create **new business and product opportunities** with precise and repeatable cutting into more desirable objects that require less processing down the line.

## Many more creative possibilities where that came from

Previous studies by **Genvind**, a similar recycling consortium show **favorable conclusions with direct re-use of WTB's in second life application**



# QUESTIONS or IDEAS?

**Pavel Chvojka**

[pch@advantis.dk](mailto:pch@advantis.dk)

[Linkedin.com/in/pavelchvojka/](https://www.linkedin.com/in/pavelchvojka/)

# Circular Business Models and knowledge sharing regarding wind turbine blades

**EC**HT

Nina Vielen-Kallio

Lead of Circularity in Energy Transition

Date: 1<sup>st</sup> of March 2024



**EoLOVHUBS**

The logo features a stylized green graphic above the text. The graphic consists of three curved lines that meet at a central point, forming a shape reminiscent of a wind turbine or a hub. The text 'EoLOVHUBS' is written in a bold, sans-serif font. The 'EoLO' part is in black, and the 'VHUBS' part is in green, matching the color of the graphic above.

## ECHT

**ECHT directs and accelerates sustainable strategic transitions to concrete business in the blue and green economy**



**Nina Vielen-Kallio**  
**Lead of Circularity in Energy Transition**  
**[Nina@echt.community](mailto:Nina@echt.community)**



# CONTENTS

- 1 EoLO-HUBs project
- 2 Circular and Sustainable Business Models (CSBM)
- 3 Knowledge sharing
- 4 Invitation

The logo features a stylized white icon of a three-pronged fork or a central hub with three arms extending outwards, positioned above the text 'EoLO HUBS'. The background of the top half of the slide is a dark green gradient with diagonal stripes and some lighter green abstract shapes.

# EoLO HUBS

## 01 **Project**

---

### What is EoLO-HUBs

# 1 Project – High overview

- Horizon Europe, 10 MEUR, 18 partners
- **1. Decommissioning and pre-treatment** of wind turbine blades, including handling, non-destructive inspection tools, cutting, shredding, and sorting.
- **2. Sustainable fibre reclamation** processes addressing two alternative technologies: Low carbon pyrolysis and green chemistry solvolysis.
- **3. Upgrading processes** for the recovered fibres, including both glass fibre and carbon fibre



# 1 Project - Partners



The logo features a stylized white icon of a three-pronged fork or a similar structure, positioned above the text 'EoLOV HUBS'. The background of the top half of the slide is a dark green gradient with diagonal stripes and some lighter green abstract shapes.

# EoLOV HUBS

02

**Circular and Sustainable Business Models (CSBM)**

---

How are CSBM developed in the project

## 2. Circular and Sustainable Business models

- Often Business Models developed bottom up and driven by technology
- Holistic approach missing, which is crucial for Circular Business Models (by default, larger group of stakeholders involved)
- EoLO-HUBs assesses successful Circular Business Models (theory and practice)
- Key focus on development of **Decision Making Framework** with top-down approach
- = Circular and **SUSTAINABLE** Business Models (CSBM)



## 2. CBM – Examples of drivers

- Political, such as net zero targets
- Economic (growth)
- Social / job opportunities
- Technical (innovations)
- Environmental / carbon savings
- Legal in waste management

*Built based on research of A. Velenturf et co, University of Leeds*





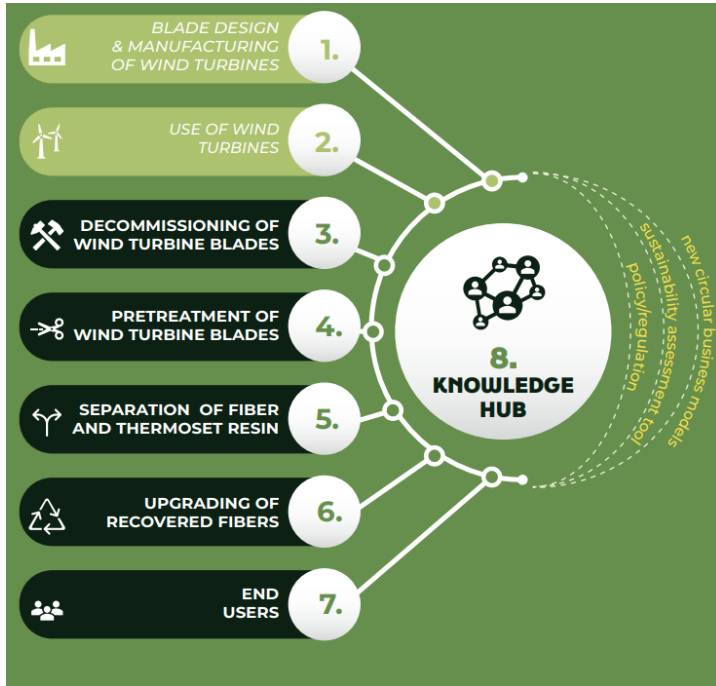
**EoLOV HUBS**

**03** Knowledge sharing

---

Knowledge Hub

# 3. Knowledge Hub content





# EoLOV HUBS

## 04 Invitation

---

Opportunity to become part of the solution

# 4. Join, learn, share

- Knowledge Hub of EoLO-HUBs is interactive
- Wind Turbine Blades, but also other composites
- Connected with sister projects
  - Baldes2Build
  - ReFresh
- **Website** <https://www.eolo-hubs.eu/>



The logo for EoLOVHUBS features a stylized green icon above the text. The icon consists of three curved lines that meet at a central point, forming a shape reminiscent of a three-lobed leaf or a stylized 'Y'. The text 'EoLOVHUBS' is written in a bold, sans-serif font. The 'Eo' is in black, 'LOV' is in a dark green, and 'HUBS' is in a lighter green. The 'V' is the largest and most prominent letter, with the green icon integrated into its top and right sides.

# EoLOVHUBS

**ECHT**

Nina Vielen-Kallio

Lead of Circularity in Energy Transition

[Nina@echt.community](mailto:Nina@echt.community)

+31 6 520 90 273

# CO-CREATION WORKSHOP

## CASE STUDY DIGI-GLASS

### INSPIRATION BUSINESS CASE, DIGITAL SYSTEMS FOR GF SORTING CHALLENGE

# VALUE NETWORK CHAIN ECOSYSTEM IN CIRCULAR ECONOMY



# VALUE NETWORK CHAIN ECOSYSTEM FOR CIRCULAR ECONOMY

Step 1 Map your Value Chain Ecosystem to Identify Potential CE Opportunities

Step 2 Map your Business and Production Processes to Identify CE Hindering Bottlenecks



## WHY move from Linear to Circular Economy?

1. **Towards Zero Waste**
2. Resource Conservation
3. Sustainability
4. Economic Growth
5. Social Benefits, local jobs

# AN ID & VERIFIED BOTTLENECK FOR CE IN GF IS SORTING SCRAP/RESIDUE IN SHOP FLOORS

How feasible is setting up sorting and collection facilities on industrial site?

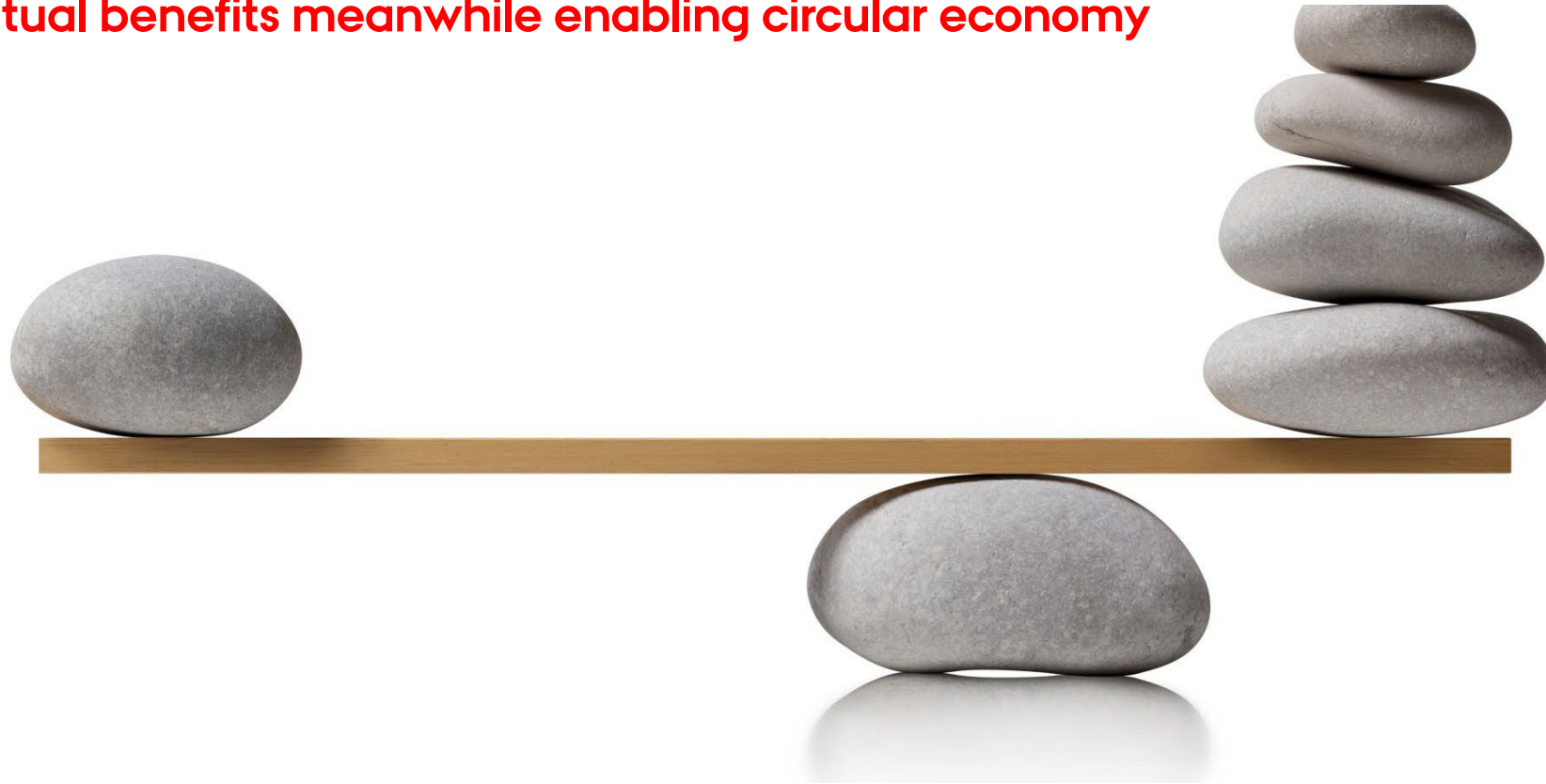


In your opinion, what hinders the use of GF residues/waste?  
10 responses

Uncontrollable/unknown properties	Uncertain supply chain/amounts	It is not economically feasible
Not enough information about the availability and quality of fibers	No local availability	Logistics
Lack of communication between actors	mostly downcycling happens - as such industries outside of common continuous fibre application must step in	Unawareness

# STEP 3 CO-CREATE BUSINESS MODELS FOR MUTUAL BENEFIT

Co-create / Ideate new business models with your value network chain ecosystem aiming to generate mutual benefits meanwhile enabling circular economy



# INSTRUCTIONS: TAKE THE BUSINESS MODEL TEMPLATE FROM LINK

Step 0 Download/Upload Link :

[https://aarhusuni.padlet.org/michail\\_beliatis/business-model-co-creation-workshop-for-glassfiber-circular--okk0d65gu8tc484h](https://aarhusuni.padlet.org/michail_beliatis/business-model-co-creation-workshop-for-glassfiber-circular--okk0d65gu8tc484h)

Step 1 Map your Value Chain Ecosystem to Identify Potential CE Opportunities (identify a customer or supplier who could use your GF residue/scrap)

Step 2 Map your Business and Production Processes to Identify CE Hinderings Bottlenecks (would a robotic shorting of GF residue could support your manufacturing process for CE? **Let us know**)

Step 3 Create a Business Model with value proposition (what) aiming for mutual benefit filling the template and then take a photo and upload you it at online dashboard

Step 4 Write some feedback comment or wish to be pushed it at EU commission and national policy makers

This poster is created for the hybrid Co-creation workshop as part of the Circular Economy for Enterprises event 2024.

This event is part of the integrated project to help drive the transition and is supported by organizations from the following countries: Denmark, Latvia and Sweden.

Interreg Baltic Sea Region Co-funded by the European Union

CIRCULAR ECONOMY GlassCircle AARHUS UNIVERSITY

### Business Model Innovation

St. Gallen Magic Triangle

1. Who is your target customer (segment)?

- Identify target customers
- Define which customer group your business model is designed for
- Is customer segment B2B or B2C?

2. What do you offer to the customer?

- Identify the unique value the customer will receive
- Consider what the chosen target customer finds valuable
- Use the outside-in principle and see the value proposition from the customers' point of view

3. How is the value proposition created?

- Identify all activities related to the company's value chain and all the resources
- Include physical assets, such as buildings and technology
- Consider human assets as people with the general or unique skills Include the suppliers

4. Why does your business model generate profit?

- Identify the profit mechanism of the business model

Work framework for the co-creation

WHO?

WHAT?

HOW?

WHY?

Upload link: [https://aarhusuni.padlet.org/michail\\_beliatis/business-model-co-creation-workshop-for-glassfiber-circular--okk0d65gu8tc484h](https://aarhusuni.padlet.org/michail_beliatis/business-model-co-creation-workshop-for-glassfiber-circular--okk0d65gu8tc484h)

# ANY VOLANTER CASE?

## WHO?

## WHAT?

## HOW?

## WHY?

Waste Material Provide  
End-users  
Case Company

Circular Business Model  
Product-Service System

3D Printing & Mechanical Recycling  
Operational Process  
Business Model Innovation

Circular Economy Perspectives  
Value Creation through Sustainability  
Feasibility of 3D Printed Molds

### 1. Who is your target customer (segment)?

- Identify target customers
- Define which customer group your business model is designed for
- Is customer segment B2B or B2C?

What?

### 2. What do you offer to the customer?

- Identify the unique value the customer will receive
- Consider what the chosen target customer finds valuable
- Use the outside-in principle and see the value proposition from the customers' point of view

Value proposition

Who?

### 3. How is the value proposition created?

- Identify all activities related to the company's value chain and all the resources
- Include physical assets, such as buildings and technology
- Consider human assets as people with the general or unique skills Include the suppliers

Profit mechanism

Value chain

### 4. Why does your business model generate profit?

- Identify the profit mechanism of the business model

Why?

How?

# INSPIRATION CASE FOR BUSINESS MODEL INNOVATION WITH THE ROBOTIC SOLUTION & ST. GALLEN MAGIC TRIANGLE

## WHO?

## WHAT?

## HOW?

## WHY?

Waste Material Provide  
End-users  
Case Company

Circular Business Model  
Product-Service System

3D Printing & Mechanical Recycling  
Operational Process  
Business Model Innovation

Circular Economy Perspectives  
Value Creation through Sustainability  
Feasibility of 3D Printed Molds

### 1. Who is your target customer (segment)?

- Identify target customers
- Define which customer group your business model is designed for
- Is customer segment B2B or B2C?

What?

### 2. What do you offer to the customer?

- Identify the unique value the customer will receive
- Consider what the chosen target customer finds valuable
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Value proposition

Who?

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- Include physical assets, such as buildings and technology
- Consider human assets as people with the general or unique skills Include the suppliers

Profit mechanism

Value chain

Why?

### 4. Why does your business model generate profit?

- Identify the profit mechanism of the business model

How?



**DEPARTMENT OF BUSINESS DEVELOPMENT AND  
TECHNOLOGY**  
AARHUS UNIVERSITY