

Circular Cities



Japanese Knotweed as resource for 3D printing

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WAGENINGEN
UNIVERSITY & RESEARCH



Introducing myself

Ir. Edwin Keijsers

Researcher (1997-)

Wageningen Food & Biobased Research

- **Circular economy**
- **Biorefinery**
- **Fibre extraction**
- **Fibre industry**



Outline



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- **Circular Economy**
- **Circular cities**
- **Bio-waste**
- **Knotweed to 3D printing**
- **Practical Work**



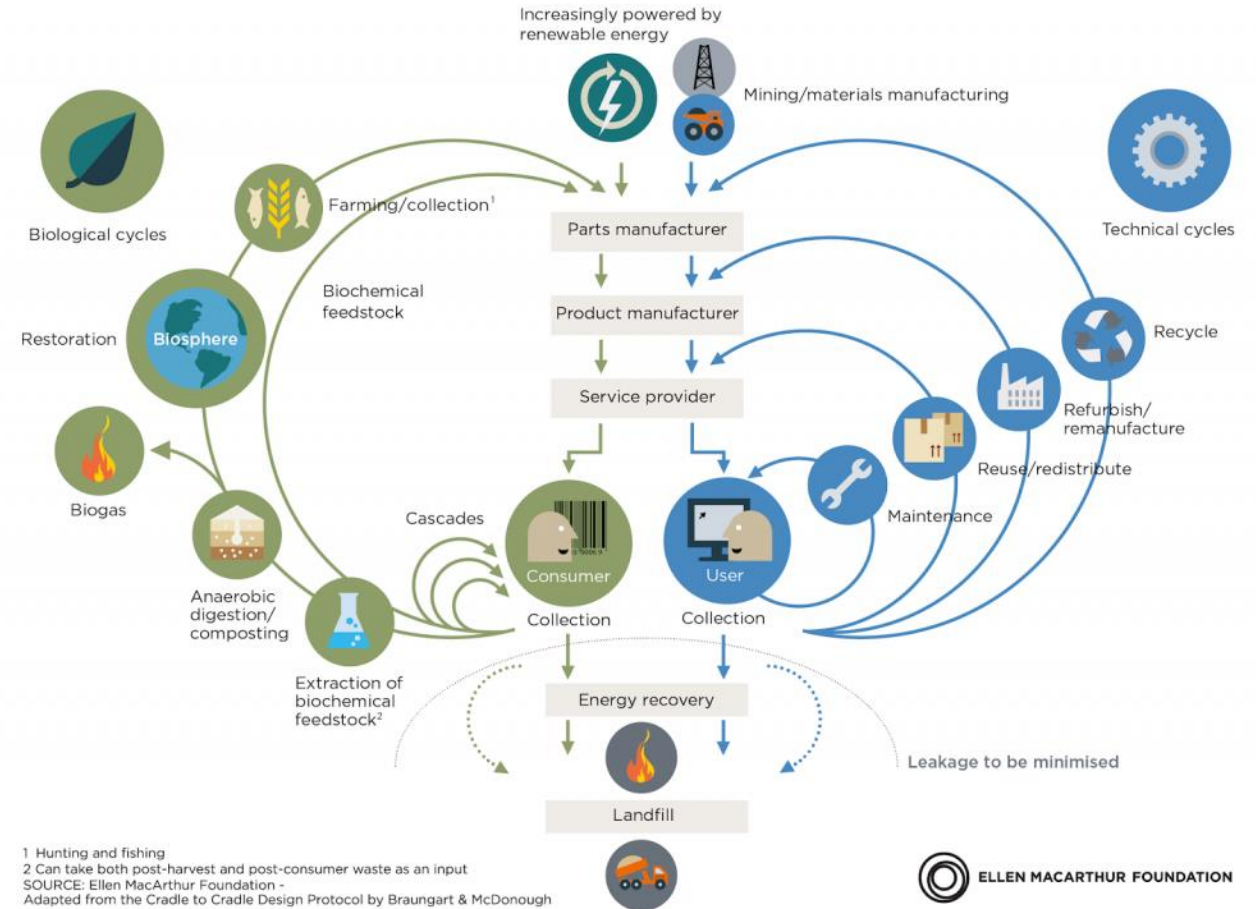
Circular economy



CIRCULAR ECONOMY - an industrial system that is restorative by design

Circular use of bio – waste from green spaces

LADDER VAN LANSINK - THE WASTE HIERARCHY



1 Hunting and fishing
 2 Can take both post-harvest and post-consumer waste as an input
 SOURCE: Ellen MacArthur Foundation -
 Adapted from the Cradle to Cradle Design Protocol by Braungart & McDonough



Introduction – Basic facts

CityLoops is an EU-funded project focusing on **circular economy solutions** for **bio-waste**, and **construction and demolition waste** (CDW), including soil.



Seven European cities plan to pilot a series of circular economy actions tackling these two waste streams with the aim of **achieving material circularity**.

Why bio-waste?

According to the European Commission, **the European Union produces approximately 130 Mt of bio-waste per year**, a number, projected to increase by 10% by 2020.

Bio-waste consists of organic fractions of municipal solid waste as well as bio-waste from commercial sources and public spaces. Overall, 68% of bio-waste produced annually in the EU consists of food waste originating from food manufacturing and packaging processes (39%), household scraps (42%), and restaurants/grocery stores (19%).



CityLoops goal



To better understand how local governments can best promote the transition to a circular economy (CE) in their city.

Closing urban material and resource loops, and thereby reducing the environmental footprint, increasing regenerative capacities, and stimulating new business opportunities



Support actions

Develop an evaluation framework, based around a series of circularity and sustainability indicators, to measure success

Led by NRI

Develop a methodology for assessing urban circularity, together with a decision support dashboard

Led by Metabolism of Cities

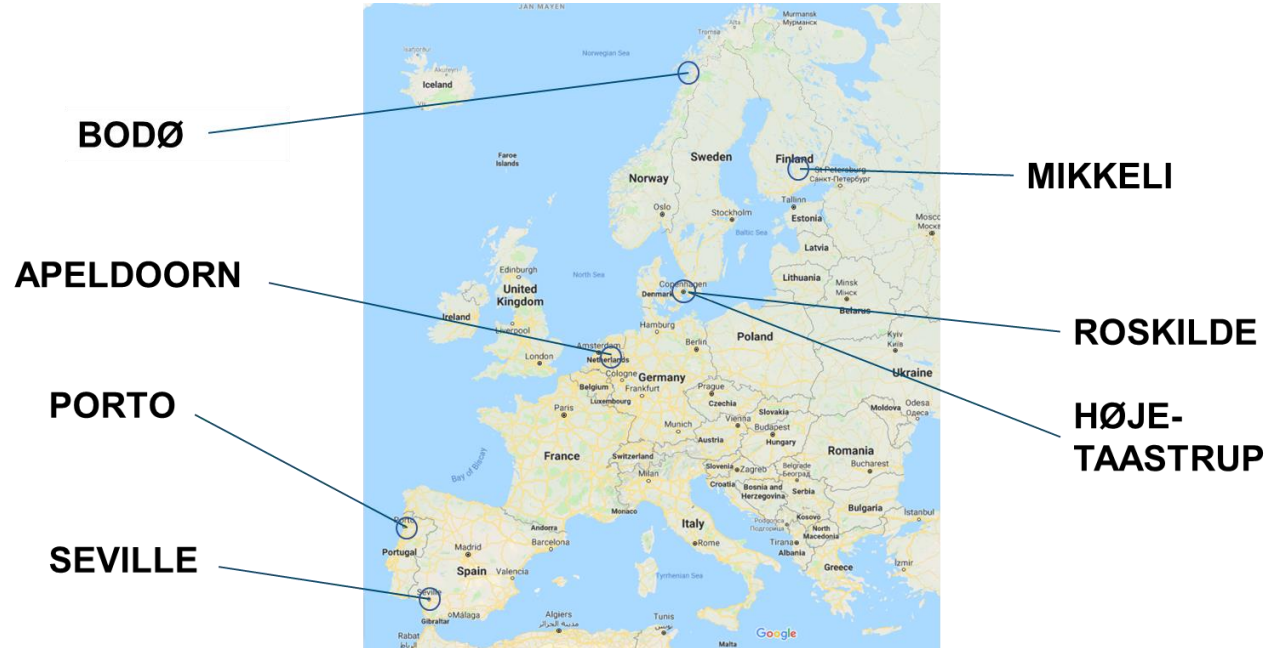
Test different stakeholder engagement processes in each city to accompany the demo actions from start to finish

Led by NRI

Exploit the potential of public procurement to support the demonstration activities (WP5 – RWS)

Led by RWS

The cities



VALLES OCCIDENTAL
CDW & BW

MURCIA
BW

TORRES VEDRAS
Municipal Water, Wastewater
and Waste Management
CDW & BW





Get involved!

Is your organisation located in one of the CityLoops regions? Join the collaborative learning networks.

Apeldoorn



The city wants to:

- develop **new processing methods and business models to upcycle biomass** from its public spaces.

- Bokashi from leaves
- Biochar from pruning
- **3D print filament from knotweed**
- Paper from grass



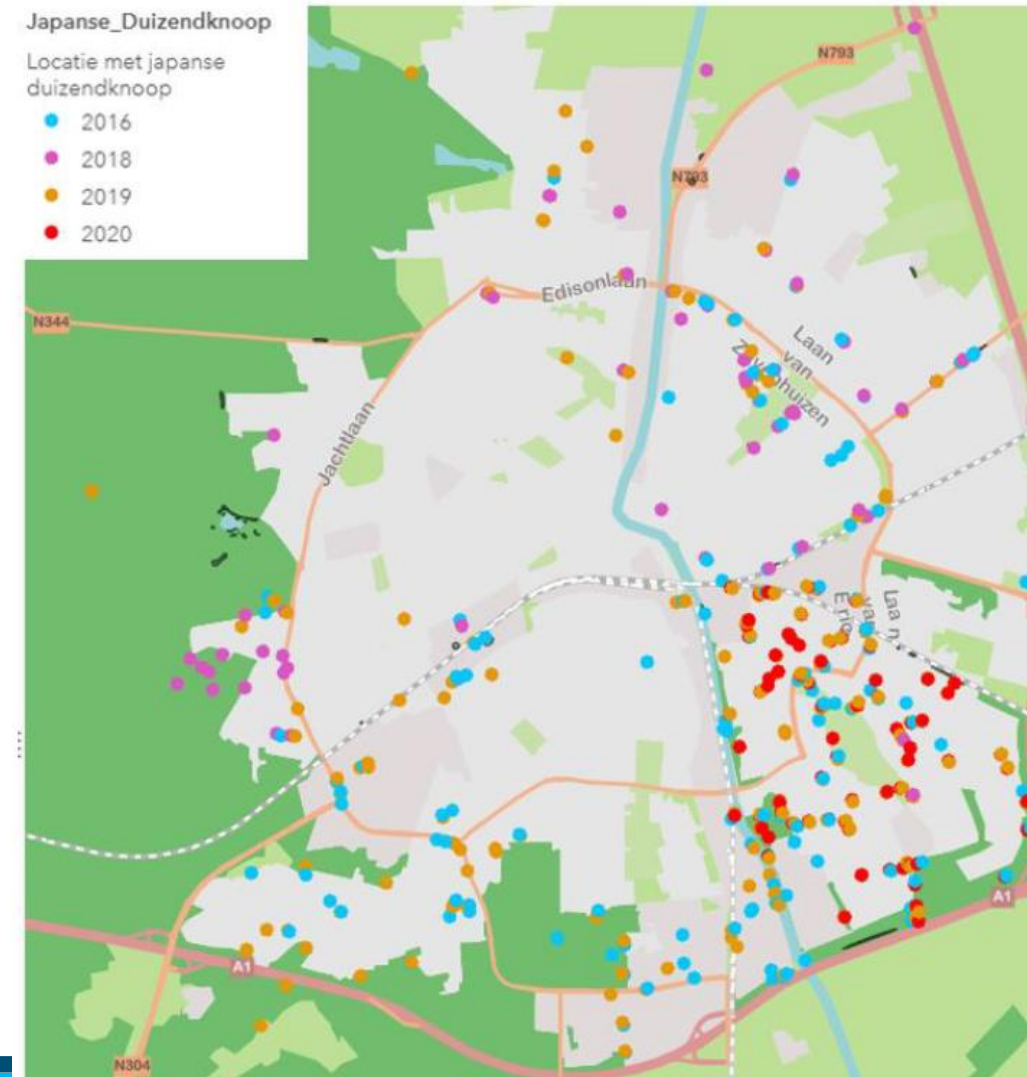
162,445
inhabitants



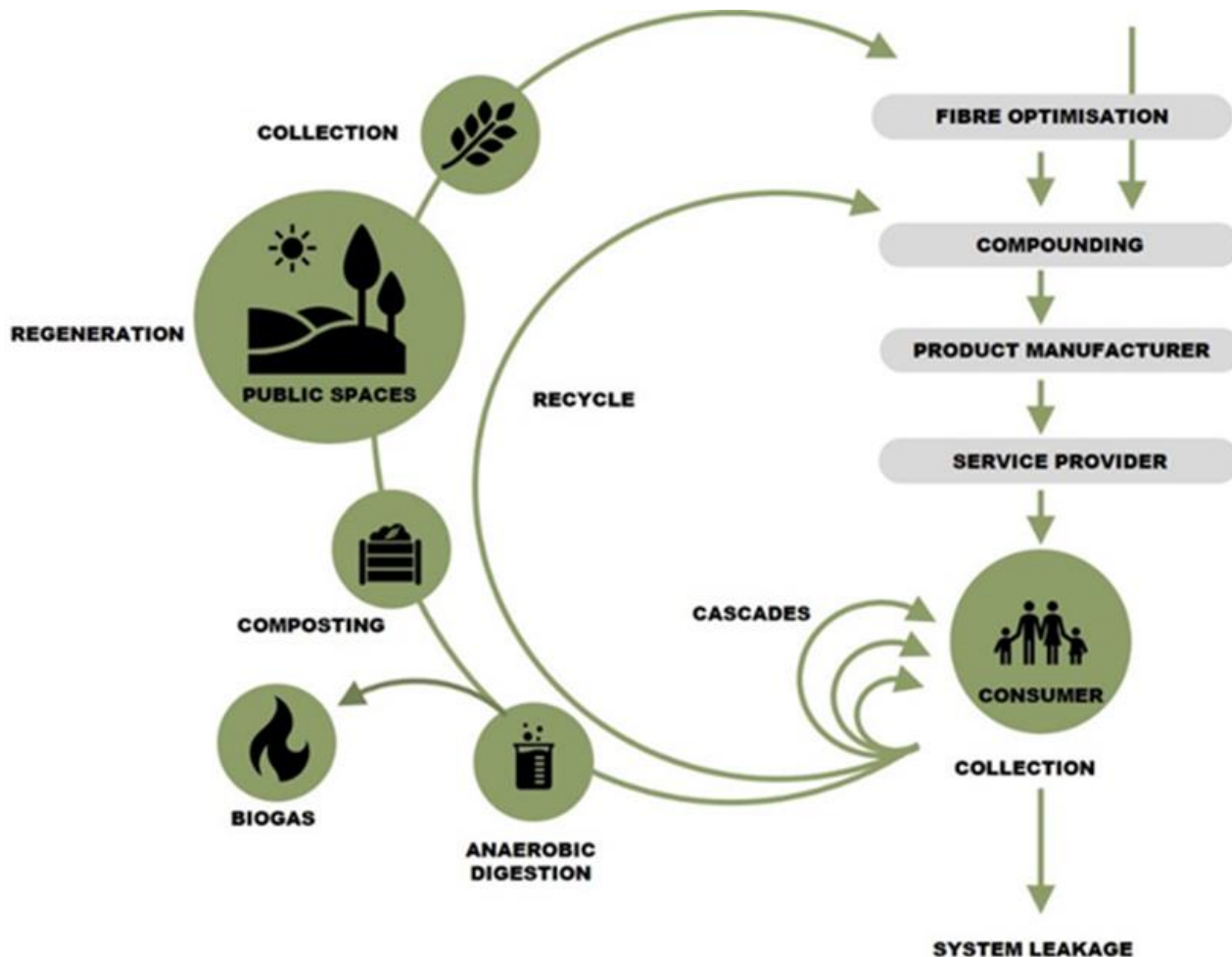
Why Knotweed?



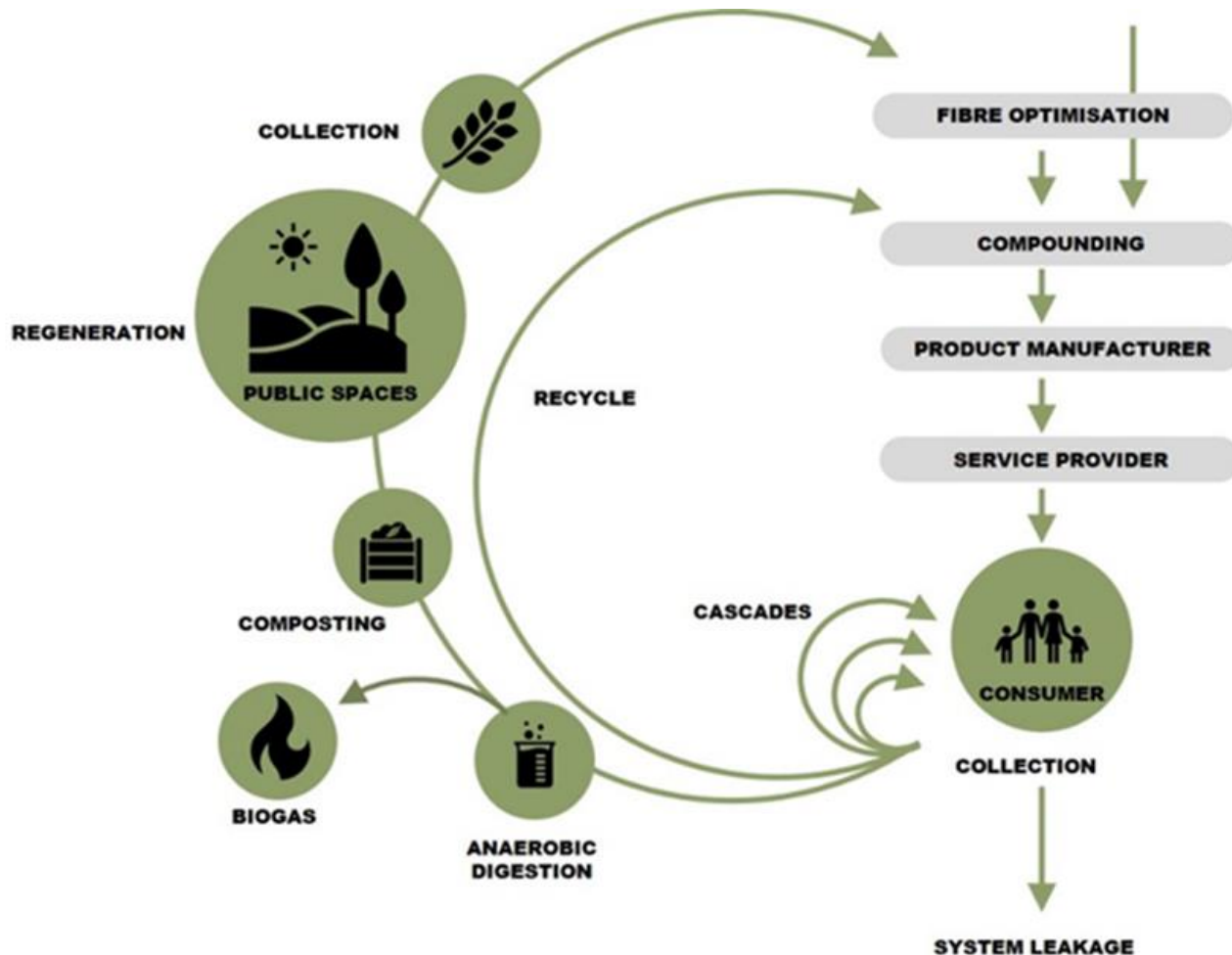
- Current practice: selective collection and destruction
 - Clean and uniform resource
- Contains long fibres, increasing composite properties
- In future other bio – waste resources could be included in the business case



Knotweed into 3D-printing

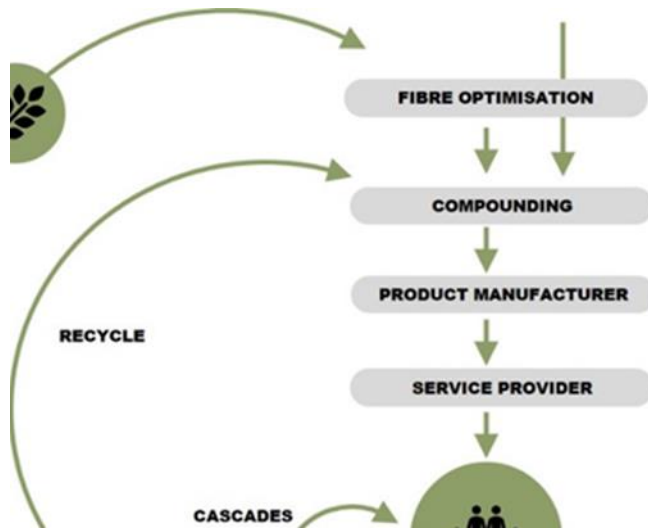


Knotweed into 3D-printing



- Harvest Knotweed
- Produce Filament
- Produce objects
 - Makerspace
 - Repair cafe
 - Outside furniture
- Recycle
- Compost
- Regenerate public spaces
- Harvest Knotweed

From knotweed to filament?



- Fibre optimisation, cleaning, extraction, drying
- Compounding: Mixing of fibre and matrix material (PLA)
- Filament production
- 3D- printing



Practical work: Collection



Practical work: Cutting



Practical work: Cleaning



Practical work: Fibre Optimization



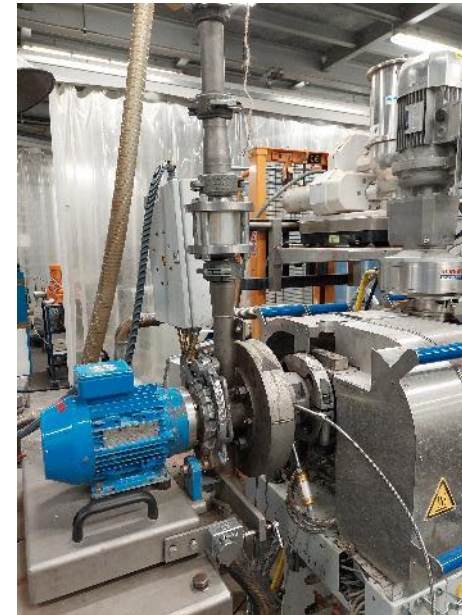
Practical work



Practical work



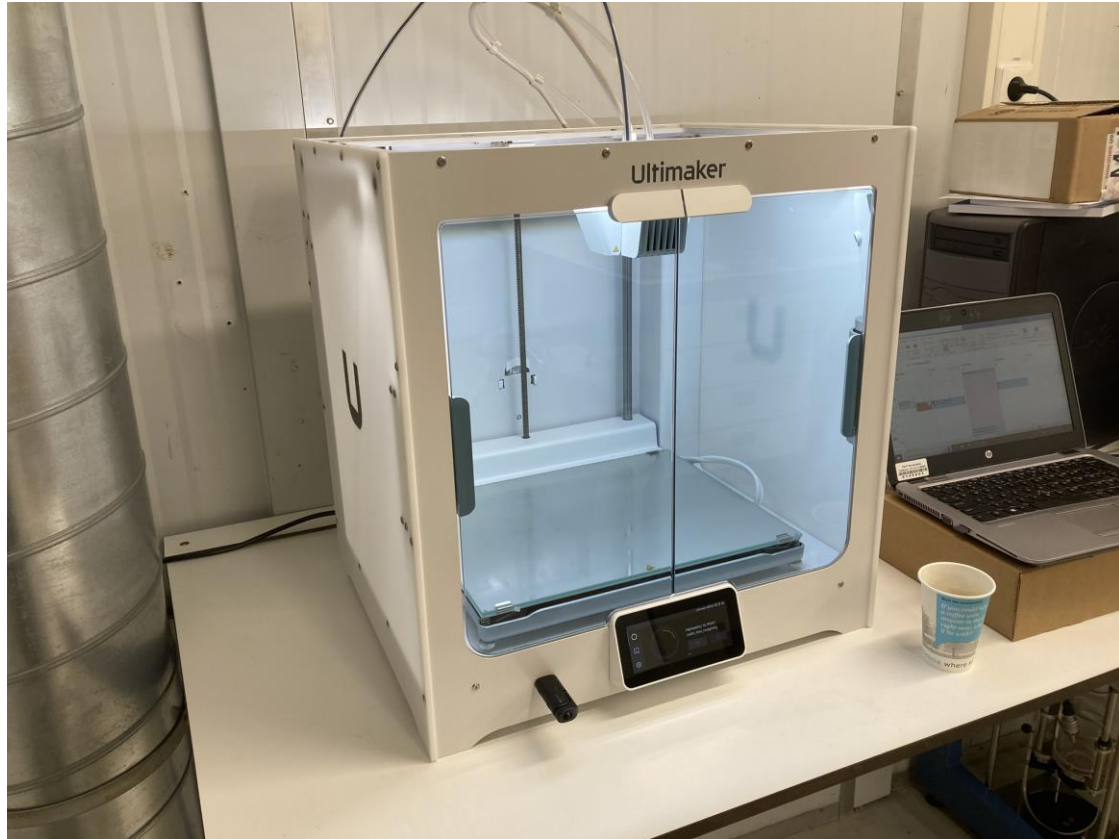
Practical work: Compounding



Practical work: Filament production



Practical work: 3D printing





**THANK YOU
VERY MUCH!**

Website: www.cityloops.eu

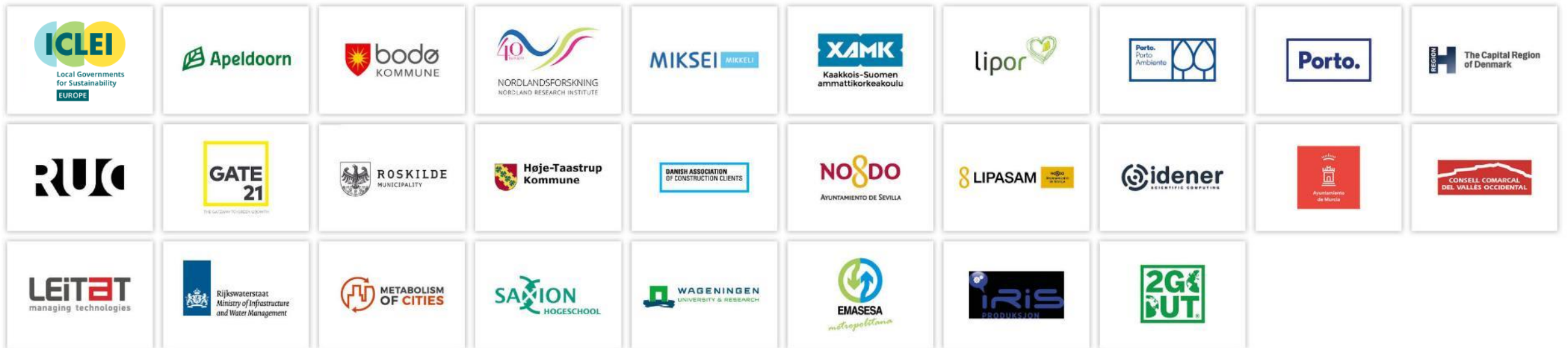
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